Improving the dietary intake of children attending centre-based childcare in NSW, Australia

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I hereby certify that the work embodied in the thesis is my own work, conducted under normal supervision. The thesis contains no material which has been accepted, or is being examined, for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository, subject to the provisions of the Copyright Act 1968 and any approved embargo.

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CONFLICT OF INTEREST STATEMENT

Courtney Jayne Barnes reports no conflicts of interest.

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Finally, to Alex. Thank you for attempting to show interest as I bored you with the steps of a systematic review or how to measure the contents of a lunchbox. Thank you for celebrating the wins and absorbing the losses, no matter how big or small. Even though it may not have always been obvious, your unwavering support, your unlimited patience, and your ability to keep the wine rack well-stocked, was always appreciated. You have been my touchstone through this entire journey, and for you I am most grateful. And now, let the post-PhD adventures begin.

LIST OF PUBLICATIONS FROM THESIS CHAPTERS

This thesis is presented as a series of five publications. At the time of thesis submission, all of these papers were published or submitted for publication in peer reviewed journals.

Table 1.1 Outline of thesis Chapters and associated publications

Chapter	Chapter Title	Publication
Two	The association between Australian ECEC centre healthy eating practices and children's healthy eating behaviours: a cross-sectional study within lunchbox centres	**Barnes C**, Yoong SL, Wolfenden L, Nathan N, Wedesweiler T, Kerr J, et al. The Association between Australian Childcare Centre Healthy Eating Practices and Children's Healthy Eating Behaviours: A Cross-Sectional Study within Lunchbox Centres. Nutrients. 2021;13(4):1139.
Three	A pilot randomised controlled trial of a web-based implementation intervention to increase child intake of fruit and vegetables within ECEC centres	**Barnes C**, Grady A, Nathan N, Wolfenden L, Pond N, McFayden T, et al. A pilot randomised controlled trial of a web-based implementation intervention to increase child intake of fruit and vegetables within childcare centres. Pilot and Feasibility Studies. 2020;6(1):163.
Four Part A	Feasibility of a web-based implementation intervention to improve child dietary intake in Early Childhood Education and Care: a pilot randomised controlled trial	**Barnes C**, Yoong SL, Nathan N, Wolfenden L, Wedesweiler T, Kerr J et al. Feasibility of a web-based implementation intervention to improve child dietary intake in Early Childhood Education and Care: a pilot randomized controlled trial. J Med Internet Res (submitted). doi:10.2196/25902.
Four Part B	Prioritising scalability during the evaluation of a web-based intervention to improve the implementation of evidence-based healthy eating practices in childcare centres	**Barnes C**, Yoong SL. Prioritising scalability during the evaluation of a web-based intervention to improve the implementation of evidence-based healthy eating practices in ECEC centres. Nutrition & Dietetics (submitted).
Five	Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within ECEC centres	Wolfenden L, **Barnes C**, Jones J, Finch M, Wyse RJ, Kingsland M, et al. Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within childcare services. Cochrane Database of Systematic Reviews. 2020;2(2):Cd011779.

CO-AUTHOR STATEMENTS FOR CHAPTER TWO

By signing below I confirm that Courtney Barnes contributed to the publication entitled:

The association between Australian ECEC centre healthy eating practices and children's healthy eating behaviours: a cross-sectional study within lunchbox centres

By:

- Contributing to the development of the research question
- Contributing to the research design and study methodology
- Determining the measures to be used
- Developing data collection tools
- Overseeing data collection and data entry
- Cleaning and analysing the data
- Leading the writing of the manuscript

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By signing below I confirm that Courtney Barnes contributed to the publication entitled:

A pilot randomised controlled trial of a web-based implementation intervention to increase child intake of fruit and vegetables within ECEC centres

By:

- Contributing to the development of the research question
- Contributing to the research design and study methodology
- Determining the measures to be used
- Leading the writing of the manuscript

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By signing below I confirm that Courtney Barnes contributed to the publication entitled:

Feasibility of a web-based implementation intervention to improve child dietary intake in Early Childhood Education and Care: a pilot randomised controlled trial

By:

- Contributing to the development of the research question
- Contributing to the research design and study methodology
- Leading the development of intervention resources
- Determining the measures to be used
- Developing data collection tools
- Overseeing data collection and data entry
- Cleaning and analysing the data
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By signing below I confirm that Courtney Barnes contributed to the publication entitled:

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By:

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- Contributing to the research design and study methodology
- Determining the measures to be used
- Developing data collection tools
- Overseeing data collection and data entry
- Cleaning and analysing the data
- Leading the writing of the manuscript

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CO-AUTHOR STATEMENTS FOR CHAPTER FIVE

By signing below I confirm that Courtney Barnes contributed to the publication entitled:

Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within ECEC centres (Review)

By:

- Screening abstracts and titles
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- Data extraction
- Assessing the overall certainty of the evidence
- Contributing to the narrative synthesis, meta-analysis and interpretation
- Co-leading the writing of the manuscript

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IMPACT OF COVID-19 ON THESIS COMPLETION

Restrictions relating to the COVID-19 pandemic had a substantial impact on the research conducted within this program of work. Specifically, follow-up data collection for the main research study described in thesis Chapters Three and Four was unable to be conducted as originally intended due to the inability to conduct site visits with participating Early Childhood Education and Care (ECEC) centres. The child dietary intake and ECEC centre nutrition environment data intended to be collected during the follow-up site visits was required for the development of the following thesis chapters:

- Effectiveness of a web-based intervention to improve child intake of fruit and vegetable serves within ECEC: A cluster randomised controlled trial.
- Mixed-methods process evaluation of a cluster randomised controlled trial of an intervention to improve child intake of fruit and vegetable servings within ECEC.

These planned thesis chapters would have contributed substantially to the narrative of this thesis by providing evidence of the effect of the pilot web-based implementation intervention (Chapter Three and Four) on improving child dietary intake of fruit and vegetable servings in care. As a result of the COVID-19 pandemic, this program of work was adapted to ensure the produced Chapters still contributed to addressing gaps in the evidence base, whilst also facilitating the development and application of the research skills required of a PhD research program. As such, thesis Chapter Four (Part A) instead reported on the main implementation outcomes as originally proposed within the study protocol (Chapter Three) and trial registration. Additionally, the research team undertook a novel approach to evaluate the scalability of the implementation strategies employed within the pilot implementation trial (Chapter Three and Four). This process is described in Chapter Four Part B. I led the production of both of these publications.

My development and application of the research skills required of a PhD research program have been summarised in the Statement of Personal Contribution section (page xxxiii). Further, I have enhanced these research skills through leading and contributing to a number of additional peer-reviewed publications throughout my candidature. The details of these publications are provided in the Additional Peer-Reviewed Publications section (page xvii).

ADDITIONAL PEER-REVIEWED PUBLICATIONS

During my candidature, I contributed to an additional 15 manuscripts that have been published in peer-reviewed journals. These publications align with my broad research focus, however, are not specific to the main research study within this thesis. Therefore, the publications were not included as thesis chapters. Details of the additional publications are listed below:

- **Barnes C**, McCrabb S, Stacey F, Nathan N, Yoong SL, Grady A, et al. Improving implementation of school-based healthy eating and physical activity policies, practices, and programs: a systematic review. Translational Behavioural Medicine. 2021.
- Wyse R, Jackson JK, Delaney T, Grady A, Stacey F, Wolfenden L, **Barnes C** et al. The Effectiveness of Interventions Delivered Using Digital Food Environments to Encourage Healthy Food Choices: A Systematic Review and Meta-Analysis. Nutrients. 2021;13(7):2255.
- Ooi JY, Wolfenden L, Sutherland R, Nathan N, Oldmeadow C, McLaughlin M, **Barnes C** et al. A Systematic Review of the Recent Consumption Levels of Sugar-Sweetened Beverages in Children and Adolescents From the World Health Organization Regions With High Dietary-Related Burden of Disease. Asia-Pacific journal of public health. 2021:10105395211014642.
- Yoong SL, Jones J, Pearson N, Swindle T**, Barnes C**, Delaney T, et al. An Overview of Research Opportunities to Increase the Impact of Nutrition Intervention Research in Early Childhood and Education Care Settings According to the RE-AIM Framework. International journal of environmental research and public health. 2021;18(5):2745.
- Grady A, **Barnes C**, Lum M, Jones J, Yoong SL. Impact of Nudge Strategies on Nutrition Education Participation in Child Care: Randomized Controlled Trial. Journal of Nutrition Education and Behaviour. 2021;53(2):151-6.
- Yoong SL, Lum M, Jackson J, Wolfenden L, **Barnes C**, Jones J, et al. Healthy eating interventions delivered in early childhood education and care settings for improving the diet of children aged six years and below. Cochrane Database of Systematic Reviews. 2021(1).
- Yoong SL, Jackson J, **Barnes C**, Pearson N, Swindle T, O'Reilly S, et al. Changing landscape of nutrition and dietetics research? A bibliographic analysis of top-tier published research in 1998 and 2018. Public Health Nutrition. 2021:1-22.
- Wolfenden L, **Barnes C**, Lane C, McCrabb S, Brown HM, Gerritsen S, et al. Consolidating evidence on the effectiveness of interventions promoting fruit and vegetable consumption: an umbrella review. International Journal of Behavioural Nutrition and Physical Activity. 2021;18(1):11.
- Grady A, **Barnes C**, Wolfenden L, Lecathelinais C, Yoong SL. Barriers and Enablers to Adoption of Digital Health Interventions to Support the Implementation of Dietary Guidelines

in Early Childhood Education and Care: Cross-Sectional Study. Journal of medical Internet research. 2020;22(11):e22036.

- Brown A, **Barnes C**, Byaruhanga J, McLaughlin M, Hodder RK, Booth D, et al. Effectiveness of Technology-Enabled Knowledge Translation Strategies in Improving the Use of Research in Public Health: Systematic Review. Journal of medical Internet research. 2020;22(7):e17274
- Yoong SL, Grady A, Wiggers JH, Stacey FG, Rissel C, Flood V, **Barnes C**, et al. Child-level evaluation of a web-based intervention to improve dietary guideline implementation in childcare centers: a cluster-randomized controlled trial. The American Journal of Clinical Nutrition. 2020;111(4):854-63.
- Jackson J, Wolfenden L, Grady A, Lum M, Leonard A, McCrabb S, **Barnes C**, et al. Early childhood education and care-based healthy eating interventions for improving child diet: a systematic review protocol. Systematic Reviews. 2020;9(1):181.
- Grady A, Wolfenden L, Wiggers J, Rissel C, Finch M, Flood V, **Barnes C**, et al. Effectiveness of a Web-Based Menu-Planning Intervention to Improve Childcare Service Compliance With Dietary Guidelines: Randomized Controlled Trial. Journal of medical Internet research. 2020;22(2):e13401.
- Yoong SL, Nathan N, Reilly K, Sutherland R, Straus S, **Barnes C**, et al. Adapting implementation strategies: a case study of how to support implementation of healthy canteen policies. Public Health. 2019;177:19-25.
- Hodder RK, O'Brien KM, Stacey FG, Tzelepis F, Wyse RJ, Bartlem KM, **Barnes C**, et al. Interventions for increasing fruit and vegetable consumption in children aged five years and under. Cochrane Database of Systematic Reviews. 2019(11).

CONFERENCE PRESENTATIONS RELATED TO THIS THESIS

During my candidature, I presented findings arising from my thesis at local, national and international conferences. The details of the presentations are listed below.

- **Barnes C**, Yoong SL, Wolfenden L, Nathan N, Wedesweiler T, Kerr J, Ward DS, Grady A. Feasibility of a web-based intervention to improve the implementation of healthy eating practices in childcare. Dietitians Australia Annual Conference, July 2021.
- **Barnes C**, Yoong SL, Wolfenden L, Nathan N, Wedesweiler T, Kerr J, Ward DS, Grady A. Feasibility of a web-based intervention to improve the implementation of healthy eating practices in childcare. 20th Annual Meeting International Society for Behavioural Nutrition and Physical Activity XChange Initiative, 8 – 10 June 2021.
- **Barnes C**, Grady A, Wolfenden L, Nathan N, Yoong S. Feasibility of a web-based intervention to improve the implementation of nutrition practices in childcare. Evidence and Implementation Summit, 30 – 31 March 2021.
- Wolfenden L, **Barnes C**, Jones J, Finch M, Wyse R, Kingsland M, Tzelepis F, Grady A, Hodder R, Booth D, Yoong S. Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within childcare services. 19th Annual Meeting International Society for Behavioural Nutrition and Physical Activity XChange Initiative, 17 – 20 June 2020.
- **Barnes C**, Grady A, Wolfenden L, Nathan N, Yoong S. A web-based intervention to improve child intake of fruit and vegetables in childcare. 19th Annual Meeting International Society for Behavioural Nutrition and Physical Activity XChange Initiative, 17 – 20 June 2020.
- **Barnes C**, Grady A, Vaughn A, Nathan N, Wolfenden L, Yoong S. A cluster randomised controlled trial of a web-based intervention to improve child dietary intake within childcare centres. Annual Hunter Cancer Research Symposium 8 November 2019, Newcastle, Australia.
- Wolfenden L, **Barnes C**, Jones J, Finch M, Wyse R, Kingsland M, Tzelepis F, Grady A, Hodder R, Booth D, Yoong S. Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within childcare services. Public Health Association Australia Annual Conference, 12 – 14 June 2019, Melbourne, Australia.
- Wolfenden L, **Barnes C**, Jones J, Finch M, Wyse R, Kingsland M, Tzelepis F, Grady A, Hodder R, Booth D, Yoong S. Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within childcare services. Dietitians Association Australia Annual Conference, 12 – 14 August 2019, Gold Coast, Australia.

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GLOSSARY OF COMMON ABBREVIATIONS

BMI	Body Mass Index
CATI	Computer Assisted Telephone Interview
Childcare EATS	Childcare Electronic Assessment Tool and Support
CI	Confidence Interval
DALY	Disability-Adjusted Life Years
ECEC	Early Childhood Education and Care
EPAO	Environment and Policy Assessment and Observation
EPOC	Effective Practice and Organisation of Care
GRADE	Grades of Recommendation, Assessment, Development and Evaluation
NAPSACC	Nutrition and Physical Activity Self-Assessment for Child Care
NSW	New South Wales
RA	Research Assistant
RCT	Randomised Controlled Trial
SD	Standard Deviation
SMD	Standard Mean Difference
U.K.	United Kingdom
U.S.	United States

ABSTRACT

Introduction and aims

Poor dietary behaviours are leading modifiable risk factors of overweight and obesity in childhood. The Early Childhood Education and Care (ECEC) setting provides a unique opportunity to influence the development of children's dietary behaviours, with several components of ECEC centre nutrition environments associated with improved child dietary intake. In response to this, evidence-based policies and practices have been developed, which acknowledge the potential for the ECEC setting to influence child dietary intake. However, current implementation of such policies and practices within the ECEC setting is poor. In order for interventions to improve implementation of healthy eating policies and practices to result in population-wide health improvements, they must be both effective and also scalable. Research suggests, however, that current interventions are not designed and delivered in ways that are amenable to scale up. As such, this thesis sought to address the identified limitations of the current evidence base by describing the development, and investigating the potential impact, of a web-based implementation intervention to improve ECEC centre nutrition environments and child dietary intake at scale.

Specifically, the objectives of this thesis were to:

1. Examine the association between ECEC centre healthy eating practices in influencing children's healthy eating behaviours (Chapter Two);
2. Assess the impact and scalability of a web-based implementation intervention aiming to increase child intake of fruit and vegetables within ECEC centres (Chapter Three and Four);
3. Systematically review strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices and programmes within ECEC centres (Chapter Five); and
4. Summarise implications for future policy, practice and research (Chapter Six).

Results

A cross-sectional study in 22 ECEC centres in the Hunter New England (HNE) region of New South Wales (NSW), determined that the availability of foods within children's lunchboxes was associated with children's intake of such foods ($P < 0.01$). Additionally, this study demonstrated that several other healthy eating practices, including centre provision of intentional healthy eating learning experiences (estimate −0.56; $P = 0.01$) and the use of feeding practices that support children's healthy eating (estimate −2.02; $P = 0.04$) were associated with reduced child intake of saturated fat in care. Findings of this study provided considerable guidance for the development of a pilot implementation trial within 22 ECEC centres in the HNE region of NSW, which aimed to improve the implementation

of the identified centre healthy eating practices. The trial found that the web-based intervention together with health promotion officer support was highly feasible, acceptable to centre staff, can be delivered at low-cost, and is potentially effective in improving centre implementation of healthy eating practices. A scalability assessment also found that this implementation intervention may potentially be amenable to delivery to a large number of ECEC centres. Such findings indicate that the web-based intervention is a potentially effective and scalable approach to providing support to ECEC centres to improve the implementation of healthy eating practices. Finally, the systematic review consisting of 21 studies provides evidence of the effectiveness of strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices and programmes within ECEC centres.

Conclusion

This thesis provides a compilation of implementation-focused research on improving the implementation of evidence-based healthy eating policies and practices within ECEC centres. Additionally, it provides considerable guidance for the development of future implementation interventions to improve child dietary intake in care at scale.

STATEMENT OF PERSONAL CONTRIBUTION

I was involved in all aspects of the research conducted as part of this thesis, including study conceptualisation and design, ethical approval, recruitment, intervention development, implementation and evaluation of the primary study reported in Chapters Three and Four. An outline of my contributions are detailed below.

Study design and planning

I was intricately involved in the design, development and planning of the primary study reported in Chapters Three and Four. I led the application of relevant evidence-based theoretical frameworks to guide the selection and development of appropriate implementation strategies. In collaboration with supervisors and the project team, I led the development of intervention delivery protocols and all intervention materials, including the web-based program. I also led the development of an evaluation plan to guide the collection of outcome and process data. I also worked closely with members of the Aboriginal community, including health promotion practitioners and ECEC centre staff, to ensure the development, delivery and evaluation of the study was culturally appropriate.

Ethics approval and clinical trial registry

I led the drafting of ethics applications for approval by the Hunter New England Local Health District Human Research Ethics Committee (06/07/26/4.04) and the University of Newcastle Human Research Ethics Committee (H-2008-0343). I led the drafting of recruitment material, including participant consent forms and information statements. I assisted with prospectively registering the primary study reported in Chapters Three and Four with the Australian New Zealand Trials Registry (ACTRN12619001158156).

Study measures

In consultation with the project team, I developed and adapted the measures used within the cross-sectional study in Chapter Two and primary study reported in Chapters Three and Four. This included modifying the Environment and Policy Assessment and Observation (EPAO) tool to ensure its applicability to Australian ECEC centre nutrition environments, in addition to the tools used to conduct lunchbox measurements to assess child dietary intake. I was also responsible for the drafting of survey items completed by ECEC centre nominated supervisors and centre champions.

Data collection, entry and management

I was responsible for planning and coordinating the data collection conducted for the primary study reported in Chapters Three and Four. This involved developing training materials, data collection

protocols and training research assistants. I oversaw data collection processes and was responsible for data entry and management.

Intervention implementation

I oversaw the implementation of the primary study in Chapters Three and Four. I contributed to the development of implementation protocols and led pilot testing of the intervention within ECEC centres. As a Health Promotion Officer, I delivered components of the intervention, including educational outreach visits and ongoing telephone and email support with ECEC centres.

Data cleaning and analysis

I determined the methods of statistical analysis and led all data cleaning and analysis processes. I was responsible for the interpretation of results and the presentation of the data.

Systematic review

I was involved in all aspects of the Cochrane systematic review described in Chapter Five and oversaw the refinement of the search strategy, screening, data extraction, risk of bias and GRADE assessment processes. I co-led the narrative synthesis and meta-analysis of the review findings, as well as the drafting of the manuscript.

Dissemination of thesis findings

During my candidature, the results of the research have been presented at four international and three national conferences. I was lead author on four publications, and second author for the Cochrane systematic review included as Chapters within this thesis. I was corresponding author for all publications, addressing reviewer comments in consultation with my supervisors and managing the publication process.

CHAPTER ONE

THESIS INTRODUCTION

CHAPTER OVERVIEW

This introductory Chapter provides an overview of the crucial role that Early Childhood Education and Care (ECEC) setting plays in influencing the development of child dietary behaviours, and thus, addressing childhood overweight and obesity. The Chapter first outlines the prevalence of overweight and obesity, followed by the burden of disease attributed to overweight and obesity, internationally and within Australia. The contribution of poor dietary behaviours towards overweight and obesity is highlighted, in addition to a summary of international population-level dietary guidelines as a strategy for chronic disease prevention. Current low levels of child compliance with such guidelines is then noted. The potential role of ECEC as a setting to influence child dietary behaviours is introduced, and an outline of previous research conducted within the ECEC setting to improve the implementation of evidence-based healthy eating policies and practices, thus improving child dietary intake, is provided. This Chapter considers the potential of web-based interventions to address limitations of previous interventions and provide scalable support to ECEC centres on a population level. This Chapter concludes with the central thesis aim and the specific objectives of studies included within this thesis.

PREVALENCE OF OVERWEIGHT AND OBESITY

International perspective

Overweight and obesity has been defined by the World Health Organization (WHO) as abnormal or excessive fat accumulation that may result in impaired health (1). The prevalence of childhood overweight and obesity has considerably increased within recent decades. In 2016, an estimated 41 million children aged 0-5 years were overweight or obese, a sizeable increase from 32 million children in 1990 (2). Within Canada, an estimated 31% of children were overweight or obese in 2016, an increase from 23% in 1979 (3). In the U.K., 13% of children were overweight and 10% were obese in 2017, with the prevalence steadily increasing over recent decades (4). The WHO has estimated that 70 million children aged 0-5 years internationally will be overweight or obese by 2025 (1). Encouragingly, research has indicated that the rise in the prevalence of childhood overweight and obesity has potentially begun to plateau in several countries, including New Zealand, Switzerland and Germany (5, 6). Research indicates that the early development of obesity in childhood predicts obesity in adulthood, especially for children classified as severely obese (7). Systematic review evidence suggests that obese children and adolescents are approximately five times more likely to be classified as obese in adulthood than those who were not obese (7). Further, approximately 55% of obese children will be obese in adolescence, with approximately 80% of these adolescents still classified as obese in adulthood (8).

Given the increased prevalence of childhood overweight and obesity, and the association between childhood and adult weight status, it is unsurprising that an increase in adult overweight and obesity is also evident. Globally, the prevalence of obesity in adults nearly tripled between 1975 and 2016, with an estimated 39% of adults (aged ≥18 years) classified as overweight or obese in 2016 (1). The proportion of overweight or obese adult males (39%) was similar to overweight or obese adult females (40%) (1). When examining trends within specific countries, the substantial rise in the prevalence of overweight and obesity is clearly evident. Within Canada, over 60% of adults were overweight or obese in 2017, with obesity rates tripling in the past three decades (9). Similarly in the United Kingdom (U.K.), the majority of adults (68%) were overweight or obese in 2018, increasing from 53% in 1993 (10). Consistently across countries, the prevalence of overweight and obesity is greater in areas of higher socioeconomic disadvantage (9-11).

Australian perspective

Similar to global trends, the prevalence of childhood overweight and obesity in Australia has increased substantially in recent decades (12, 13). In 2014-2015, Australian children aged 2-5 years were twice as likely to be obese (9%) as children of the same age in 1995 (4%) (12, 13). An estimated 20% of Australian children aged 2-5 years were overweight or obese in 2014-15, with similar proportions for males and females (12, 13). Promisingly, recent research has reported that whilst the prevalence of overweight and obesity in Australian children is still high, rates are potentially beginning to stabilise (5, 14). However, although estimates indicates a plateauing of overweight and obesity within the Australian population aged 0-5 years, emerging research suggests that the difference in overweight and obesity rates between low and high income, as well as urban and rural population groups is widening (15).

Within the Australian adult population, 67% of adults aged ≥18 years were overweight or obese in 2017-2018 (12). The prevalence of overweight or obesity in Australian males was higher compared to females, with 75% of males and 60% of females aged ≥18 years considered overweight or obese in 2017-18 (12). Similarly to trends globally, the prevalence of overweight and obese Australian adults has risen in recent decades, increasing from 57% of Australians aged ≥18 years overweight or obese in 1995 (12). Comparably to trends globally, the prevalence of overweight and obesity is higher in areas of Australia with greater socioeconomic disadvantage. In 2017-18, Australian adults aged ≥18 years residing in the lowest socioeconomic areas were more likely to be overweight or obese than those in the highest socioeconomic areas (72% compared to 62%) (13).

BURDEN OF DISEASE: OVERWEIGHT AND OBESITY

International perspective

Overweight and obesity is a leading contributor to the development of chronic diseases, including cardiovascular disease and type 2 diabetes, as well as specific types of cancer such as liver, kidney and colon cancer (16). The 2019 Global Burden of Disease (GBD) study, which provided an estimate for the health effects of poor dietary behaviours in 204 countries, reported that five million premature deaths were a result of high body mass index (BMI) (17, 18). BMI is the measure predominately used to estimate overweight and obesity on a population-level, calculated as a person's weight (in kilograms) divided by square of their height (in metres) (1). In adults, overweight is typically defined as one to two standard deviations (SD) above the reference population median BMI, whilst obesity is more than two SD above the median (1). Of the five million premature deaths attributed to high BMI, more than two-thirds of these deaths were due to cardiovascular disease (17, 18). Additionally, type 2 diabetes was the second leading cause of high BMI-related premature deaths, contributing to one million deaths globally (17, 18).

Daily adjusted life years (DALY), which are used to assess the burden of disease (with one DALY representing the loss of the equivalent of one year of full health) (19), were also measured within the 2019 GBD study (17, 18). Findings indicated that high BMI contributed to 160 million DALYs, including 86.7 million DALYs due to cardiovascular disease and 45.7 million DALYs due to type 2 diabetes (17, 18). Overall, high BMI represented 6.3% of DALYs from any cause, globally (17, 18).

The economic burden of overweight and obesity on a global scale is also extensive. A 2011 systematic review by Withrow et al. identified 32 studies examining the direct costs associated with obesity (i.e. costs resulting from outpatient and inpatient healthcare, such as surgery) (20). Findings of the review concluded that between 0.7% and 2.8% of total healthcare expenditure across countries was attributed to obesity (20). In 2014, the global economic impact of obesity was estimated to be $2.0 trillion U.S. dollars (approximately $2.6 trillion Australian dollars [AUD]), including healthcare system costs in addition to the cost of lost productivity (e.g. health-related absence from work) (21).

Australian perspective

On a national-level, the burden of disease attributed to overweight and obesity within Australia is also substantial. An estimated 8.4% of total disease burden in Australia was due to overweight and obesity in 2015, with this proportion increasing in areas of high social disadvantage (22). Fifty-four percent of the diabetes burden and 25% of the coronary heart disease burden was due to overweight and obesity (22). Additionally, overweight and obesity contributed to nearly 400,000 DALYs in Australia in 2015, with 80,700 of these DALYs due to coronary heart disease and 55,300 DALYs due to diabetes (23).

A 2019 systematic review of 18 studies examined the economic burden of preventable diseases in Australia, and that estimated overweight and obesity cost the healthcare system up to $4.6 billion AUD annually (24), whilst the annual value of productivity loss was up to $14.9 billion AUD (24). As a result of the increasing overweight and obesity prevalence, as well as the attributable burden of disease, addressing overweight and obesity is considered a public health priority within Australia, and globally (25-28).

Given the progression of overweight and obesity from childhood into adulthood (7, 8), and the detrimental health and economic impacts resulting from excessive weight gain on a national and global scale (16-24), targeting the drivers of childhood overweight and obesity is a crucial prevention strategy.

POOR DIETARY BEHAVIOURS THAT CONTRIBUTE TO EXCESSIVE WEIGHT GAIN IN CHILDREN

Excessive weight gain is a result of an individual's energy intake exceeding their energy expenditure, with overweight and obesity an outcome of this continued imbalance (29). Poor dietary behaviours, including high intake of energy-dense discretionary foods items (i.e. foods high in sodium, saturated fat and added sugars), and low intake of fruit and vegetables, are leading causes of this imbalance (1). It is important to note what whilst the evidence base suggests that it is critical to support healthy dietary behaviours for a number of overall developmental goals (e.g. cognitive development) (30), this thesis discusses the role of dietary behaviours predominately in relation to obesity risk.

A number of systematic reviews have been conducted within recent years to strengthen the evidence-base regarding the association between poor dietary behaviours and excessive weight gain (31-33). For example, the most recent systematic review by Schlesinger et al. (2019) examined 25 prospective studies which assessed the association between specific foods (e.g. fruits, vegetables, wholegrains, refined grains and sugar-sweetened beverages), and the risk of weight gain, overweight and obesity (31). Findings of the meta-analyses demonstrated an inverse relationship between fruit, vegetable and wholegrain consumption and the development of overweight and obesity (31). Further, meta-analyses identified a positive association between the consumption of refined grains and sugar-sweetened beverages and the development of overweight and obesity (31).

Several systematic reviews have specifically examined the association between poor dietary behaviours in children and the risk of developing overweight and obesity. For example, a 2014 systematic review of seven cross-sectional studies by Ambrosini et al. examined the association between child dietary patterns and the risk of developing obesity in later years of life (32). A positive relationship between child dietary patterns that were high in energy-dense, high-fat, low-fibre foods

and obesity risk in later years of life was reported in four of the seven studies (32). Similar findings were reported in a 2012 systematic review by Perez-Escamilla et al., which examined six cohort studies in children and adolescents to assess the relationship between dietary energy density and adiposity (33). Of the six studies examining children and adolescents, four studies reported a positive association between dietary energy density (i.e. from high-fat, high-sugar diets) and increased child adiposity (33).

Given the fundamental role poor dietary behaviours play in the development of childhood overweight and obesity, leading organisations such as the WHO have recommended that strategies to address excessive weight gain should target these behaviours (34). However, the influence of complex social and environmental-level factors (e.g. availability and cost of healthy foods, low household income, and lower levels of education) on the development of poor dietary behaviours, and thus, overweight and obesity, is extensive (29). For example, research internationally and within Australia indicates that children residing in areas of higher socioeconomic disadvantage eat less fruit and vegetables, and consume more foods high in sodium and saturated fat (35-37). As such, population-based approaches encompassing the individual, social and environmental factors that contribute to excessive weight gain are required.

DIETARY GUIDELINES PROMOTING GOOD NUTRITION

International and national dietary guidelines (38-44) have been developed to provide population-level guidance on dietary intake that focuses on reducing chronic disease, including overweight and obesity, and maintaining the overall wellbeing of the population. These guidelines are typically based on the best available scientific evidence, which is then synthesised and translated into population-level dietary advice and guidance (38).

International dietary guidelines

To maximise the potential impact of dietary guidelines on addressing dietary behaviours contributing to poor health, the WHO established a series of principles to guide the development of such guidelines (35). The principles acknowledge the diverse nutritional needs across life-spans and are specific to adults as well as infants and young children (Table 1.2) (39).

Within the United States (U.S.) public health agencies and healthcare providers rely on the 2015-2020 U.S. Dietary Guidelines to support the development of federal nutrition policies, national health promotion and disease prevention initiatives (40, 41). The 2016 U.K. Dietary Guidelines, known as the *Eatwell Guide*, have been developed to ensure organisations and individuals are provided with consistent messages regarding the balance of foods in a healthy diet, including the types and

quantities of foods recommended (42, 43). In Canada, the *Eating Well with Canada's Food Guide* was revised in 2019 to promote healthy eating and overall nutritional well-being within the population, and support improvements to the Canadian food environment through the best available scientific evidence (44).

Table 1.2 Summary of the World Health Organization principles of a healthy diet (39)

Age group	WHO Principle
Adults	A healthy diet includes the following: - Fruit, vegetables, legumes, nuts and wholegrains - At least 400g of fruit and vegetables per day, excluding potatoes, sweet potatoes, cassava and other starchy roots. - Less than 10% of total energy intake from free sugars (equivalent to 50g for a person of healthy body weight consuming about 2000 calories per day) and ideally is less than 5% for additional health benefits. Free sugars are all sugars added to foods or drinks by the manufacturer, cook or consumer, as well as sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates. - Less than 30% of total energy intake from fats. Unsaturated fats are preferable to saturated fats and trans-fats of all kinds, including both industrially-produced trans-fats and ruminant trans-fats. It is suggested that the intake of saturated fats be reduced to less than 10% of total energy intake and trans-fats to less than 1% of total energy intake. In particular, industrially-produced trans-fats are not part of a healthy diet and should be avoided - Less than 5g of salt per day. Salt should be iodised.
Infants and young children	In the first 2 years of a child's life, optimal nutrition fosters healthy growth and improves cognitive development. It also reduces the risk of becoming overweight or obese and developing non-communicable diseases (NCDs) later in life. Advice on a healthy diet for infants and children is similar to that for adults, but the following elements are also important: - Infants should be breastfed exclusively during the first 6 months of life. - Infants should be breastfed continuously until 2 years of age and beyond. - From 6 months of age, breast milk should be complemented with a variety of adequate, safe and nutrient-dense foods. Salt and sugars should not be added to complementary foods.

Australian dietary guidelines

The Australian Dietary Guidelines were revised in 2013 based on the best available empirical evidence at the time (38). The aim of the Australian Dietary Guidelines is to: promote health and wellbeing; reduce the risk of diet-related conditions (e.g. high cholesterol and obesity); and reduce the risk of chronic diseases, such as cardiovascular disease and type 2 diabetes (38). These guidelines provide the population with age group and activity level specific information on the types and quantities of foods recommended to be consumed (38). The *Australian Guide to Healthy Eating* was developed to provide a visual representation of the proportion of the five food groups recommended for daily consumption (Table 1.3).

Table 1.3 Summary of the Australian Dietary Guidelines (38)

Sex and age group	Recommended daily number of servings from each of the five food groups					
	Fruit	Vegetables	Breads and cereals	Meat and meat alternatives	Dairy	Discretionary foods
Men						
19-50	2	6	6	3	2½	0-3
51-70	2	5½	6	2½	2½	0-2½
70+	2	5	4½	2½	3½	0-2½
Women*						
19-50	2	5	6	2½	2½	0-2½
51-70	2	5	4	2	4	0-2½
70+	2	5	3	2	4	0-2
Toddlers						
1-2	½	2-3	4	1	1-1½	0
Boys						
2-3	1	2½	4	1	1½	0-1
4-8	1½	4½	4	1½	2	0-2½
9-11	2	5	5	2½	2½	0-3
12-13	2	5½	6	2½	3½	0-3
14-18	2	5½	7	2½	3½	0-5
Girls*						
2-3	1	2½	4	1	1½	0-1
4-8	1½	4½	4	1½	1½	0-1
9-11	2	5	4	2½	3	0-3
12-13	2	5	5	2½	3½	0-2½
14-18	2	5	7	2½	3½	0-2½

*Additional servings of some food groups recommended during pregnancy and lactation.

CHILDREN DO NOT MEET DIETARY GUIDELINE RECOMMENDATIONS

International perspective

Despite the existence of dietary guidelines, population studies indicate that child consumption of fruit, vegetables and energy-dense discretionary food items do not align with guideline recommendations. Children in the U.S. consume an inadequate number of fruit and vegetable servings, whilst exceeding recommendations for energy-dense discretionary food items (45, 46). For example, in 2010 over 94% of children aged 2-3 years and 90% of children aged 4-8 years did not consume the recommended number of vegetable servings per day (45, 46). Additionally, 99% of children aged 2-8 years exceeded recommendations for food items high in added sugar and fat (45, 46). Inadequate consumption of fruit and vegetable servings was also evident in Canadian children, with a 2007 survey reporting that 54% of children aged 2-3 years, and 31% of children aged 4-8 years consuming the recommended daily servings of fruit and vegetables (47). Canadian children are also exceeding recommendations for foods high in sodium, with over 75% of children aged 1-8 years exceeding the recommended upper limit, increasing the risk of adverse health effects (48).

Australian perspective

A paucity of national-level dietary consumption data clearly exists within Australia, with the most recent national survey of Australian children published in 2013 (38, 49). It found that 97% of Australian children aged 2-3 years and 73.1% of children aged 4-8 years consumed the recommended daily fruit intake of 1–1.5 servings per day (38, 49). The proportion of children meeting the vegetable recommendation was substantially lower, with an estimated 20% of children aged 2-3 years and 3.3% of children aged 4-8 years consuming the recommended daily vegetable intake of 2.5-4.5 servings per day (38, 49). The noticeable decline in the proportion of children aged 4-8 years consuming the recommended vegetable servings compared to children aged 2-3 years is worth highlighting. Given the vegetable recommendation for children aged 4-8 years is nearly double the recommendation for the younger age group (38, 49), it is evident that children are much less likely to consume the expected quantity as they grow up. Further, evidence suggests that as children grow older, their usual intake of core foods, such as vegetables, begins to be partially substituted with discretionary foods (50). The Australian Dietary Guidelines recommend children aged 2-3 years consume a maximum of one serving (600 kilojoules) per day of discretionary foods, with the maximum limit increasing slightly for children aged 4-8 years to 1-2.5 servings (38). However, current evidence estimates that children aged 2-3 years consumed at least 30% of their daily energy intake through energy-dense discretionary food (50). The consumption of such foods also increased with age, with children aged 4-8 years consuming 38% of their daily energy intake through energy-dense discretionary foods (50). This equates to at least five servings of discretionary food items per day, substantially more than the maximum recommendation of 2.5 servings. Excessive consumption of these foods can lead to unhealthy weight gain and an increased risk of developing other health issues (51).

EARLY CHILDHOOD EDUCATION AND CARE AS A SETTING TO INFLUENCE CHILD DIETARY BEHAVIOURS

As early childhood is a crucial period for development of healthy eating behaviours (52), and there is strong evidence that dietary behaviours developed in early childhood track into adulthood (53), improving children's dietary behaviours is a recommended strategy to reduce the development of obesity and non-communicable diseases (27). In response to this, the WHO have developed the *Global Strategy on Diet, Physical Activity and Health*, a call to action to member states to address poor dietary behaviours in children by implementing evidence-based prevention strategies and dietary guidelines in early education and care (ECEC) settings to reduce the prevalence of these contributing dietary risk factors (34).

Internationally and within Australia, at least 80% of children attend formal centre-based care, including preschool and long day care (herein referred to as ECEC centres) (54, 55). Therefore, interventions to improve dietary behaviours within this setting have the opportunity to reach a substantial number of young children on an ongoing basis. On average, Australian children attend care for 21 hours per week, providing multiple opportunities to reinforce healthy dietary behaviours (56). When examining Australian child preschool enrolments by socioeconomic status, children who live in the highest socioeconomic areas (i.e. least disadvantaged) are more likely to be enrolled in a preschool program (95% of children aged 4 years, 22% of children aged 5 years) than children from the lowest socioeconomic areas (i.e. most disadvantaged) (76% of children aged 4 years, 17% of children aged 5 years) (57). The variation in enrolment between socioeconomic groups is potentially due to the lower household income in families residing low socioeconomic areas (58) and the high costs of childcare, with research indicating that 45% of families experience difficulties with the cost of childcare in Australia (59). As children can consume a significant proportion (up to 67%) of their daily nutrition intake whilst in care, providing opportunities to influence overall dietary intake (60). Previous research suggests that interventions aimed at modifying the ECEC centre nutrition environment can improve child dietary intake (61, 62).

ECEC centres have the existing infrastructure required to promote the development of healthy eating behaviours in care. Accreditation standards exist for ECEC centres within Australia and internationally, which specify that centres are to provide environments supportive of healthy eating (63, 64). In Australia, the National Quality Standards developed by the Australian Children's Education and Care Quality Authority (ACECQA) specifies that healthy eating is to be promoted by centres and appropriate for each child (63). In the U.S., the Caring for Our Children document details National Health and Safety Performance Standards for ECEC centres, including the provision of nourishing food daily and specification that feeding should occur in a relaxed and pleasant environment that fosters positive social behaviour (64).

Previous research has identified several characteristics of centre nutrition environments that are associated with child dietary intake in care. These characteristics include centre nutrition policies which outline centre strategies to implement healthy eating practices, educator feeding behaviours (e.g. role modelling healthy food choices) and educators completing professional development in nutrition (61, 65-67). A recent umbrella review by Matwiejczyk et al. (2018) aimed to identify the characteristics of effective interventions targeting healthy eating in ECEC centres (68). Findings of the review determined that the majority of effective interventions were multi-component, multi-level and targeted determinants of healthy eating behaviours at both the environmental-level (e.g. educator practices and centre nutrition policies) and individual-level (e.g. child knowledge, attitudes, beliefs) (68). Interventions targeting environmental-level determinants, including centre food provision or parental provision of lunchboxes, centre nutrition policies and changes in educator practices,

consistently reported improvements in the amount of fruit and vegetables offered to children, and fewer sugar sweetened beverages and discretionary foods provided (68). However, Matwiejczyk et al. highlighted concerns regarding the quality of the evidence, particularly in experimental trials where child dietary intake was the primary outcome, due to a lack of studies using validated measures (68). Considerable heterogeneity between studies in the level of intervention (e.g. individual-level or environmental-level) precluded pooling of data and limited the ability to measure the effect of specific intervention characteristics on child diet outcomes (68). Despite these limitations, Matwiejczyk et al. provided several recommendations for future research, including targeting intervention strategies at environmental-level and individual-level determinants through a multi-component, multi-level approach, and building the capacity of educators and parents (68).

The majority of the evidence-base to date has focused on the characteristics of nutrition environments within menu-based centres, which provide food for children to consume in care. However, a large proportion of ECEC centres within Australia are lunchbox centres (69), which require parents or guardians to pack food from home for children to consume in care. In addition to differences in food provision, there are several characteristics that distinguish menu-based and lunchbox centres. For example, menu-based centres are typically long day care centres, which open for eight or more hours per day and cater for children aged 0-6 years (56, 70). In contrast, lunchbox centres are predominately preschools, which have shorter hours of operation and cater for children aged 3-5 years (56, 71). In lunchbox centres, the availability of food to children is reliant on parent packing behaviours, differing from menu-based centres where staff members (e.g. cooks and menu-planners) are often explicitly employed in this role (40, 69). Centre cooks and menu-planners within these centres are expected to comply with sector-specific dietary guidelines, which specify the types and quantities of food to be provided to children at the centre (40, 72, 73). Such prescriptive guidance for the contents of lunchboxes packed by parents does not exist for centres where foods are brought from home. These differences suggest that ECEC-level factors associated with child dietary intake in menu-based centres may not generalise to lunchbox centres. However, research in this area is lacking. Studies assessing centre practices and environments that are associated with child dietary intake in lunchbox centres is therefore warranted.

While some gaps in evidence exist within lunchbox centres, sector-specific evidence-based healthy eating policies and practices have been established which acknowledge the potential for the ECEC setting to influence child dietary intake (40, 74, 75). In the U.S., ECEC centres participating in the *Child and Adult Food Program*, a federal food assistance program, are required to comply with a number of healthy eating practices in order to be eligible for government reimbursement for meals and snacks provided at the centres (72). Additionally in the U.S., state-based nutrition regulations exist to guide the development of healthy ECEC centre environments, with recommendations

including that centres limit the provision of sugar-sweetened beverages and nutrient-poor foods, ensure the availability of water, and avoid the use of food to encourage desired behaviour (40).

On a national-level in Australia, the ECEC centre regulatory authority (ACECQA), recommends for educators to provide children with educational healthy eating experiences, whilst also implementing and reinforcing healthy eating practices (e.g. role modelling healthy food choices) during mealtimes (63). At a state level, ECEC centres within New South Wales, Australia, are guided by the *Munch & Move* programme which requires centres to implement several healthy eating policies and practices, including: written nutrition policies; staff role modelling of healthy food and drink choices; nutrition learning experiences; staff completion of professional development in nutrition; and, communication with families to ensure the provision of food in care is consistent with dietary guidelines (75). Within each New South Wales local health district, health promotion officers are employed by the state government to support the implementation of health promotion programmes (i.e. *Munch & Move*) within community-based settings, including schools and ECEC centres. Such support generally consists of the provision of educational materials (e.g. factsheets and learning resources), training and professional development opportunities relating to healthy eating and physical activity (75).

ECEC CENTRES DO NOT ROUTINELY IMPLEMENT EVIDENCE-BASED HEALTHY EATING POLICIES AND PRACTICES

Despite the existence of evidence-based healthy eating policies and practices, research indicates that current implementation of these policies and practices is suboptimal. Without adequate implementation, the true public health benefits of such policies and practices will not be fully achieved. Within Australia, cross-sectional studies (76, 77) have indicated that only 68% of centres have a written nutrition policy (76), and 60% of children attending ECEC have more than one serving of discretionary food items within their lunchboxes (77). In Australian menu-based centres, a 2013 cross-sectional study with 46 centres reported that no centres met the dietary guideline recommendations for all food groups, with 96% of centres failing to meet the recommended provision of vegetable servings (78).

Comparably in the U.S., a 2014 cross-sectional study in 83 ECEC centres in Oklahoma indicated that the menus provided excessive amounts of sodium alongside inadequate dietary fibre, iron and carbohydrate (79). An additional cross-sectional study with 314 centres in Oklahoma found that only 21% of centres had a standard nutrition curriculum (e.g. providing healthy eating learning experiences to children) and 27% of centres had educational materials (e.g. books and toys) that promote healthy eating available to children (80). Implementation of several practices related to the mealtime environment and educator feeding behaviours were also poor. For example, a 2020 cross-sectional study with 119 centres in Nebraska, U.S., reported that only 67% of centres avoided the use of food to

calm upset children or encourage appropriate behaviour, and more than 39% of centres praised children for finishing their food (81). In the Netherlands, a cross-sectional study with 24 ECEC centres concluded that 65% of centre staff often or always pressured a child to eat, whilst only 68% encouraged children to try new foods (82).

BARRIERS TO ECEC CENTRE IMPLEMENTATION OF EVIDENCE-BASED HEALTHY EATING POLICIES AND PRACTICES

Given the low rates of implementation of evidence-based policies and practices in ECEC, previous research has been conducted to examine the barriers to the implementation of such policies and practices within the ECEC setting (81, 83, 84). Gaining a comprehensive understanding of the barriers inhibiting ECEC centre implementation of healthy eating policies and practices enables appropriate support strategies to improve implementation to be identified (84). Seward et al. conducted a systematic review of studies published between 1994-2015 examining factors that influence the implementation of dietary guidelines within menu-based ECEC centres (84). From the 12 studies included in the review, key barriers and facilitators to the implementation of dietary guidelines were identified (84). The most commonly reported barriers were related to centre environmental context and resources (e.g. a lack of menu planning resources, cost and time to plan menus), limited educator knowledge regarding general nutrition and sector-specific guidelines, as well as a lack of belief in capabilities (e.g. cooking skills) (84). Similar themes were reported when examining the facilitators to dietary guideline implementation, including factors relating to centre environmental context and resources (e.g. supportive environments through enforced centre nutrition policies) and centre staff skills (e.g. staff completion of nutrition-related training) (84).

Since the publication of the review by Seward et al. in 2017, further studies have been conducted which contribute to the evidence base. For example, a cross-sectional study published in 2020 by Dev et al. examined the barriers to providing healthier meals and implementing healthy mealtime practices in 81 rural ECEC centres in Oklahoma (81). Thirty-two percent of centres reported that children not liking the taste of healthier meals and snacks was a barrier to providing healthier food options, whilst 25% of centres reported that the stressfulness of mealtimes was a barrier to the implementation of healthy mealtime practices (81). Additionally, 24% of ECEC centres reported that educators do not have time to sit with children during mealtimes, therefore, reducing the opportunities for positive role modelling of healthy food choices (81).

In 2017, Wallace et al. conducted 48 in-depth interviews with educators and directors from 13 ECEC centres in Western Australia, and identified several barriers to the implementation of practices targeting centre nutrition environments (83). Educators expressed that a lack of confidence prohibited them from facilitating discussions regarding nutrition and healthy eating with parents (83). Barriers

relating to the influence of parents on children's eating behaviours were also raised (e.g. parents non-medical dietary requests for their children), with a need for access to a nutrition expert or credible information that could be disseminated to parents identified (83). A lack of knowledge regarding dietary guidelines and healthy eating practices amongst educators was also identified as a barrier within the interviews (83). Wallace et al. concluded that a lack of nutrition-related knowledge could limit the ability of educators to adequately role model healthy food choices and provide a positive nutrition environment to children (83). As such, implementation strategies that target these identified barriers to implementation are required.

EFFECTIVE STRATEGIES TO IMPROVE THE IMPLEMENTATION OF EVIDENCE-BASED HEALTHY EATING POLICIES AND PRACTICES AT SCALE

The implementation of evidence-based healthy eating policies and practices at scale (i.e. in more than 50 ECEC centres) is required in order for ECEC-based interventions to result in population-level health improvements. Scalability has been defined by Milat et al. as the ability of an intervention shown to be efficacious on a small scale to be expanded under real-world conditions to reach a greater proportion of the eligible population while retaining effectiveness (85). Despite WHO recommendations for the scale-up of public health interventions (86) and the existence of multiple frameworks developed to guide the scale-up process (87-89), successfully undertaking scale-up of public health interventions is complex. For example, a 2019 review by McCrabb et al. which examined the effectiveness of scaled-up obesity-prevention interventions, determined that the effects of scaled-up interventions were typically 75% or less of those reported in their respective pre-scaled trials (90). Such attenuation in effectiveness highlights the complexity of successfully scaling-up public health interventions.

Comprehensive implementation and scale-up frameworks suggest a number of factors influence the likely success of efforts to implement evidence-based interventions at scale (88, 89, 91). These include characteristics of the intervention itself, such as its cost to deliver, the skills or expertise required to deliver it, and its acceptability to staff, parents and children (88, 89, 91). Additional factors include the support strategies available to overcome barriers to local-level implementation, including the availability of human, technical and organisational resources, as well as factors related to the organisations in which the intervention is to be scaled, including the implementation climate, readiness of an organisation to change, or the perceived implementation self-efficacy, knowledge and skills of staff (88, 89, 91). Studies have found, when such barriers are able to be overcome, large improvements in the implementation and reach of healthy eating and physical activity promotion programmes can be achieved (92). For example, implementation of healthy school canteen guidelines

increased markedly (56%) and was scaled-up across hundreds of NSW schools following a comprehensive model of implementation support whilst retaining effectiveness (92).

Despite its importance to improvements in child health outcomes, there is little empirical evidence in the ECEC setting regarding the effectiveness of strategies to improve implementation, and implementation at scale, of healthy eating policies or practices (93). A 2016 Cochrane systematic review by Wolfenden et al. identified just 10 trials, which aimed to improve the implementation of policies, practices or programmes by ECEC centres that promote child healthy eating, physical activity and/or obesity prevention (93). Of these, two studies solely targeted healthy eating and six targeted a combination of healthy eating and physical activity (93). Although findings of the review indicated that the majority of these eight studies were successful in improving the implementation of at least one healthy eating policy or practice, only two of the eight studies were undertaken 'at scale' (69, 94), defined in the review as implementation occurring in more than 50 centres (93). The search was undertaken in 2015 and requires updating due to a number of recently published studies. Therefore, the current evidence base provides little guidance on the types of strategies that would be effective in improving implementation of healthy eating policies and practices at scale. In order to improve the population-level impact of ECEC-based healthy eating interventions, the development and testing of implementation interventions delivered at scale under real world contexts represents a priority for the field.

POTENTIAL OF WEB-BASED MODALITIES TO PROVIDE SCALABLE SUPPORT TO ECEC CENTRES

Interventions delivered via web-based modalities provide an attractive opportunity to improve implementation of evidence-based ECEC healthy eating policies and practices at scale. Several characteristics of web-based interventions are consistent with factors identified within recent reviews as being integral for achieving effective scale-up (91). Firstly, Milat et al. concluded that infrastructure to support implementation, such as training, delivery systems and technical resources, were key success factors for scaling-up public health interventions (91). Formative research has been conducted within the ECEC setting to investigate the potential acceptability of employing web-based modalities to support implementation (83, 95). A 2014 cross-sectional study by Yoong et al. within 214 centres in NSW found that 100% of centres have the necessary infrastructure (e.g. computer, internet) to use a web-based program, and the use of web-based features to support practice change is highly acceptable amongst the majority of centre supervisors (95). In 2017, Wallace et al. introduced the concept of a web-based program to support educators during qualitative interviews with 48 centre educators and directors in Western Australia (83). Findings of the qualitative study indicated that having access to a web-based program, which housed readily available educational materials and

online professional development opportunities, was well supported by centre educators and directors (83). Multiple studies conducted within the ECEC setting have also demonstrated the ability for web-based modalities to effectively provide implementation support to centre staff. For example, a controlled trial conducted by Ward et al. in 2020 within 78 ECEC centres in Canada compared the impact of web-based versus face-to-face training on educator implementation of healthy eating practices (96). Compared to usual practice, educators in the web-based training group reported a significantly greater improvement in implementation of healthy eating practices (p=0.03), assessed via a self-administered questionnaire with educators which included 12 items relating to the implementation of educator healthy eating practices (96). Each item was scored between 0 and 3, with three representing best practice (96). These findings suggest that the provision of web-based training is a potentially effective alternative to traditional training approaches, such as face-to-face workshops.

Secondly, the ability of interventions to employ implementation strategies to address barriers to local-level implementation was identified by Milat et al. as an influential factor to the scale-up of an intervention. Previous interventions conducted within the ECEC setting have demonstrated the ability for web-based modalities to house a suite of implementation strategies to address barriers to centre staff practice change. A 2017 study by Kennedy et al. employed a web-based program to improve ECEC staff practices and preschool physical activity environments in order to increase child physical activity within nine preschools in South Carolina, U.S (97). The web-based program housed several implementation strategies, including audit with feedback, educational materials and the development of a formal implementation blueprint to facilitate changes in practice (97).

Finally, Milat et al. reported that the cost to deliver interventions substantially influences the amenability of such interventions to be delivered at scale (91). Previous web-based interventions conducted within the ECEC setting have demonstrated their ability to be delivered at low cost, and their potential to be a cost-effective alternative to traditional methods of implementation support (96, 98). A cost-effectiveness analysis of a randomised controlled trial (RCT) examining the impact of a web-based menu planning program on the implementation of ECEC menu planning guidelines concluded that the program was a less costly alternative to traditional menu planning approaches (i.e. face-to-face) (98). Additionally, the controlled trial above by Ward et al. reported that the cost to deliver the web-based training to centre staff was substantially reduced in comparison to the costs to deliver the face-to-face training (96).

PREVIOUS TRIALS EMPLOYING WEB-BASED MODALITIES TO IMPROVE THE IMPLEMENTATION OF HEALTHY EATING PRACTICES WITHIN ECEC CENTRES

Despite the promise of web-based interventions being a scalable support mechanism for ECEC centres to improve implementation of healthy eating policies and practices, only two RCTs evaluating the impact of web-based programs to improve nutrition environments of ECEC centres have been conducted (99, 100). Within the U.S., a 4-month RCT by Ward et al. (2017) was conducted within 33 ECEC centres to examine the potential impact of the web-based *Nutrition and Physical Activity Self-Assessment in Child Care (Go-NAPSACC)* program on improving centre nutrition environments (99). The *Go-NAPSACC* program targeted ECEC centre staff to facilitate change in practice through a process of audit with feedback, goal setting and action planning (99). Following the development of an action plan, ECEC centres were encouraged to use the educational materials (i.e. factsheets, policy templates) available via the web-based program to support the implementation of goals and drive practice change (99). The intervention employed a minimal support model to assist implementation, consisting of one face-to-face educational outreach visit with a trained technical assistant (i.e. from a professional organisation who provide support to ECEC centres) to familiarise centres with the program, and ongoing support via telephone calls on a monthly basis (99). Additional ongoing support and centralised technical assistance was provided to centres via the web-based program (99).

The study reported improvements in centre provision of foods (effect size: 0.74, P = 0.16) and beverages (effect size: 0.54, P = 0.06), as well as centre menus (effect size: 0.73, P = 0.08), however, the improvements were not statistically significant (99). Due to its pilot nature, engagement with the web-based program was not assessed. Additionally, findings from the process evaluation indicated that a need for additional technical assistance and a lack of computer literacy were barriers to program use (99). Ward et al. identified several limitations that should be addressed in future evaluations, including the short implementation period, lack of rigorous measures to evaluate program effectiveness and implementation, and a limited incorporation of theory (99).

Within Australia, a 12-month RCT by Grady et al. was conducted in 54 ECEC centres in NSW to assess the impact of a web-based menu planning program on the implementation of menu planning guidelines (100). The web-based program employed several implementation strategies to support centre menu planners in providing menus that aligned with sector-specific dietary guidelines (100). These strategies included audit with feedback and educational materials, in addition to an educational outreach visit and ongoing support provided by health promotion officers. To assist with uptake of the menu planning program, the development of the program was guided by the Technology Acceptance Model (101), with the Theoretical Domains Framework also employed to guide the selection of

implementation support strategies (100, 102). The study found statistically significant improvements in the provision and consumption of individual core food groups, including fruit (provision 0.21 servings, 95%CI 0.02, 0.40; consumption 0.39 servings, 95%CI 0.12, 0.65) and discretionary foods (provision -0.33 servings, 95%CI -0.54, -0.11; consumption -0.40 servings, 95%CI -0.64, -0.16) (100, 103). However, the study did not find a significant improvement the mean number of food groups compliant with dietary guidelines between groups at follow-up (i.e. the primary outcome of the trial) (100, 103). Nonetheless, the web-based program was highly acceptable to centre menu planners and nominated supervisors (100), and a cost-effectiveness analysis of the trial concluded that the program was a less costly alternative to traditional menu planning approaches (98). Although such findings are encouraging, Grady et al. solely targeted menu provision and did not seek to improve the implementation of healthy eating practices (e.g. educator feeding practices, provision of healthy eating learning experiences) known to influence child dietary intake. The authors had several recommendations for future web-based interventions within the ECEC setting, including exploring differing strategies to support the implementation of dietary guidelines and engagement with web-based programs within centres (100).

Although these trials show promise for the potential of web-based interventions in improving the implementation of healthy eating policies and practices within ECEC centres, both trials were solely conducted within menu-based centres, and one study targeted a narrow range of healthy eating practices (i.e. solely menu provision). No RCTs of web-based interventions that aim to improve the implementation of healthy eating practices within lunchbox centres have been conducted. Given the substantial proportion of ECEC centres within Australia that are lunchbox centres, research to investigate the potential impact of web-based interventions to improve implementation of healthy eating policies and practices within these centres at scale is warranted.

CHAPTER CONCLUSION

Overweight and obesity impose a substantial health and economic burden on populations, globally. As dietary behaviours are a key driver of excessive weight gain, and such behaviours are likely to track into adulthood, interventions to address poor dietary behaviours within the early years are recommended. Despite the potential for interventions conducted within the ECEC setting to influence the development of child dietary behaviours, few effective and scalable interventions developed to improve the implementation of healthy eating policies and practices within ECEC centres exist. As such, this thesis consists of a series of Chapters exploring potential opportunities to support the implementation of healthy eating policies and practices via web-based modalities within ECEC centres.

THESIS AIMS

The central aim of this thesis was to describe the development, and investigate the potential impact of a web-based implementation intervention to improve ECEC centre nutrition environments and child dietary intake.

Specifically, the objectives of this thesis are to:

1. Examine the association between ECEC centre healthy eating practices in influencing children's healthy eating behaviours (Chapter Two);
2. Assess the impact and scalability of a web-based implementation intervention aiming to increase child intake of fruit and vegetables within ECEC centres (Chapters Three and Four);
3. Systematically review strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices and programmes within ECEC centres (Chapter Five); and
4. Provide a summary of thesis findings, and implications and recommendations for future policy, practice and research (Chapter Six).

THESIS STRUCTURE

This thesis includes a series of papers that have been published, and aligns with the University of Newcastle's regulations regarding thesis submission by publication. Following the introduction provided in Chapter One, the succeeding Chapters are as follows:

Table 1.4 Thesis Chapters and publications

Chapter	Chapter Title	Relevant publications
Two	The association between Australian ECEC Centre Healthy Eating Practices and Children's Healthy Eating Behaviours: A Cross-Sectional Study within Lunchbox Centres.	**Barnes C**, Yoong SL, Wolfenden L, Nathan N, Wedesweiler T, Kerr J, et al. The Association between Australian Childcare Centre Healthy Eating Practices and Children's Healthy Eating Behaviours: A Cross-Sectional Study within Lunchbox Centres. Nutrients. 2021;13(4):1139. **(published)**
Three	A pilot randomised controlled trial of a web-based implementation intervention to increase child intake of fruit and vegetables within ECEC centres.	**Barnes C**, Grady A, Nathan N, Wolfenden L, Pond N, McFadyen T, et al. A pilot randomised controlled trial of a web-based implementation intervention to increase child intake of fruit and vegetables within childcare centres. Pilot and Feasibility Studies. 2020;6(1):163. **(published)**
Four Part A	Feasibility of a web-based implementation intervention to improve child dietary intake in Early Childhood Education and Care: a pilot randomised controlled trial.	**Barnes C**, Yoong SL, Nathan N, Wolfenden L, Wedesweiler T, Kerr J et al. Feasibility of a web-based implementation intervention to improve child dietary intake in Early Childhood Education and Care: a pilot randomized controlled trial. J Med Internet Res **(submitted)**. doi:10.2196/25902.
Four Part B	Prioritising scalability during the evaluation of a web-based intervention to improve the implementation of evidence-based healthy eating practices in ECEC centres	**Barnes C**, Yoong SL. Prioritising scalability during the evaluation of a web-based intervention to improve the implementation of evidence-based healthy eating practices in ECEC centres. Nutrition & Dietetics **(submitted)**.
Five	Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within ECEC centres.	Wolfenden L, **Barnes C**, Jones J, Finch M, Wyse RJ, Kingsland M, et al. Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within childcare services. Cochrane Database of Systematic Reviews. 2020;2(2):Cd011779. **(published)**
Six	A summary of thesis findings, and implications and recommendations for future policy, practice and research.	N/A

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CHAPTER TWO

THE ASSOCIATION BETWEEN AUSTRALIAN ECEC CENTRE HEALTHY EATING PRACTICES AND CHILDREN'S HEALTHY EATING BEHAVIOURS: A CROSS-SECTIONAL STUDY WITHIN LUNCHBOX CENTRES

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Additional materials in Appendices 2.1–2.6

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ABSTRACT

The association between healthy eating practices and child dietary intake in Early Childhood Education and Care (ECEC) centres where parents pack foods from home has received little attention. This study aimed to: (1) Describe the nutritional content of foods and beverages consumed by children in care; and (2) Assess the association between centre healthy eating practices and child intake of fruit and vegetable servings, added sugar (grams), saturated fat (grams) and sodium (milligrams) in care. A cross-sectional study amongst 448 children attending 22 ECEC centres in New South Wales, Australia, was conducted. Child dietary intake was measured via weighed lunchbox measurements, photographs and researcher observation, and centre healthy eating practices were assessed via researcher observation of centre nutrition environments. Children attending lunchbox centres consumed, on average 0.80 servings (standard deviation (SD)) 0.69) of fruit and 0.27 servings (SD 0.51) of vegetables in care. The availability of foods within children's lunchboxes was associated with intake of such foods ($P < 0.01$). Centre provision of intentional healthy eating learning experiences (estimate −0.56; $P = 0.01$) and the use of feeding practices that support children's healthy eating (estimate −2.02; $P = 0.04$) were significantly associated with reduced child intake of saturated fat. Interventions to improve child dietary behaviours in centres should focus on a range of healthy eating practices, including the availability of foods packed within lunchboxes.

INTRODUCTION

Poor dietary behaviours, including low intake of fruit and vegetables, and high intake of energy-dense discretionary foods (i.e., foods high in added sugar, sodium and saturated fat), are the leading modifiable risk factors for the development of obesity and non-communicable diseases (1). As early childhood is a crucial period for the development of healthy eating behaviours, which are known to track into adulthood (2), improving the dietary behaviours of young children is recommended to reduce the burden of disease from obesity and non-communicable diseases (3). Early childhood education and care (ECEC) is an attractive setting to deliver interventions to improve children's dietary behaviours. At least 80% of children in Australia, United States (U.S.) and United Kingdom (U.K.) attend centre-based ECEC centres, including long day care and preschools (4, 5), providing multiple opportunities to influence and reinforce children's dietary behaviours. Further, the fostering of children's dietary behaviours aligns with the philosophy of the setting, as accreditation processes require ECEC centres to create environments supportive of child health (6, 7).

Within ECEC centres that provide meals and snacks to children on site (i.e., menu-based centres), food availability and a number of additional characteristics of centre nutrition environments have been

found to be associated with improved child dietary intake in care (8–11). A recent review consolidating evidence from systematic reviews to examine the potential effectiveness of ECEC centre practices concluded that healthy food availability was associated with improved child dietary intake in care (11). A U.S. study conducted in 2000 with 28 children attending care concluded that positive educator role modelling of healthy eating increased child intake of fruit (8). A 2015 study with 398 children from 24 Dutch preschools found children ate more servings of fruit when they participated in meal preparation, and ate more vegetables when encouraged by educators to continue eating vegetables (9). Further, a 2019 study with 58 preschool managers and 585 children in Finland found that having comprehensive written food policies which include educator feeding practices and the provision of food in care was associated with higher child intake of vegetables (10). Given the association between centre nutrition environments and child dietary intake, best-practice guidelines recommend centres implement evidence-based healthy eating practices targeting the characteristics of centre nutrition environments known to be supportive of children's healthy eating behaviours (12, 13).

The majority of research to support the association between healthy eating practices, including food availability, and child dietary intake in care has, however, been conducted within menu-based centres (11). At present, it is unknown whether such factors influence child dietary intake within centres where parents or guardians are required to pack food from home (i.e., within lunchboxes) for children to consume in care. Differing operational characteristics among menu-based and lunchbox centres may mean the associations between healthy eating practices and child dietary intake established in menu-based centres do not generalise (14, 15). For example, in Australia, lunchbox centres are more likely to cater only for children aged 3 to 5 years, and have shorter hours of operation compared with menu-based centres (14, 15). Furthermore, mealtimes within menu-based centres are becoming increasingly family style, with children encouraged to serve their own portions (13), compared to the pre-prepared portions available within children's lunchboxes. Finally, sector-specific dietary guidelines exist for menu-based centres which specify the types and quantities of food to be provided to children in care (16, 17), but do not provide such prescriptive guidance for the content of lunchboxes packed for parents. Despite lunchbox centres making up a significant proportion of Australian ECEC centres (18), few studies have described the nutrition environment and healthy eating practices of lunchbox centres, nor examined the association between such factors and child dietary intake. Such evidence is required for the development of targeted interventions for this setting to improve public health nutrition.

In the context of the current evidence base, the aims of this study were to: (1) describe the nutritional content of foods and beverages consumed by children in care; and (2) assess the association between centre healthy eating practices and child dietary intake of fruit and vegetable servings, added sugar (grams (g)), saturated fat (g) and sodium (milligrams (mg)) in care.

It was hypothesised the implementation of centre healthy eating practices would be positively associated with child dietary intake of fruit and vegetable servings, and negatively associated with child dietary intake of added sugar, saturated fat and sodium in care.

MATERIALS AND METHODS

Study design and setting

A cross-sectional study was undertaken in 22 Early Childhood Education and Care (ECEC) centres in the Hunter New England (HNE) region of New South Wales (NSW), Australia. ECEC centres included long day care and preschools, typically enrolling children between 0 and 6 years old, prior to compulsory schooling (19). ECEC centres within the study region currently participating in a cluster randomised controlled trial (RCT) to improve child dietary intake in care served as the sampling frame for the study, with baseline data from the trial presented within this paper (20). The sample size of 440 children and 22 ECEC centres (estimating 20 children per centre) was calculated to enable the detection of clinically meaningful differences in the trial outcomes (20).

Ethical approval to conduct the study was obtained from the HNE (approval no: 06/07/26/4.04) and the University of Newcastle (reference number: H−2008-0343) Human Research Ethics Committees.

Study recruitment and procedures

ECEC centres

Centres were eligible to participate in the study if they met the following criteria: (1) enrol more than 20 children per day; (2) have internet access at the centre; (3) do not provide meals or snacks to children (i.e., parents or caregivers provide food packed in lunchboxes); (4) not be currently participating in any other intervention to improve child healthy eating and/or physical activity; and (5) not be fully compliant with healthy eating practices targeted by the intervention and specified in the NSW state obesity prevention program (i.e., *Munch & Move*) according to NSW Ministry of Health data monitoring (21). Centres were excluded from the study if they: (1) were a mobile preschool, family day care or a centre that did not provide care to children aged 2–5 years; (2) catered exclusively for children requiring specialist care; or (3) were run by the Department of Education, due to differing operational characteristics.

Potentially eligible centres located within the HNE region were identified through data provided by the NSW Ministry of Health (21). A recruitment package consisting of an information statement and consent form was progressively distributed to potentially eligible centres via mail and email in random order. Approximately two weeks later, a research assistant telephoned potentially eligible

centres to review study details, assess centre eligibility, request consent for study participation and schedule a two-day data collection site visit with consenting centres. Centres were contacted in this random order until the required number of centres (n = 22) consented.

Children

For children to be eligible, they were required to: (1) have prior written consent from a parent or guardian; (2) be aged between 2 and 5 years; and (3) not have a dietary restriction that requires specialised tailoring of their diet (e.g., allergies).

Following written consent from centres to participate in the study, centre staff were asked to distribute information statements and consent forms to parents with children aged between 2 and 5 years via usual communication methods with parents, including email, parent communication apps, and child pigeonholes. For those centres that consisted of more than one classroom, staff were asked to only distribute information statements and consent forms to the classroom with the highest number of children enrolled aged between 2 and 5 years. Prior to data collection and on the days of the site visit, trained research assistants (RAs) attended the centre during drop off time to discuss the purpose of the study with parents, assess child eligibility and obtain parent consent for child/ren to participate.

Data collection procedures and measures

Data collection occurred between September 2019 and December 2019.

Child dietary intake of fruit and vegetables servings in care

Measurements of lunchbox foods and beverages were conducted to assess servings of fruit and vegetables consumed whilst in care. Similar to lunchbox assessments previously conducted in ECEC centres (22), two trained RAs attended each centre on two consecutive days to assess the lunchboxes of participating children. Lunchbox assessments were conducted over two days for a centre, but only on one day for each child. Specifically, lunchboxes were measured on two occasions across the day: before the first meal and after the last meal. During this process, RAs took a photo of the lunchbox contents and weighed each food item packed within the lunchbox, whilst adhering to strict food handling protocols. RAs then repeated this process after the last meal, with intake calculated based on foods and beverages present at the first measurement minus foods remaining at the second measurement. For food or beverage items that contained mixed ingredients (e.g., sandwiches, homemade baked goods, casseroles, pasta dishes), the RAs observed each food item and recorded a detailed description of each item, including name of item, estimated quantity (e.g., number of bread slices, cups of rice, tablespoons of sauce) and type (e.g., white, wholegrain). This approach has been taken for previous dietary assessments conducted within the ECEC setting (23). All food wastage,

including packaging, partially consumed items and food items dropped on the floor, were collected by the RAs throughout the day and were factored into child intake measurements. Weighed food record data is considered gold standard for measuring child dietary intake in the setting (20, 22, 24).

Prior to data collection, RAs completed a one-day training session conducted by trained dietitians with experience in the data collection methods, in which RAs practiced weighing, observing and recording food and beverage items packed within children's lunchboxes (22). Prior to data collection, all RAs completed a practical assessment in which they were required to score above 80% on a test assessing their accuracy of weighing, observing and recording foods and beverages (22). For quality assurance purposes RAs were accompanied by a trained dietitian with data collection experience for their first day of data collection.

Following data collection, a trained dietitian entered the weighed and observed food data into FoodWorks v10, a nutrient analysis database (25). When the type or quantity of a food item was unclear, trained dietitians developed a list of standard assumptions to be applied across all lunchbox measurements. For example, a thin spread of margarine on a sandwich was assumed to be 0.5 teaspoons (2g) of monounsaturated margarine, whilst one regular slice of cheese was assumed to be 21g of reduced fat cheddar cheese. For quality assurance purposes, each assumption was checked by a minimum of two dietitians with experience evaluating child dietary intake within the ECEC setting, with disagreements solved via consensus when required. All food and beverage items were categorised into food groups, and serving sizes consumed in accordance with the Australian Guide to Healthy Eating (AGHE) to calculate the servings of fruit and vegetables (26). When required, lunchbox photographs were used to validate food and beverage descriptions and weights recorded during data collection (22).

Child dietary intake of added sugar, saturated fat and sodium in care

Child dietary intake of added sugar (g), saturated fat (g) and sodium (mg) from all food and beverage items consumed whilst in care was calculated using the nutrient output provided by the weighed food record data entered into FoodWorks v10 (25) following the process described above. Added sugar was defined as per the Australian Dietary Guidelines and Food Standards Australia and New Zealand (FSANZ), and included sugars refined from plants (22, 27). Sodium was defined according to FSANZ, and included the sodium content from all sources (27).

Centre healthy eating practices

A modified version of the Environmental and Policy Assessment and Observation (EPAO) tool (28) was used to assess the healthy eating practices potentially influencing child diet. The EPAO tool has been previously validated and is considered the gold standard in assessing ECEC centre nutrition

environments (28). Selected items within the EPAO considered appropriate to the Australian lunchbox centre context were used to assess the following five practices: (1) supporting families to provide healthier foods consistent with dietary guidelines. For example, monitoring children's lunchboxes and communicating with parents regarding lunchbox contents (two items); (2) provision of intentional healthy eating learning experiences, such as formal nutrition lessons and informal conversations (two items); (3) use of educator feeding practices that support children's healthy eating. For example, educator role modelling healthy foods, avoiding the use of food as bribes and encouraging children to try new foods (21 items); (4) staff participation in professional development targeting healthy eating (one item); and (5) having a comprehensive written nutrition policy that outlines key healthy eating practices (13 items). Additionally, a sixth practice, the availability of food and beverages from foods packed within children's lunchboxes, including fruit and vegetable servings, as well as added sugar (g), saturated fat (g) and sodium (mg), was calculated through the lunchbox measurement process described above.

As the EPAO was originally developed to assess menu-based ECEC centres, items related to menu provision were replaced with items specific to lunchbox centres (e.g., educators monitoring children's lunchboxes for compliance with dietary guidelines). Relevant EPAO items were identified and mapped to each of the healthy eating practices by health practitioners (i.e., a dietitian and public health nutritionist) with experience working with lunchbox ECEC centres. The mapping of these items to each practice was then reviewed by two behavioural researchers (with experience in measurement development in the setting) to obtain consensus.

As per EPAO data collection training protocols (28), RAs completed a one-day training session conducted by a trained researcher with data collection experience prior to the conduct of data collection to familiarise themselves with the tool and data collection protocols. RAs also attended a ECEC centre to complete a practice observation of a centre nutrition environment with an experienced member of the research team. During the practice observation, RAs and the research team member independently completed the EPAO and compared responses to ensure consistency in approaches. For quality assurance purposes, RAs were accompanied by a trained researcher with data collection experience for their first day of data collection.

In accordance with the EPAO protocol, on one of the two days of data collection, a trained RA completed a one-day observation (i.e., between 9am and 3pm) of the centre nutrition environment and reviewed ECEC centre documentation (28). The same room selected for the lunchbox measurements (i.e., the classroom with the highest number of children enrolled aged 2–5 years) also participated in the centre nutrition environment observation. The observation component of the EPAO assessed educator use of feeding practices supportive of children's healthy eating, centres supporting families

to provide healthier foods consistent with dietary guidelines and the provision of intentional healthy eating learning experiences. At each meal occasion (i.e., morning tea, lunch and afternoon tea), an RA observed the centre nutrition environment and recorded if a specific item was observed or not on the data collection form. The documentation component of the EPAO assessed centre nutrition policy contents, staff completion of professional development in nutrition, and evidence of supporting families to provide healthy foods consistent with dietary guidelines. An RA reviewed documentation and recorded the relevant content of each document on the data collection form. Copies of relevant documentation, including centre nutrition policies and evidence of professional development, were collected to validate information recorded on the EPAO data collection form. Following the site visit, a trained RA entered the EPAO data collected via multiple sources (i.e., the observation and documentation review) into Excel. Items within each of the healthy eating practice were given a score out of three, with the score for each of the practices calculated by summing the scores from the relevant items, then dividing by the number of items within the practice (scoring range of 0–3). A score of 0 indicates a healthy eating practice is not implemented during any meal occasion (i.e., no item was achieved), whilst a score of 3 indicates a healthy eating practice is fully implemented at every meal occasion (i.e., all items were achieved).

Centre and child demographics

Centre demographic information was collected during a telephone interview with centre nominated supervisors and included type of centre (i.e., long day care or preschool), days of operation, centre opening and closing hours, and number of children enrolled aged between 2 and 5 years (29, 30). Centre geographical information (i.e., postcode) was used to classify centre locality (i.e., either urban or regional/remote) and socio-economic status (i.e., either low or high social disadvantage).

Child demographics were captured through information recorded on parent consent forms. Parents reported their child's age, sex (as recorded on the child's birth certificate), usual number of days attending care, and child Aboriginal and/or Torres Strait Islander background.

Statistical Analysis

Statistical analyses were performed using SAS 9.3 software. Descriptive statistics, including means and standard deviations, were used to describe centre and child demographics, and the fruit and vegetable servings, sugar (g), saturated fat (g) and sodium (mg), consumed by children in care and packed in children's lunchboxes.

Centre postcodes ranked in the top 50% of NSW according to the 2016 Socio-Economic Indexes for Areas (SEIFA) were classified as least disadvantaged (i.e., high SES), whilst the lower 50% of postcodes were classified as most disadvantaged (i.e., low SES) (31). The Australian Statistical

Geography Standards were used to classify centre locality as either urban or regional/remote (32). Differences in centre SES and geographic location between consenting and non-consenting centres were examined via chi-square analyses to identify potential participation bias. Standardised scores were calculated for each EPAO item to account for the variation in the number of mealtimes within participating centres (i.e., preschools predominately had two mealtimes, long day care centres had three), allowing for direct comparison of healthy eating practices between centres with a different number of mealtimes. In the rare instances (1% of EPAO items) where data was missing for an EPAO item within a mealtime, we assumed the missing item had the same value as the recorded value for the other mealtimes for that centre. Multilevel mixed-effects linear regressions were performed to determine the association between overall and individual item healthy eating practices (independent variable) and measures of child dietary intake (dependent variable). These included a random intercept effect for the centre to account for potential clustering, as well as fixed effects for SES and centre locality to account for centre characteristics associated with child dietary intake. Statistical significance was defined as $P < 0.05$.

RESULTS

Of the potentially eligible centres within the sampling frame (n = 85), 57 centres were sent an information statement and consent form. Of these, 25 (53%) centres declined to participate (lack of time, n = 21; study of lessor importance, n = 2; lack of staff capacity, n = 2) and 10 (21%) centres were ineligible (provided food to children, n = 3; NSW Department of Education centre, n = 6; involved in another healthy eating or physical activity study, n = 1), resulting in a study consent rate of 47%. There were no significant differences in centre area SES or centre geographic location between consenting and non-consenting centres. Within participating ECEC centres, the average child consent rate to participate in lunchbox measurements was 75%, with lunchbox measurement data collected for 448 children (89.2% of consenting children due to absenteeism on data collection days).

The majority of participating ECEC centres were preschools (90.1%) (Table 2.1) and enrolled an average of 29.9 (standard deviation (SD) 9.8) children aged 2–5 years. Fourteen (63.8%) centres were located in high SES areas, with 16 (72.7%) located in urban areas (major cities). On average, participating children were aged 4.7 years (SD 0.7) and attended care for 2.6 days per week (SD 0.8).

Table 2.1 Demographic characteristics of participating centres and children

Centre (*n* = 22)	***n***	**%**
Type of centre:		
Preschool	20	90.1%
Long Day Care	2	9.9%

Number of child enrolments aged 2–5 years (mean, SD)	29.9 (9.8)	-
Centre opening hours (mean, SD)	8 (0.9)	-
Number of days open per week (mean, SD)	4.9 (0.4)	-
Socio-Economic Indexes for Areas (SEIFA):		
Most disadvantaged (low socioeconomic status (SES))	8	36.4%
Least disadvantaged (high SES)	14	63.8%
Geographic location:		
Urban (major cities)	16	72.7%
Regional/remote (inner regional, outer regional, remote)	6	27.3%
Child (n = 448)	***n***	**%**
Age (mean, SD):	4.7 (0.7)	-
Sex: Female	210	46.9%
Male	238	53.1%
Aboriginal and/or Torres Strait Islander background	44	9.8%
Number of days attending care (mean, SD)	2.6 (0.8)	-

SD: standard deviation.

Child dietary intake

Results of the lunchbox measurements indicate that children consumed a mean of 0.80 (SD 0.69) servings of fruit and 0.27 (SD 0.51) servings of vegetables (Table 2.2). Children consumed a mean of 8.06 g (SD 8.44) of added sugar, 5.57 g (SD 3.96) of saturated fat and 668.60 mg (SD 328.57) of sodium.

When examining the association between the availability of foods and beverages packed within children's lunchboxes and child dietary intake, results of the multilevel mixed-effects linear regression indicate that there was a statistically significant association between fruit servings packed within lunchboxes and those consumed (estimate 0.51; standard error (SE) 0.02; $P < 0.01$) and vegetable servings packed and consumed (estimate 0.72; SE 0.02; $P < 0.01$) (Table 2.2). Results also indicated that there were statistically significant associations between the amount of added sugar, saturated fat and sodium available from foods and beverages packed within children's lunchboxes, and child dietary intake of those nutrients (Table 2.2)

Table 2.2 Servings and nutritional content for foods and beverages packed (available to children) within lunchboxes and consumed from children's lunchboxes (n = 448), and the association between availability and child dietary intake

Food group or nutrient	Packed within lunchboxes	Child dietary intake	Percentage of packed consumed	Association between availability and child dietary intake
	mean (SD)	mean (SD)	%	Estimate (SE); P value
Fruit (serving)	1.33 (0.94)	0.80 (0.69)	60.15	0.51 (0.02); P < 0.01 *
Vegetable (serving)	0.40 (0.63)	0.27 (0.51)	67.50	0.72 (0.02); P < 0.01 *
Added sugar (g)	10.17 (10.37)	8.06 (8.44)	79.25	0.65 (0.02); P < 0.01 *
Saturated fat (g)	7.80 (5.12)	5.57 (3.96)	71.41	0.61 (0.02); P < 0.01 *
Sodium (mg)	917.42 (413.91)	668.60 (328.57)	72.88	0.00 (0.00); P < 0.01 *

SE: standard error; * Denotes a statistically significant association ($P < 0.05$).

Association between healthy eating practices and child dietary intake of fruit and vegetables

The mean scores for centre healthy eating practices have been provided in Table 2.3. The highest mean score evident was the use of feeding practices that support children's healthy eating with 1.86 (SD 0.22; range 1.57–2.36) out of 3. Results of the multilevel mixed-effects linear regression indicate there were no statistically significant associations identified between healthy eating practices and child intake of fruit and vegetable servings (Table 2.4).

Several statistically significant positive associations between individual items within the healthy eating practices and child intake of fruit and vegetable servings were identified (Table 2.4). Educators observing children's lunchboxes for consistency with dietary guidelines was significantly associated with increased child intake of fruit servings (estimate 0.07; SE 0.03; P = 0.01), as well as educators using an authoritative feeding style (e.g., educators used supportive strategies such as reason and education, rather than bribes or threats) (estimate 0.09; SE 0.04; P = 0.04). Educators allowing children to choose between two healthy food options was significantly associated with increased child intake of vegetable servings (estimate 0.07; SE 0.04; P = 0.05).

The inclusion of several items within centre nutrition policies was significantly associated with child dietary intake. For example, the inclusion of educator participation in professional development in healthy eating was negatively associated with child intake of vegetable servings (i.e., intake decreased) (estimate −0.09; SE 0.04; P = 0.04), whilst the inclusion of staff avoiding the use of food to calm a child or as a bribe to get a child to behave was positively associated with increased child intake of fruit servings (estimate 0.11; SE 0.05; P = 0.02).

Table 2.3 Centre healthy eating practices (n = 22)

Healthy eating practice *	Mean score (SD)	Range **
Supporting families to provide healthier foods consistent with dietary guidelines	0.62 (0.98)	0.00–3.00
Provision of intentional learning experiences about healthy eating	0.52 (0.99)	0.00–3.00
Use of feeding practices that support children's healthy eating	1.86 (0.22)	1.57–2.36
Educator participation in professional development in healthy eating	0.32 (0.89)	0.00–3.00
Comprehensive written nutrition policy	1.02 (0.35)	0.35–1.96

* Each healthy eating practice was scored out of three; ** Represents the distribution of scores calculated across participating centres (i.e., lowest - highest score calculated within each practice); See Table 2.4 for availability of foods and beverage packed in lunchboxes.

Association between healthy eating practices and child dietary intake of added sugar, saturated fat and sodium

Results of the multilevel mixed-effects linear regression indicate that there were several statistically significant negative associations between the ECEC centres healthy eating practices and child intake of saturated fat (i.e., reduced intake) (Table 2.4). This included centre provision of intentional learning experiences about healthy eating (estimate −0.56; SE 0.19; P = 0.01) and the use of feeding practices that support children's healthy eating (estimate −2.02; SE 0.92; P = 0.04).

Multiple statistically significant associations between individual items within the healthy eating practices and child dietary intake of added sugar, saturated fat and sodium intake were also identified (Table 2.4). The provision of both formal (estimate −0.44; SE 0.16; P = 0.01) and informal (estimate −0.61; SE 0.22; P = 0.01) nutrition education to children and educators using an authoritative feeding style (estimate −0.50; SE 0.23; P = 0.04) were negatively associated with child intake of saturated fat (i.e., reduced intake). Having a variety of healthy foods visible to children during mealtimes was positively associated with child intake of added sugar (i.e., increased intake) (estimate 1.10; SE 0.43; P = 0.02), whilst educators requiring children to sit at the table until they finished food was negatively associated with child dietary intake of sodium (i.e., reduced intake) (estimate 127.55; SE 51.79; P = 0.02).

Table 2.4 Multilevel linear regression estimates of the association between centre healthy eating practices and child dietary intake

Items	Fruit intake (serving)		Vegetable intake (serving)		Added sugar intake (g)		Saturated fat intake (g)		Sodium intake (mg)	
	Estimate (SE)	P value	Estimate (SE)	P value	Estimate (SE)	P value	Estimate (SE)	P value	Estimate (SE)	P value
Supporting families to provide healthier foods consistent with dietary guidelines										
Educator observed children's lunchboxes	0.07 (0.03)	0.01*	−0.00 (0.03)	0.91	0.00 (0.42)	0.99	−0.03 (0.16)	0.86	23.28 (17.94)	0.21
Centres provide feedback to families regarding lunchbox contents	0.00 (0.03)	0.94	−0.00 (0.04)	0.98	0.43 (0.46)	0.37	−0.32 (0.18)	0.09	−24.31 (20.03)	0.24
Overall practice	0.07 (0.04)	0.08	−0.00 (0.04)	0.93	0.32 (0.56)	0.58	−0.25 (0.22)	0.26	3.05 (25.25)	0.91
Provision of intentional learning experiences about healthy eating										
Formal nutrition education to children	0.03 (0.03)	0.28	0.03 (0.03)	0.43	−0.55 (0.41)	0.19	−0.44 (0.16)	0.01*	1.70 (19.32)	0.93
Informal nutrition education to children	−0.00 (0.05)	0.97	0.07 (0.04)	0.10	−0.94 0.58)	0.12	−0.61 (0.22)	0.01*	0.50 (27.87)	0.99
Overall practice	0.03 (0.04)	0.52	0.05 (0.04)	0.23	−0.78 (0.50)	0.14	−0.56 (0.19)	0.01*	1.50 (24.08)	0.95
Use of feeding practices that support children's healthy eating										
Educator used an authoritative feeding style	0.09 (0.04)	0.04*	−0.05 (0.05)	0.28	−0.54 (0.63)	0.40	−0.50 (0.23)	0.04	21.86 (28.01)	0.44
Educator used food to calm an upset child.	0.28 (0.22)	0.22	−0.05 (0.24)	0.84	−3.99 (2.98)	0.20	−0.06 (1.21)	0.96	51.38 (137.63)	0.71
Educator encouraged children to sit	0.08 (0.04)	0.06	0.01 (0.04)	0.78	0.58 (0.55)	0.31	0.12 (0.22)	0.58	34.80 (24.03)	0.16
Educator let the children choose between two healthy food options	0.03 (0.04)	0.44	0.07 (0.04)	0.05*	−0.13 (0.51)	0.80	−0.51 (0.19)	0.02*	−11.50 (22.80)	0.62
Educator ate with the children during meal times	−0.01 (0.03)	0.79	−0.04 (0.03)	0.31	0.02 (0.46)	0.96	0.00 (0.17)	0.99	−22.97 (19.71)	0.26
Educator enthusiastically role modelling eating healthy foods	0.02 (0.04)	0.59	0.00 (0.04)	0.91	−0.27 (0.50)	0.59	−0.37 (0.18)	0.06	−11.58 (22.35)	0.61
Educator made fruit and vegetables easier to eat	0.00 (0.04)	0.93	−0.01 (0.04)	0.70	0.45 (0.47)	0.36	0.02 (0.18)	0.90	31.86 (20.16)	0.13
A variety of healthy foods are visible to children	0.03 (0.04)	0.47	0.02 (0.04)	0.63	1.10 (0.43)	0.02*	0.19 (0.19)	0.34	−9.52 (22.59)	0.68
Unhealthy snack foods are visible to children	−0.01 (0.04)	0.74	−0.06 (0.04)	0.12	0.61 (0.48)	0.22	0.18 (0.19)	0.35	30.18 (21.50)	0.18

Items	Fruit intake (serving)		Vegetable intake (serving)		Added sugar intake (g)		Saturated fat intake (g)		Sodium intake (mg)	
	Estimate (SE)	P value	Estimate (SE)	P value	Estimate (SE)	P value	Estimate (SE)	P value	Estimate (SE)	P value
Educator ate unhealthy foods during the meal time	−0.07 (0.13)	0.56	−0.16 (0.12)	0.22	1.85 (1.66)	0.28	−0.75 (0.65)	0.26	81.13 (73.52)	0.28
Educator shows indifference to children	0.08 (0.21)	0.71	0.19 (0.20)	0.35	−1.15 (2.70)	0.68	−1.47 (1.09)	0.20	−56.01 (119.31)	0.64
Educator insisted that a child eat a food	0.00 (0.05)	0.94	−0.02 (0.05)	0.77	−0.87 (0.67)	0.21	−0.55 (0.26)	0.05	−29.82 (30.28)	0.34
Educator negotiated with children to eat healthy foods	0.04 (0.05)	0.48	0.02 (0.06)	0.71	0.46 (0.75)	0.55	0.29 (0.28)	0.31	−40.42 (32.70)	0.23
Educator encouraged children to try new or less preferred foods	−0.06 (0.06)	0.29	0.04 (0.06)	0.54	0.36 (0.76)_	0.64	0.13 (0.30)	0.68	−49.07 (32.11)	0.14
Educator led pleasant conversations during meals	0.00 (0.04)	0.98	0.01 (0.05)	0.77	0.54 (0.59)	0.37	−0.22 (0.22)	0.34	−38.83 (25.85)	0.15
Educator praised children for finishing food	−0.05 (0.08)	0.48	−0.03 (0.08)	0.72	−2.07 (0.88)	0.03	−0.67 (0.37)	0.09	3.45 (46.70)	0.94
Educator reasoned with the children to eat healthy foods	0.00 (0.06)	0.98	−0.02 (0.07)	0.78	−0.39 (0.87)	0.66	−0.09 (0.34)	0.80	−61.61 (35.82)	0.10
Educator used food as a reward/ withheld food as a punishment	0.00 (0.06)	0.95	−0.08 (0.06)	0.20	−0.47 (0.79)	0.56	−0.39 (0.30)	0.22	33.45 (34.81)	0.35
Educator rushed children to eat.	0.01 (0.06)	0.84	0.08 (0.06)	0.18	−0.59 (0.80)	0.47	−0.46 (0.29)	0.13	−24.74 (35.33)	0.49
Educator required children to sit at the table until they finished all food	0.00 (0.10)	0.96	0.06 (0.10)	0.55	−0.87 (1.34)	0.53	−0.69 (0.47)	0.16	−127.55 (51.79)	0.02*
Educator spoon fed a child	0.07 (0.14)	0.60	0.12 (0.14)	0.42	−1.93 (1.85)	0.31	0.08 (0.74)	0.91	105.49 (79.78)	0.20
Overall practice	0.19 (0.18)	0.31	−0.04 (0.19)	0.84	1.08 (2.50)	0.67	−2.02 (0.92)	0.04	−64.11 (111.48)	0.57
Staff participation in professional development in healthy eating										
Overall practice	0.00 (0.04)	0.95	−0.04 (0.04)	0.43	0.21 (0.61)	0.74	−0.06 (0.23)	0.79	22.86 (26.73)	0.40
Comprehensive written nutrition policy										
Encouraging children to eat healthy foods without bribes or threats.	−0.05 (0.05)	0.36	−0.05 (0.05)	0.37	−0.66 (0.72)	0.37	0.22 (0.27)	0.41	12.61 (32.39)	0.70

Items	Fruit intake (serving)		Vegetable intake (serving)		Added sugar intake (g)		Saturated fat intake (g)		Sodium intake (mg)	
	Estimate (SE)	P value	Estimate (SE)	P value	Estimate (SE)	P value	Estimate (SE)	P value	Estimate (SE)	P value
Avoiding the use of food to calm a child or as a bribe	0.11 (0.05)	0.02*	0.04 (0.05)	0.44	−0.46 (0.72)	0.53	0.04 (0.27)	0.87	−4.24 (32.08)	0.90
Staff participation in professional development in healthy eating	−0.00 (0.04)	0.97	−0.09 (0.04)	0.03*	0.70 (0.52)	0.20	0.04 (0.21)	0.85	40.25 (22.51)	0.09
Educators enthusiastically role model	0.10 (0.07)	0.17	0.00 (0.07)	0.96	−0.73 (0.96)	0.46	−0.01 (0.37)	0.98	40.39 (42.16)	0.35
Providing a planned nutrition education activity for children	−0.03 (0.11)	0.80	−0.15 (0.11)	0.18	1.34 (1.50)	0.38	0.39 (0.55)	0.48	4.24 (69.14)	0.95
Checking with a child about their hunger/fullness before removing food	0.02 (0.05)	0.67	−0.04 (0.06)	0.48	0.64 (0.72)	0.38	0.30 (0.27)	0.28	5.39 (33.67)	0.87
Talk with children about food and provide informal nutrition education	0.05 (0.04)	0.30	0.03 (0.05)	0.54	−0.65 (0.59)	0.28	0.00 (0.23)	0.98	26.14 (26.32)	0.33
Strategies are in place to ensure that food brought from home is consistent with Australian Dietary Guidelines	0.01 (0.05)	0.90	0.02 (0.06)	0.69	−0.33 (0.73)	0.66	−0.21 (0.27)	0.45	−3.34 (32.90)	0.92
Offering families education on child nutrition once or more times per year	−0.02 (0.05)	0.74	0.03 (0.05)	0.57	−0.27 (0.64)	0.68	−0.13 (0.24)	0.60	31.43 (28.13)	0.28
Educators making positive comments about healthy foods eaten by children	0.05 (0.04)	0.30	0.03 (0.05)	0.54	−0.66 (0.59)	0.28	0.01 (0.23)	0.98	26.14 (26.32)	0.33
Praising children for trying new or less preferred foods	0.03 (0.05)	0.58	−0.02 (0.06)	0.70	−0.82 (0.71)	0.26	−0.20 (0.28)	0.47	37.94 (31.24)	0.24
Educators avoid using preferred foods to encourage children to eat new or less preferred foods	−0.08 (0.05)	0.13	0.00 (0.06)	0.95	−0.64 (0.75)	0.41	−0.18 (0.29)	0.55	−7.02 (34.03)	0.84
Educators not eating unhealthy foods or unhealthy beverages	−0.07 (0.06)	0.25	−0.03 (0.06)	0.64	0.27 (0.85)	0.75	−0.01 (0.32)	0.98	−8.59 (37.50)	0.82
Overall practice	0.05 (0.11)	0.63	−0.04 (0.11)	0.72	−1.04 (1.49)	0.50	−0.01 (0.57)	0.99	80.72 (64.32)	0.23

* Denotes a statistically significant association ($P < 0.05$)

DISCUSSION

To our knowledge, this is the first study to assess the association between healthy eating practices and child dietary intake within Australian lunchbox ECEC centres. The study found low servings of fruit and vegetables consumed from foods packed within children's lunchboxes, in addition to high intake of added sugar, saturated fat and sodium. The hypothesis that the implementation of centre healthy eating practices would be positively associated with child dietary intake of fruit and vegetable servings, and negatively associated with child dietary intake of added sugar, saturated fat and sodium, was partially supported. The study found consistent associations between the availability of fruit, vegetables, added sugar, saturated fat and sodium in lunchboxes and child dietary intake of these in care, but less consistent associations between these measures of child dietary intake and other healthy eating practices. The findings provide important information for policy makers and practitioners interested in improving child nutrition in this sector.

Reported intakes of fruit (0.80 servings) and vegetables (0.27 servings) in this study is consistent with previous Australian studies examining child dietary intake within lunchbox centres (33, 34). For example, previous cross-sectional studies conducted within NSW have reported intakes of 0.7 servings of fruit and 0.1–0.2 servings of vegetables (33, 34). More broadly, cross-sectional studies conducted within U.S. ECEC centres have also found low intakes of fruit and vegetables from foods packed within children's lunchboxes to consume in care (35, 36). The limited intake of vegetable servings in care is of particular concern, with sector-specific guidelines recommending for children to consume one to two servings of vegetables whilst in care per day (12). Such findings indicate that there is extensive scope to improve child intake of vegetables in care.

The availability of foods within lunchboxes was significantly associated with child dietary intake of these items ($P < 0.01$). This finding is consistent with previous research conducted within other education-based settings such as schools, where food availability was found to be closely associated with child dietary intake (37, 38). As the effectiveness of other supportive educator feeding practices are, to a large extent, reliant on healthy foods being available within lunchboxes, strategies to support parents lunchbox packing behaviours should be a priority. This is supported by a 2019 systematic review by Nathan et al. examining lunchbox interventions within schools and ECEC centres, which highlighted that the inclusion of strategies that actively target parents was particularly important to improve child dietary intake in care (39). Other Australian initiatives, such as the Healthy Lunch Box developed by Cancer Council NSW, have been established to provide specific evidence-based recommendations to support the packing of healthy lunchboxes (40). However, the impact of such an initiative on parent packing and child dietary intake has not been evaluated to our knowledge.

Findings from the multilevel linear regressions suggest that in addition to improving availability, considerable opportunities exist to improve child dietary intake via other healthy eating practices. Despite the absence of a significant association between supporting families to provide healthier foods and child dietary intake of fruit and vegetable servings at an overall practice level, findings at the individual item level show promise. Educators observing children's lunchboxes for consistency with dietary guidelines was significantly associated with increased child intake of fruit (estimate 0.07; SE 0.03; P = 0.01). As this is the first study to examine the association between healthy eating practices and child dietary intake within Australian lunchbox centres, this finding is particularly noteworthy. Future interventions aiming to improve child dietary intake within lunchbox centres should consider targeting this item in order to maximise the impact of the intervention.

The study found the provision of intentional healthy eating learning experiences was significantly associated with reduced child intake of saturated fat (estimate −0.56; SE 0.19; P = 0.01). This is broadly in contrast to a cross-sectional study by Ward et al. examining the nutrition environments of 50 Canadian preschools, which found no association between the provision of intentional healthy eating learning experiences and total fat intake (41). Our study findings of a statistically significant association between healthy eating learning experiences and reduced intake of saturated fat, but not for other nutrients considered as markers for energy-dense discretionary foods (i.e., added sugar and sodium), is noteworthy. The potential mechanism for this differential association should be explored further. Interestingly, our study did not find a significant association between centre nutrition policies overall and child dietary intake. This is in contrast to a study of menu-based centres by Lehto et al., which found that centres having a comprehensive written food policy resulted in higher child intake of vegetables in care (10). The differences in reported associations between our study and those undertaken in menu-based centres may be due to a range of methodological differences between the studies. Alternatively, they may suggest the contextual differences between lunchbox and menu-based centres may alter the strength of association between these centre types. Further research is warranted to investigate such hypotheses.

Other than strategies targeting the availability of foods within children's lunchboxes, a number of educator-related healthy eating practices such as monitoring children's lunchboxes, using an authoritative feeding style and the provision of intentional healthy eating learning experiences, should be prioritised within future ECEC-based interventions. Given the potential impact on child dietary intake, strategies to support centres to implement these healthy eating practices are required. Employing theoretical frameworks, such as the Consolidated Framework for Implementation Research (CFIR) (42), can provide a systematic approach to identifying barriers to centres implementing the recommended healthy eating practices identified in this study, and develop support strategies accordingly. As this is the first study to examine the association between centre healthy

eating practices and child dietary intake within lunchbox centres, additional studies with well-defined practices and validated items are required to confirm the healthy eating practices most influential on child dietary intake. Such evidence can provide guidance to practitioners to support centres in implementing healthy eating practices to improve child dietary intake in care.

Strengths and Limitations

This study had several strengths, including the use of gold standard objective measures to assess both child dietary intake and centre healthy eating practices (24, 28). Additionally, the study obtained a high consent rate of 75% from parents for their child(ren) to participate in lunchbox observation and measurements. However, the study is not without its limitations. Whilst similar to other studies conducted in the ECEC setting (29, 30), a consent rate of 47% was obtained from ECEC centres to participate in the study, limiting the potential generalisability of study findings. The study eligibility criteria, including the exclusion of centres currently compliant with healthy eating practices specified within the NSW state obesity prevention program and centres run by the Department of Education, may further limit the potential generalisability of the findings. Dietary intake was measured across one day for each child, and therefore does not take into account potential daily fluctuations in intake. Additionally, the inability of RAs to confirm the nutrient content of mixed ingredient food items packed within children's lunchboxes (e.g., homemade baked goods) may have resulted in the under or over estimation of some nutrient values. As such, the results may not be a true indication of child dietary intake in care. Given the importance of adequate fruit and vegetable consumption and limited consumption of added sugar, saturated fat and sodium to achieve and maintain good health (43), future studies should explore child dietary intake of such food groups and nutrients and provide a comparison to relevant dietary recommendations (34). Despite the use of gold standard methodology, the presence of an RA whilst observing centre nutrition environments may have unintentionally influenced centre staff behaviour that may have not otherwise occurred (41), such as role modelling healthy food choices or providing nutrition education to children. Additionally, centre nutrition environment observations were conducted by a single RA at each centre, with inter-rater reliability not formally assessed. Given a small sample size (n = 22 centres) and the large number of multilevel linear regressions performed, the results of the regressions should be interpreted with caution (44). Finally, the cross-sectional study design precludes the assessment of causal relationships occurring.

CONCLUSIONS

Given this was the first study to examine the association between centre healthy eating practices and child dietary intake within Australian lunchbox centres, it contributes substantially to a previously limited evidence base. Findings of the study suggest that future interventions should focus on

improving the availability of foods packed within children's lunchboxes, in combination with targeting educator-related healthy eating practices to improve child dietary intake within lunchbox centres. Future research assessing child dietary intake and centre nutrition environments over multiple days within a broader range of ECEC centres may be warranted to provide a better understanding of the association between centre healthy eating practices and child dietary intake.

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CHAPTER THREE

A PILOT RANDOMISED CONTROLLED TRIAL OF A WEB-BASED IMPLEMENTATION INTERVENTION TO INCREASE CHILD INTAKE OF FRUIT AND VEGETABLES WITHIN ECEC CENTRES

A version of this Chapter was published in *Pilot and Feasibility Studies*

Additional materials in Appendices 3.1 – 3.14

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ABSTRACT

Introduction

As dietary behaviours developed during early childhood are known to track into adulthood, interventions that aim to improve child nutrition at a population level are recommended. Whilst early childhood education and care (ECEC) is a promising setting for interventions targeting children's nutrition behaviours, previous interventions have largely used high intensity, face-to-face approaches, limiting their reach, implementation and potential impact at a population level. Web-based modalities represent a promising means of supporting the delivery of ECEC-based interventions whilst overcoming challenges of previous approaches; however, the feasibility of using such modalities to support implementation is largely unknown. As such, this Chapter describes the protocol for our study that sought to collect feasibility and pilot data to inform the design of a web-based intervention together with health promotion officer support within ECEC centres. Child dietary intake will also be assessed to provide an estimate of the impact of the implementation intervention.

Methods

A superiority cluster randomised controlled trial with repeat cross-sectional data collection employing an effectiveness-implementation type-II hybrid design will be conducted with ECEC centres within the Hunter New England region of New South Wales, Australia. Type-II hybrid designs provide the opportunity to assess intervention efficacy whilst piloting the feasibility of the implementation strategies. Centres allocated to the intervention group will receive access to a web-based program together with health promotion officer support to implement targeted healthy eating practices to improve child diet in care. A number of outcomes will be assessed to inform the feasibility to conduct a larger trial, including ECEC centre and parent recruitment and consent rates for each component of data collection, uptake of the implementation strategies, acceptability of the intervention and implementation strategies, appropriateness of the implementation strategies and the contextual factors influencing implementation.

Discussion

This study will provide high-quality evidence regarding the potential feasibility of a web-based intervention and the impact of healthy eating practices on child diet in care. Web-based modalities provide a promising approach for population-wide implementation support to ECEC centres given their potential reach and consistency with existing infrastructure.

Trial registration

Prospectively registered with Australian New Zealand Clinical Trial Registry (ACTRN1261900115 8156).

INTRODUCTION

Childhood overweight and obesity increases the risk of adult obesity and several other chronic diseases, including cardiovascular disease, type 2 diabetes and specific cancers (1). Internationally, more than 41 million children aged 0–5 years were classified as overweight or obese in 2016 (1). Poor dietary behaviours, including low intake of fruit and vegetables and high intake of energy-dense discretionary food and beverages (those which are high in sodium, saturated fat and added sugars), are considered to be primary risk factors for the development of childhood overweight and obesity (2). Current evidence from Australia, the United States (U.S.) and the United Kingdom (U.K.) report that over 90% of pre-school aged children do not consume recommended servings of vegetables, and almost all consume excessive amounts of discretionary foods (3–5). Although substantially higher than vegetables, evidence suggests that an inadequate proportion of children are consuming the recommended servings of fruit (6). As dietary behaviours developed during early childhood are known to track into adulthood (7), interventions that aim to improve child nutrition at a population level are recommended (8). Early childhood education and care (ECEC) is a promising setting for interventions targeting children's nutrition behaviours. With at least 80% of children in countries including Australia and the U.K. attending formal centre-based ECEC (herein referred to as ECEC centres) (4, 9), including long day care and preschools, interventions targeting this setting have the potential to reach a large number of children during a crucial developmental period. In Australia, children attend care for an average of 21 hours per week (10), providing multiple opportunities to reinforce healthy eating behaviours. Furthermore, as children can consume up to two thirds of their recommended daily intake whilst in care (11), interventions to improve the nutrition environments of ECEC centres have the potential to substantially improve a child's overall nutrition intake.

Internationally, sector-specific recommendations for ECEC centres exist (12–14) which acknowledge the potential impact of the ECEC centre environment on influencing children's dietary intake. Importantly, two recent scoping reviews summarising findings from systematic reviews have identified several ECEC-based healthy eating practices associated with improved child diet outcomes. These include the provision of interactive child education to improve child knowledge and skills, educator positive role modelling, and engaging with parents to target the provision of healthier foods (15, 16). Whilst the implementation of such practices could potentially improve child nutrition, studies show that such practices are not routinely implemented by ECEC staff (17). A 2016 systematic review of implementation support strategies in the ECEC setting suggests that comprehensive approaches, addressing multiple barriers to implementation, may be most effective in

improving centre uptake of evidence-based nutrition interventions and dietary intake of children in care (18). However, such approaches are often resource-intensive, relying on face-to-face training and ongoing support to ECEC centre staff, which pose significant financial constraints to achieve sustained implementation at scale (18).

Web-based modalities may be a promising way of supporting the implementation of ECEC-based interventions whilst overcoming some of the challenges of previous approaches. As 100% of ECEC centres in Australia have access to and use a computer daily for reporting requirements (19), web-based interventions are likely to have a broader reach compared to traditional face-to-face modalities (19). Additionally, web-based approaches have the potential to be more cost-effective than traditional approaches by reducing the burden on resources such as time and staffing and allowing access to the intervention at a time and place convenient to staff (15). Further, behavioural strategies can be embedded within web-based interventions to deliberately target reported barriers to the implementation of healthy eating practices (20).

To our knowledge, only two randomised controlled trials (RCT) on the impact of a web-based program in ECEC centres have been published. A pilot implementation RCT with 31 centres who provided food in care in the U.S. assessed the impact of the web-based Nutrition and Physical Activity in Child Care (Go-NAPSACC) program on ECEC nutrition environments (20). The study assessed improvements in ECEC nutrition environments via ECEC centre director self-report and found that centres who had received the intervention had improved self-reported nutrition environment scores (20). Within Australia, one RCT with 54 centres evaluated the impact of a web-based menu planning program on centre provision of foods in accordance with sector dietary guidelines. Whilst the intervention did not result in a statistically significant increase in dietary guideline compliance, significant improvements in the provision and consumption of healthy foods and a significant decrease in unhealthy foods were found (21, 22). Whilst these studies show promise, little is known about the feasibility of implementing such an intervention within Australian ECEC centres, particularly amongst those that are not responsible for providing food to children.
Given the limited existing evidence base, the primary objective of this Chapter was to describe the protocol for a study to examine, via a type-II hybrid cluster RCT, the potential feasibility of a web-based intervention together with health promotion officer support within ECEC centres, whilst assessing the uptake, acceptability and appropriateness of the intervention and implementation strategies, and contextual factors influencing implementation.

Secondary objectives are to:

1. Examine the potential effects of the implementation strategy employed in the study on ECEC centre implementation of recommended practices;

2. Assess the effectiveness of the intervention in increasing child dietary intake of fruit and vegetable servings, and decreasing child dietary intake of sodium (milligrams (mg)), saturated fat (grams (g)) and added sugar (g) in care; and
3. Assess the effectiveness of the intervention in increasing servings of fruit and vegetables packed within children's lunchboxes.

METHODS AND ANALYSIS

Study design and setting

A superiority cluster RCT with repeat cross-sectional data collection employing an effectiveness-implementation type-II hybrid design will be conducted (23). A hybrid effectiveness-implementation design enables the assessment of the feasibility of the intervention and the potential effects of an implementation strategy on centre implementation of healthy eating practices, whilst assessing the effectiveness of the intervention in improving child dietary intake of fruit and vegetables (24). The study will take place in the Hunter New England (HNE) region of the state of New South Wales (NSW), Australia. The HNE region has approximately 422 centre-based ECEC centres, including preschools and long day care, which typically enrol children aged 0–6 years for an average 21 hours per week (10, 25). The protocol is reported according to the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) (26).

Study population and recruitment

ECEC centres

To be eligible, ECEC centres must (1) enrol more than 20 children per day, (2) have internet access at the centre, (3) not provide meals or snacks to children (i.e. parents or caregivers must be required to provide food packed in lunchboxes), (4) not be currently participating in any other intervention to improve child healthy eating and/or physical activity and (5) not be fully compliant with healthy eating practices targeted by the intervention and specified in the NSW state obesity prevention program (i.e. *Munch & Move*) (27). Mobile preschool, family day care centres and centres that do not cater to children aged 2–5 years, cater exclusively for children requiring specialist care, or are run by the Department of Education and Communities Centre will be excluded due to differing operational characteristics. A list of potentially eligible centre-based ECEC centres located within the HNE region will be provided by the NSW Ministry of Health (28). Evidence-based recruitment strategies in the ECEC setting will be employed to reduce risk of recruitment bias and maximise centre participation in the study (29–31). Specifically, one member of the research team will coordinate centre recruitment and monitor consent rates (32). A recruitment package consisting of a study information statement

and consent form will be progressively distributed to potentially eligible centres in random order. Approximately 2 weeks later, a research assistant (RA) will telephone centres in random order to assess eligibility, review study details and request consent for study participation. Centres will continue to be contacted until the required number have consented. Such recruitment strategies have been used previously by the research team to obtain consent rates over 70% (33). The RA will also schedule a 2-day site visit to complete baseline data collection for consenting centres. Centre-level information provided by the NSW Ministry of Health and demographic information collected during centre recruitment calls will be used to characterise non-participants and assess the potential for selection bias. To minimise attrition, centres will be contacted prior to follow-up data collection to thank them for their participation and to schedule a date for data collection at a time convenient to them (32, 34).

Children

In order for children to be eligible to participate, they must (1) have prior written consent from a parent or guardian, (2) be between the ages of 2 and 5 years and (3) not have a dietary restriction that requires specialised tailoring of their diet (e.g. allergies, intellectual or physical disability). Approximately 2 weeks prior to data collection, centres will be asked to distribute parent information statements and consent forms via electronic methods, including email and parent communication apps, and child pigeonholes as part of standard communication with parents. The dates of the scheduled site visits will not be disclosed to parents to avoid any changes to parent usual lunchbox packing. Additionally, approximately 1 week prior to the scheduled site visit, and on the day of the scheduled site visits, two RAs trained in recruitment and data collection procedures will be present at the ECEC centre to request written consent from parents for child participation in the study.

Randomisation and blinding

ECEC centres will be randomly allocated following a block randomisation procedure in a 1:1 ratio to either intervention or control using a computerised random number function in Microsoft Excel 2013. Due to the demographic and socioeconomic diversity of the HNE region, randomisation will be stratified by centres with a high number of Aboriginal child enrolments (> 10%) and by centre socioeconomic status (SES), as determined by Socio-Economic Indexes for Areas categorisation using centre postcodes (35, 36). Randomisation will be completed following baseline data collection by a statistician not otherwise involved in the trial. Staff at participating ECEC centres and those delivering the intervention will be aware of group allocation. Every effort will be made to keep data collectors and analysts blind to group allocation. However, there is potential for data collectors to become aware of group allocation due to the nature of the intervention (e.g. display of intervention resources within the centre).

Intervention practices targeted by the web-intervention

The intervention will target nominated supervisors and staff within ECEC centres and support their implementation of five healthy eating practices. The selection of the targeted practices is broadly consistent with the social ecological framework (SEF) which posits that individual behaviour can be influenced via factors through five nested, hierarchical levels (individual, interpersonal, community, organisation and policy/enabling environment) (37). Whilst the framework acknowledges that broader level factors influence behaviour, this intervention seeks primarily to influence child diet whilst attending ECEC and, as such, primarily targets the individual and organisational determinants. The selection of the targeted practices are based on empirical evidence supporting the association between these practices and improved child dietary intake in ECEC, or more generally in other settings (38, 39), as well as recommendations by international, national and state guidelines (13, 14, 27).

Specifically, ECEC centres will be asked to implement the following targeted healthy eating practices within the six-month intervention period:

i. Supporting families to provide healthy foods consistent with dietary guidelines: ECEC centres will be asked to monitor children's lunchboxes for consistency with dietary guidelines on a daily basis and distribute nutrition-focused messages to parents that promote the packing of healthy lunchboxes at least twice during the intervention period. Messages will offer advice to address parents' commonly reported barriers to providing healthy foods, including overcoming fussy eating, improving food acceptance, providing healthy foods on a budget and quick and healthy options (36).
ii. Provision of intentional learning experiences about healthy eating to children: ECEC centre staff will be asked to provide children with intentional learning experiences at least twice per week aimed to support children's development of healthy eating behaviours (40). Intentional learning experiences include, but are not limited to, tasting sessions with new food, planting seeds within a vegetable garden and reading books about healthy foods.
iii. Use of feeding practices that support children's healthy eating: ECEC centre staff will be asked to provide positive reinforcement and encouragement to children to promote healthy eating and trying new foods at every meal and snack occasion. They will also be asked to model healthy food and drink choices at every meal, provide positive comments about healthy foods within children's lunchboxes and avoid the use of food incentives to encourage desired behaviour (14, 15, 41).
iv. Staff participation in professional development in healthy eating: ECEC centres will be asked to have at least 50% of staff take part in online training opportunities targeting staff healthy eating behaviours and practices in the centre (27, 42). This training contains videos, interactive

activities and reflective practice questions that will provide educators with the knowledge, skills and resources to embed healthy eating practices into their centre.

v. Having a comprehensive written nutrition policy that outlines key healthy eating practices: ECEC centres will be asked to develop or modify their existing nutrition policy to ensure the centre has strategies, procedures and guidelines to enforce the implementation of healthy eating practices to improve child diet (43). ECEC centres will be asked to include the following elements within the policy: strategies are in place to ensure staff monitor children's lunchboxes daily for alignment with dietary guidelines, communicate with families regarding foods packed within lunchboxes at least twice every six months, scheduling and delivery of intentional nutritional learning experiences at least twice per week, staff role modelling positive feeding practices at every meal and snack time to support children's healthy eating, and at least 50% of staff participate in professional development in healthy eating.

Implementation

The Behavioural Change Wheel (BCW) (44) was used to identify specific components within the web-based program as well as other implementation support strategies that could be employed to support ECEC staff to change their behaviour and/or their organisation to create supportive environments for child healthy eating, and therefore, potentially improve child diet intake in care (44). Specifically, barriers and enablers to ECEC staff behaviour change were identified through a systematic review of the literature (17, 45–48) and consultation with stakeholders, including ECEC centre staff and health promotion officers (HPO) with experience working within the setting. The BCW process outlined by Michie et al. was then followed to categorise these barriers and enablers using the COM-B model as either capability, motivation or opportunity (44). A summary of this process, including the behavioural change techniques (BCTs) employed within the intervention to address the barriers and enablers, is described in Table 3.1 (44). The implementation support strategies, defined according to the Expert Recommendations for Implementing Change (ERIC) taxonomy (49), have been previously used by the research team within ECEC-based interventions and aim to address reported barriers to intervention implementation whilst being embedded within current infrastructure of the units health promotion team (17, 50).

Specifically, the implementation strategies incorporated into the web-based program, known as Childcare Electronic Assessment Tool and Support (EATS), include:

Audit and feedback

Childcare EATS includes a self-assessment of the implementation of targeted healthy eating practices. Following the completion of the self-assessment, the web-based program will immediately provide

centres with feedback on practice performance. ECEC centres will be encouraged to complete the self-assessment at least twice during the intervention period to self-monitor improvements in practice (20, 33).

Develop a formal implementation blueprint

Following the completion of the self-assessment, ECEC centres will be encouraged to use Childcare EATS to set goals and create an action plan to facilitate improvements in practice (20). Centres will be encouraged to develop an action plan at least twice within the intervention period and continually monitor progress in consultation with centre staff to assist improvement in practice.

Distribute educational materials

Childcare EATS will house relevant materials developed through consultation with key stakeholders, including ECEC centre staff, cultural liaisons and HPOs with extensive experience working within the setting. Materials were designed to assist centre adoption of targeted practices and include factsheets, email messages and newsletter snippets to facilitate communication with parents regarding children's lunchbox alignment with guidelines; educational materials to improve staff knowledge of providing a positive nutrition environment; example activities to demonstrate intentional healthy eating learning experiences within the centre; directions to online learning opportunities, including webinars and eLearning modules to support staff professional development in healthy eating; and nutrition policy templates (27).

In addition to web-based resources, ECEC centres allocated to the intervention will receive support from HPOs within the local health district with experience working with ECEC centres. The implementation strategies provided through these HPOs will include:

Identify and prepare a centre champion

Upon notification of group allocation, the HPO will ask centres to identify and prepare a staff member from the centre who will dedicate themselves to supporting, marketing and driving implementation of the intervention (49, 51).

Table 3.1 Determinants of child diet in ECEC and strategies to address targeted barriers and enablers

1. SEF Level	2. Determinants of child diet in ECEC (Healthy eating practice)	3. ECEC staff related barrier and/or enabler (COM-B)	4. Implementation strategy behaviour change techniques to address identified barriers and strengthen enablers (Numbers represent barriers and enablers identified in column 3)
Individual	Availability of food (Communicating with families regarding lunchbox and healthy eating guidelines)	1. Staff member knowledge and abilities (capability) 2. Staff member behaviour and food preferences (motivation)	**Strategies via web-based program:** Audit with feedback: - Feedback on behaviour (1, 2, 4) - Feedback on outcome of behaviour (1, 2, 4) - Self-monitoring of behaviour (1, 2, 4) Develop a formal implementation blueprint: - Goal setting (outcome, behaviour) (3, 6, 7, 8, 9) - Action planning (4, 6, 7, 8) - Problem solving (4, 6, 7, 8) - Review goals (outcome, behaviour) (3, 6, 7, 8, 9) Distribute educational materials: - Demonstration of behaviour (1, 2) - Restructuring the physical environment (5) - Adding objects to the environment (5)
	Child knowledge and attitudes towards trying new foods (Centre provision of intentional healthy learning experiences twice per week)	3. Lack of prioritising, therefore, not scheduling time to implement change (capability)	
	Healthy role models (Child exposure to healthy role modelling practices by ECEC staff)	4. Perceived capabilities and confidence to implement change (capability)	
Organisational	ECEC staff knowledge and skills regarding healthy eating and nutrition to promote healthy eating to children (ECEC staff participation in professional development)	5. Lack of available supporting resources for intentional healthy learning experiences and communication with families (opportunity) 6. Lack of staff investment and motivation to change (opportunity)	**Additional strategies:** Ongoing consultation and local technical assistance**:** - Social support (unspecified) (6, 7) - Verbal persuasion about capability (4, 6, 9) Conduct educational outreach visit: - Instruction on how to perform behaviour (1) - Demonstration on how to perform behaviour (1) Mandate change, prepare and identify centre champion: - Identification of self as role model (3, 6) - Commitment (2, 5, 6, 7, 8) - Social support (unspecified) (5, 6, 7)
	Lack of formalised guidance and demonstrated organisational support (Centre development of a written nutrition policy which outlines centre and other stakeholder support for healthy eating)	7. Lack of formalised guidance and demonstrated support from nominated supervisors and management (opportunity) 8. Healthy eating practices a lesser priority than other standards (motivation)	
	Centre perception that meeting healthy eating practices is a lower priority (Monitoring and reporting healthy eating objectives)	9. Perceived importance and confidence to change (motivation)	

Conduct educational outreach visit

Centre staff (nominated supervisor and centre champion) will receive one face-to-face training session by an HPO to support implementation of the healthy eating practices and introduce the web-based program at the beginning of the intervention period (35). This will be a practical, hands-on training session to ensure staff are comfortable using Childcare EATS, accessing supporting resources and are aware of the key practices targeted by the intervention.

Mandate change

Centre nominated supervisors will be asked to show support for implementing targeted healthy eating practices via a memorandum of understanding, which will outline the responsibilities and expected commitment from both the ECEC centre and HPO in working to improve the implementation of healthy eating practices to improve child dietary intake in care. The memorandum of understanding will be discussed and agreed upon during the educational outreach visit with centre nominated supervisors.

Provide ongoing consultation and local technical assistance

ECEC centre staff will be provided with approximately two telephone calls by an HPO, pending ECEC centre needs, within the intervention period (52, 53). Barriers to centre implementation of healthy eating practices and use of Childcare EATS will be identified and strategies to address these barriers will be discussed. Email support will be provided by HPOs upon request by the centre. An additional training session delivered by an HPO via online modalities will be offered to centres, pending centre needs.

Control group and contamination

ECEC centres allocated to the control group will receive usual care during the intervention period. Usual care includes general support from HPO upon request to implement the state-wide obesity prevention program (i.e. *Munch & Move*) (27). Support provided to centres within the HNE region to implement this state-wide program is centrally monitored by the research team. Enhanced support to implement the healthy eating practices targeted in the intervention will be offered to control centres after 12-month follow-up data collection is complete. Assessment of potential contamination will be collected via a telephone interview with nominated supervisors and centre champions during follow-up data collection.

Outcomes

Feasibility of intervention

Feasibility of the intervention, defined as the extent to which the intervention can be successfully used or carried out within the ECEC setting (54) for a fully-powered implementation trial, will be assessed through ECEC centre and parent recruitment and consent rates for each component of data collection.

ECEC centre uptake of implementation strategies

ECEC centre use of Childcare EATS will be assessed through data provided via Google Analytics (55). These analytics include, but are not limited to, total time logged into the program, completion of the self-assessment and action plan, most frequently used program features and the number of requests for assistance. The research team has previously used these metrics to evaluate ECEC centre adoption of web-based programs (21, 56). Internal records detailing the provision of implementation strategies, including the completion, duration and centre staff in attendance at the educational outreach visit; type (i.e. telephone, email, online training), frequency and duration of ongoing support; centre staff signatories on the memorandum of understanding; and selection of a centre champion, will be maintained by research team members.

Acceptability of implementation strategies and intervention

Nominated supervisors and champions of the ECEC centres randomised to the intervention group will complete a telephone interview to assess acceptability during follow-up data collection (6 and 12 months). Acceptability will be defined as the perception amongst centre staff that the intervention and implementation strategies are agreeable, palatable or satisfactory (54). This will be assessed using modified items by Weiner et al. (57) and items previously used by the research team to capture data on perceived intervention effectiveness, unintended consequences, reach and adoption, acceptability (workforce, infrastructure, time requirements) (46, 58), and engagement with Childcare EATS (59).

Appropriateness of implementation strategies

Appropriateness, defined as the perceived fit, relevance or compatibility of the intervention and implementation strategies for the ECEC setting (54), will be evaluated through information collected during follow-up telephone interviews with centre nominated supervisors and champions. The telephone interviews will include modified items by Weiner et al. (57) and items used by the research team in previous ECEC-based interventions (33).

Implementation context

Relevant constructs within three of the five domains of the CFIR (60) (inner setting (compatibility with centre values and direction, level of priority), innovation characteristics (perceived complexity

and cost) and outer setting (external influences such as policies, regulations and peer behaviour)) will be used to identify factors associated with implementation at follow-up during a telephone interview with ECEC supervisors (17, 60).

Potential effectiveness of the implementation strategy in improving implementation of targeted healthy eating practices

ECEC centre implementation of the targeted healthy eating practices (e.g. provision of intentional learning experiences about healthy eating and staff professional development in nutrition) and additional data on centre nutrition environments will be assessed with the Environmental and Policy Assessment and Observation (EPAO) tool (61). Per EPAO protocol, a trained RA will undertake a one-day observation and review of ECEC centre documentation. The EPAO has been previously used by the research team in 18 ECEC centres (36) and has demonstrated high inter-observer agreement. The tool is considered to be gold standard for environmental observations in the ECEC setting (61). This will be undertaken at baseline and follow-up (6 and 12 months).

Secondary effectiveness outcomes

Child dietary intake of fruit and vegetable servings in care

The mean servings of fruits and vegetables from all food and beverages consumed whilst in care will be assessed through the measurement of lunchbox foods and beverages across the day. On the days of the site visit, two trained RAs will assess the lunchboxes of participating children. Measurement of lunchbox contents will be conducted on two occasions across the day: prior to the children's first meal time and after the children's last meal time. RAs will remove all contents of the lunchbox and remove any lids that inhibit the view of contents. A photo will then be taken of the entire lunchbox contents. RAs will then weigh each food item included in the lunchbox, with strict adherence to safe food handling practices to address occupational health and safety concerns. A written description of the contents will also be captured to enable accurate recordings where ingredients may not be easily deciphered via photograph, e.g. sandwiches and mixed meals. The process of photographing, weighing and recording lunchbox contents will be repeated after the children's last meal. Consumption will be calculated based on foods and beverages present at the first measurement minus foods remaining at the second measurement. Educators will direct children to keep food wastage, including all partially consumed food and beverages, within their lunchboxes. All food wastage will be collected by the research team during the second measurement and factored into child consumption measurements. The weighed plate method with photographs has been previously used by the research team (36) and has proven to be a precise measure of dietary intake in previous studies (62). This weighed food record data will be entered into a nutrient analysis database (FoodWorks) (63) by a trained dietitian blinded to centre allocation. During this process, the dietitian will categorise the food

and beverage items into food groups and calculate mean servings of fruit and vegetables consumed in accordance with the serving sizes specified within the Australian Guide to Healthy Eating (AGHE) (64). Photographs will be used to validate written descriptions of foods and the weights recorded. Lunchbox measurements will be conducted across the two-day site visits at three time points, baseline and follow-up (6 and 12 months).

Child dietary intake of sodium, saturated fat and added sugar in care

The nutrient output provided by weighed food record data entered into the nutrient analysis database (FoodWorks) following the process described above will be used to measure mean sodium (mg), saturated fat (g) and added sugars (g) from all foods and beverages consumed whilst in care.

Mean servings of fruit and vegetables packed within lunchboxes

To determine the impact of the intervention on parent provision of healthy food in lunchboxes, the mean servings of fruit and vegetables packed within children's lunchboxes will be assessed via observation and measurement of lunchbox foods and beverages following the same process described above.

Centre characteristics

Operational centre characteristics will be assessed at baseline during a telephone interview with nominated supervisors. Items within the telephone interview have been used previously by the research team (33), and include centre type (e.g. preschool, long day care), number of years in operation, days and hours of operation, postcode, number of children enrolled and attending, number of staff employed and the number of Aboriginal or Torres Strait Islander children enrolled at the centre.

Child characteristics

Child characteristics, including gender, age, Aboriginal and/or Torres Strait Islander origin, days attending care and parent level of education, will be collected from parents/guardians when providing written consent to participate in the study.

Power calculations

As this is a pilot study, a formal sample size calculation for the primary outcome is not required (65). However, we estimated the number of centres required as approximately 25% of the number needed for a fully-powered implementation trial. Based on consent rates from previous web-based intervention studies conducted within the ECEC setting, and allowing for a ECEC centre attrition rate at follow-up of 10%, it is estimated that recruitment of 22 ECEC centres would be sufficient to provide data to inform feasibility of undertaking the trial (21). To assess the impact of the intervention

on child diet, an approximate difference of 0.3 servings of both fruit and vegetables is considered clinically significant based on the potential reduction in risk of chronic disease (66, 67). As such, given the 10% ECEC centre attrition rate at follow up, recruitment of approximately 440 children from 22 ECEC centres (20 children per centre) will enable detection of a mean difference of 0.3 servings in intake of fruit and vegetable servings, with an alpha of 0.05 and an estimated ICC of 0.1 (32), with 80% power (35, 68) and a standard deviation of 0.6 servings. Based on unpublished internal data, this number of participants will allow detection of a clinically meaningful difference of approximately 1.9 g saturated fat, 4.7 g added sugar and 155 mg sodium (69).

Statistical analysis

The primary trial end-point will be the 6-month follow-up. Descriptive statistics will be used to describe ECEC centre and child characteristics, the feasibility, uptake of implementation strategies, acceptability and appropriateness of the intervention and determinants of implementation. At the centre level, to determine the impact of the intervention on the implementation of healthy eating practices, scores of the EPAO will be compared between intervention and control centres at follow-up, adjusting for baseline, through linear regression analysis. At the child and centre levels, multiple imputations will be performed as part of a sensitivity analysis for missing follow-up data as recommended by White et al (70). At the child level, mixed linear regression models will be run on all secondary outcomes, where a group-by-time interaction will assess effectiveness of the intervention. All models will include a random effect for ECEC centre to account for potential clustering effect, as well as fixed effects for prognostic variables (SES, gender) under an intention to treat framework. At the child level, subgroup analyses by centre SES and child gender will also be undertaken to assess whether there was a differential impact of the intervention.

PROGRESSION CRITERIA

Data obtained from the trial will inform decisions regarding progression to a fully powered implementation trial. Such decisions will be made via majority, from core members of the research team, including a representative from a public health service partnering in the research that intends to adopt the intervention and implementation support strategy if identified as beneficial (71). The decision will follow consideration and discussion between the core members of measures of feasibility, acceptability and appropriateness of the intervention and implementation strategies utilised in the study, and measures of the effect of the intervention on child dietary outcomes. Specifically, in order to progress, the team must deem the intervention, and implementation strategy to be sufficiently acceptable and feasible that it would likely be adopted by > 25% of ECEC centres that were offered it. Or, that this could reasonably be expected with adaptations to the intervention or implementation approach based on steps previously employed by the research team (72). Measures of implementation

of the recommended practices, together with assessment of feasibility, uptake, acceptability and appropriateness will be used to identify opportunities to further strengthen its capacity prior to a fully powered implementation trial. This will enable the identification of implementation strategies and healthy eating policies and practices required to achieve the greatest outcome in implementation, and therefore, child diet.

DISCUSSION

Interventions targeting the ECEC setting are recommended to improve child dietary intake in care due to the potential to reach a large number of children during a crucial developmental period (73). Despite the existence of evidence-based healthy eating practice recommendations, previous findings on the impact of such recommendations on child diet in care are mixed (16). Web-based interventions represent a promising modality to provide population-wide support to ECEC centres given their potential reach and consistency with existing infrastructure (19). This study will provide important data to support the conduct of a fully-powered implementation trial within Australian ECEC settings and inform the development of future implementation interventions.

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CHAPTER FOUR PART A

FEASIBILITY OF A WEB-BASED IMPLEMENTATION INTERVENTION TO IMPROVE CHILD DIETARY INTAKE IN EARLY CHILDHOOD EDUCATION AND CARE: A PILOT RANDOMISED CONTROLLED TRIAL

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ABSTRACT

Introduction

Internationally, the implementation of evidence-based healthy eating policies and practices within Early Childhood Education and Care (ECEC) settings that encourage children's healthy diets is recommended. Despite the existence of evidence-based healthy eating practices, research indicates that current implementation rates are inadequate. Web-based approaches provide a potentially effective and less costly approach to support ECEC staff with implementing nutrition policies and practices.

Objective

The broad aim of this pilot randomised controlled trial was to assess the feasibility of assessing the impact of a web-based program together with health promotion officer support, on ECEC centre implementation of healthy eating policies and practices. Specifically, we sought to: (1) Describe the completion rate of study evaluation processes (participant consent and data collection rates); (2) Examine ECEC centre uptake, acceptability and appropriateness of the intervention and implementation strategies; (3) Understand the potential cost to deliver and receive the implementation support strategies; and (4) Describe the potential impact of the web-based intervention on the implementation of targeted healthy eating practices among centres in the intervention group.

Methods

A 6-month pilot implementation trial employing a cluster-randomised controlled trial design was conducted in 22 ECEC centres within the Hunter New England region of New South Wales, Australia. Potentially eligible centres were distributed a recruitment package then telephoned by the research team to assess eligibility and obtain consent. Centres randomly allocated to the intervention group received access to a web-based program, together with health promotion officer support (e.g., educational outreach visit, local technical assistance) to implement five healthy eating practices. The web-based program incorporated audit with feedback, development of implementation blueprints and educational materials to facilitate improvement in implementation. Centres allocated to the control group received usual care.

Results

Of the 57 centres approached for the study, 22 (47%) provided consent to participate. Data collection components were completed by 100% (n=22) of centres. High uptake for implementation strategies provided by health promotion officers (91-100%) and the web-based program (100%) was observed.

At follow-up, intervention centres had logged on to the program an average of 5.18 (SD 2.52) times. The web-based program and implementation support strategies were highly acceptable (91-100%). Implementation of four healthy eating practices improved in the intervention group, ranging from 18.7% to 63.64%.

Conclusion

This study provides promising pilot data to warrant the conduct of a fully-powered implementation trial to assess the impact of the program on ECEC healthy eating practice implementation.

INTRODUCTION

Poor dietary intake in early childhood, including inadequate intake of fruit and vegetables and excessive intake of discretionary foods (high in added sugar, sodium and saturated fat), is a leading contributor to the development of child overweight, obesity, cardiovascular disease and specific types of cancers (1, 2). Globally, preschool aged children do not meet national dietary recommendations for intake of fruit and vegetable servings, whilst overconsuming discretionary food items (2-5). As dietary behaviours developed during childhood are known to track into adulthood (6), population-level interventions (i.e. interventions targeting a large proportion of the population) to improve child nutrition are recommended (7, 8). Early Childhood Education and Care (ECEC) is a promising setting for interventions aimed at improving children's nutrition behaviours, as they provide access to a large proportion of children (3, 9) for prolonged periods of time (10) during a crucial period of development (11).

Systematic review evidence has identified numerous ECEC-based interventions effective in improving child nutrition behaviours (12) and centre nutrition environments (13), including the implementation of evidence-based ECEC practices associated with improved child dietary intake in care (13, 14). The implementation of such evidence-based practices is recommended within national and international ECEC guidelines, and include the provision of healthy foods, positive educator feeding practices (e.g., role modelling healthy food choices) and developing centre nutrition policies, which detail centre strategies and guidelines to enforce the implementation of healthy eating practices (15-17). However, despite the existence of such guidelines, numerous studies have indicated that current implementation of evidence-based healthy eating practices is inadequate (18-21).

A recent Cochrane systematic review identified that multi-component implementation strategies, including researcher delivered face-to-face nutrition education sessions and ongoing support can produce small, but significant improvements in the implementation of healthy eating practices in ECEC centres (13). Although potentially effective, there are significant challenges with delivering

such interventions at scale (i.e. to a large number of ECEC centres), including financial and resource burdens on centres and the lack of alignment with centre capabilities and infrastructure (13). Web-based modalities provide a potentially effective and less costly approach to implementing nutrition interventions at scale in this setting. Previous research suggests that the use of such modalities to deliver support to centre staff is highly acceptable and fits within existing centre infrastructure (e.g., access to computers and internet) (12, 22, 23). Additionally, these modalities can reach a large proportion of the population (24) and have been associated with improvement in a range of provider behaviours and implementation outcomes in previous research delivered outside the ECEC setting (25, 26).

Within ECEC, recent trials examining the impact of web-based interventions on ECEC healthy eating practices have been conducted within menu-based centres (i.e., centres that provide food to children). A randomised controlled trial (RCT) within 54 Australian ECEC centres evaluated the impact of a web-based menu planning program on centre compliance with sector dietary guidelines (27). Results of the RCT found statistically significant improvements in the servings of core food groups and child diet intake, however the intervention had non-significant improvements in the primary outcome of menu compliance with all food groups. The study reported variable levels of engagement with the web-based program, despite high uptake of implementation support strategies, and high acceptability of the intervention and implementation support provided (27). Additionally, the web-based intervention was deemed as a cost-effective alternative to traditional menu planning approaches (23). Within the United States (U.S.), a pilot RCT conducted within 31 centres evaluated the impact of the web-based Nutrition and Physical Activity Self-Assessment for Child Care (Go-NAPSACC) program on centre nutrition environments (28). Despite improvements in food and beverages provided within intervention centres, no statistically significant differences in centre nutrition environments were reported at follow-up (28). Centre engagement with the web-based program was not reported, however uptake of the implementation support strategies was high among intervention centres. Findings from the process evaluation indicated that a lack of computer literacy among centre staff and the need for additional technical support were barriers to program use (28). Despite these studies showing promise, no RCTs examining the impact of web-based interventions on ECEC healthy eating practices within lunchbox centres (i.e., where parents pack foods for children to consume in care) have been conducted.

Given the differences between menu-based and lunchbox centres, there is a need to understand whether such interventions are feasible in the ECEC setting. Feasibility studies are recommended as they allow researchers to collect data to determine whether an intervention is appropriate for more robust testing and to pilot test recruitment and data collection methods and tools to inform a larger trial (29). As such, the aim of this pilot RCT was to determine the feasibility of conducting a fully-

powered implementation trial assessing the impact of a web-based program together with health promotion officer support, on ECEC centre implementation of healthy eating policies and practices. Specifically, we sought to: (1) Describe the completion of study evaluation processes (participant consent and data collection rates); (2) Examine ECEC centre uptake, acceptability and appropriateness of the intervention and implementation strategies; (3) Understand the potential cost to deliver and receive the implementation strategies; and (4) Describe the potential impact of the web-based intervention on the implementation of healthy eating practices among centres in the intervention group.

METHODS

Registration and ethics approval

This trial was prospectively registered with the Australian New Zealand Clinical Trials Registry (ACTRN12619001158156) and follows the Consolidated Standards of Reporting Trials (CONSORT) reporting guidelines for pilot and feasibility studies (30). Ethical approval for the trial was obtained by Hunter New England (approval no: 06/07/26/4.04) and University of Newcastle (approval H-2008-0343) Human Research Ethics Committees.

This trial was originally designed as a cluster RCT employing an effectiveness-implementation hybrid type-II design. A hybrid effectiveness-implementation design was employed to pilot the potential impact and assess the feasibility of an implementation intervention, while assessing the effectiveness of the intervention in improving child dietary intake in care as described by Curran et al (31). Due to COVID-19 precluding centre site visits to conduct follow-up data collection, child lunchbox and dietary assessments were unable to be undertaken, and as such, are not reported. Additionally, the pilot implementation outcomes (e.g. uptake, acceptability and appropriateness) were unable to be collected at 6-month follow-up as originally intended due to the impact of COVID-19 on centre operating procedures (i.e. modified hours of operation and temporary centre closures) during the planned data collection timeframe. Therefore, this paper reports on the pilot implementation outcomes that could still be evaluated at 12-month follow-up and were specified in the trial registration and protocol.

Study design and setting

A protocol detailing the study design and methodology has been published elsewhere and described in Chapter Three (32). Briefly, a pilot implementation trial employing a cluster RCT design was conducted in centre-based ECEC centres within the Hunter New England (HNE) region of New South Wales (NSW), Australia. The HNE region is socioeconomically and geographically diverse,

encompassing metropolitan, regional and remote communities with a population of over 920,000 residents (33). Approximately 422 centre-based ECEC centres, including preschools and long day care, are located within the HNE region, which typically enrol children aged 0-6 years for an average 21 hours per week (10, 34).

Participant eligibility and recruitment

Centres

Centres were eligible to participate in the trial if: (1) they enrolled >20 children per day; (2) had internet access; (3) parents provided food for children to consume while attending care (i.e., centres did not provide food); (4) they were not participating in any other healthy eating and/or physical activity intervention; and (5) they were not fully compliant with healthy eating practices (i.e. not implementing all five practices) specified in the NSW state obesity-prevention programme (i.e., *Munch & Move*) targeted by the intervention, according to NSW Ministry of Health data monitoring (35). Centres were ineligible if they were a mobile preschool or family day care centre; did not cater for children aged 2-5 years; catered exclusively for children requiring specialist care; or were classified as a NSW Department of Education centre due to differing operational characteristics.

A list of potentially eligible centres located within the HNE region was obtained from the NSW Ministry of Health (35). One member of the research team with experience recruiting centres to health promotion trials led the recruitment process and monitored consent rates. Firstly, centres were progressively distributed a recruitment package consisting of a study information statement and consent form in random order. Secondly, the research team member leading recruitment telephoned centres to discuss study details, assess eligibility and request consent for study participation (19, 36). Centres continued to be contacted until the required number (n=22) consented. During the telephone call, the research team member also scheduled a two-day baseline data collection site visit for consenting centres. Recruitment for the study was conducted between August 2019 and October 2019.

Children

In order for children to be eligible to participate, they were required to: (1) have written consent from a parent or guardian; (2) be between the ages of 2-5 years; (3) be enrolled to attend the centre on at least one of the scheduled days of data collection; and (4) not have a dietary restriction requiring specialised tailoring of their diet (e.g., allergies, intellectual or physical disability).

Approximately two weeks prior to the baseline data collection site visit, centres were asked to distribute consent forms and information statements to parents via usual communication methods, including email, communication apps and child pigeonholes. Trained research assistants (RA) with experience in recruitment and data collection attended the ECEC centres approximately one week

prior to the site visit, and on the days of the site visits, to request written consent from parents for their child/ren to participate in the study.

Randomisation and blinding

Following baseline data collection, centres were randomly allocated to the intervention or control group stratified by centre socioeconomic status (SES). Based on centre postcodes, the 2016 Socio-Economic Indexes for Areas (SEIFA) was used to classify centres as being located in the least disadvantaged (high SES) or most disadvantaged (low SES) areas (37). Centre postcodes ranked in the top 50% of NSW were classified as least disadvantaged and the lower 50% of postcodes as most disadvantaged. Centres were also stratified by those with a high number of Aboriginal child enrollments (defined as those with >10% Aboriginal child enrollments), in a 1:1 ratio through a block randomisation procedure (block sizes 2 or 4) conducted by an independent blinded statistician. Given the nature of the intervention (i.e., intervention centres were provided access to a web-based program), centres were not blinded to group allocation. Data collectors were not blinded to group allocation at follow-up.

Intervention

The intervention aimed to improve implementation of ECEC centre-level healthy eating practices. The practices targeted within the intervention are recommended by the NSW state obesity-prevention programme (i.e., *Munch & Move*) (17), as well as national and international guidelines, acknowledging the association between such practices and improved child dietary intake in care (15, 16). Specifically, the practices included:

1. Supporting families to provide healthier foods consistent with dietary guidelines: Centre staff within the intervention group were provided with healthy eating information and resources via the web-based program, and were asked to disseminate these to families via usual centre communication methods, such as mobile applications (apps), email, and written information, twice during the intervention period. Centre staff were also asked to monitor children's lunchboxes on a daily basis for consistency with sector-specific dietary guidelines and provide feedback to parents.
2. Provision of intentional healthy eating learning experiences (e.g., gardening and cooking lessons): Centre staff were asked to provide children with intentional healthy eating learning experiences at least twice per week.
3. Using feeding practices that support children's healthy eating (e.g., educator role modelling healthy food choices): Centre staff were asked to provide encouragement to children to promote healthy eating and trying new foods at every meal and snack occasion. Centre staff

were also asked to role model consuming healthy food choices and avoid the use of foods to encourage desired behaviour.

4. Staff participating in professional development targeting healthy eating: Centre staff were asked to have at least 50% of staff to participate in online training opportunities specific to staff healthy eating behaviours and centre practices.
5. Having a comprehensive written nutrition policy that outlines key healthy eating practices: Centres were asked to develop or modify existing nutrition policies to document procedures and strategies to facilitate the implementation of healthy eating practices to improve child diet.

A detailed description of these practices is provided in the published study protocol and in Chapter Three (32).

A web-based program, known as Childcare Electronic Assessment Tool and Support (EATS), was developed by the research team to support centre implementation of the five targeted healthy eating practices. Centres allocated to the intervention group were provided with free access to the web-based program. The intervention was developed by behavioural science researchers, health promotion officers (HPO), state government representatives and end-users from the ECEC setting, including nominated supervisors and educators.

Implementation strategies

The Behaviour Change Wheel (BCW) (38) was employed to guide the development and selection of implementation strategies to support centre staff in achieving behaviour change. During this process, barriers and enablers to centre behaviour change identified through a literature review and engagement with ECEC staff and stakeholders, were mapped to specific behavioural change techniques (BCTs) within the BCW (38). A suite of implementation strategies, defined according to the Expert Recommendations for Implementing Change (ERIC) taxonomy were then selected to action the BCTs within the intervention (39). The content and implementation strategies within Childcare EATS was selected to ensure user (i.e., centre staff) engagement, including self-assessment and action planning components to allow centre nominated supervisors to reflect on current practice, and housed educational resources to facilitate improvements in staff behaviour and centre processes. Features of the program were developed to integrate within existing centre procedures, (e.g., the ability to download feedback from the self-assessment quiz) and national assessment and rating standards (e.g., the development of action plans as evidence within quality improvement plans). Extensive pilot testing was undertaken with ECEC staff through face-to-face meetings with HPOs to ensure that the functionality and content of Childcare EATS was appropriate, and that any potential barriers to program use were addressed. Limitations from previous web-based interventions

conducted within the ECEC setting, including low staff computer literacy, need for ongoing technical support and competing priorities of ECEC staff, were also considered during the development of the program (28, 40).

Implementation strategies additional to those embedded within the web-based program identified via the BCW process above were employed by HPOs, who work within the state local health districts to deliver health promotion initiatives within community-based settings such as ECEC centres. HPOs received a training session and implementation manual prior to delivering the intervention. Additionally, HPOs conducted two pilot training sessions, with both internal (health service staff with extensive experience supporting ECEC centres to implement obesity-prevention initiatives) and external (ECEC centre staff) stakeholders. Application of these implementation strategies within the intervention is summarised in Table 4A.1 using the Proctor framework (41) to enable replication.

Table 4A.1 Implementation strategies and behavioural change techniques employed within the web-based intervention

Mode of delivery	**Implementation strategy according to ERIC** (39)	**Application of the implementation strategy according to Proctor** (41)	**Behaviour Change Technique actioned via the implementation strategy**
Web-based program	Audit with feedback	Actor: Web-based program. Action: The Childcare EATS program contained a self-assessment feature for centre nominated supervisors and centre champions to assess implementation of targeted healthy eating practices. Centres were automatically provided with tailored feedback on practice performance. Target(s): Nominated supervisors and centre champion knowledge, behaviour and abilities, perceived capabilities and confidence to implement change. Temporality: Commencement of the intervention. Centres were encouraged to complete the self-assessment at least twice during the intervention period to monitor change in practice, following the educational outreach visit. Dose: Twice during the intervention period. Implementation outcome: Implementation of healthy eating practices. Justification: Provision of feedback on centre behaviour has been used within previous interventions to facilitate improvement in practice within ECEC centres (28, 42).	- Feedback on behaviour - Feedback on outcome of behaviour - Self-monitoring of behaviour
	Develop a formal implementation blueprint	Actor: Web-based program. Action: Following the completion of self-assessment, centres were encouraged to select goals and develop an action plan within the Childcare EATS program. The action plan feature within the Childcare EATS program consisted of an interactive template where nominated supervisors and centre champions were provided with guidance on how to form their action plan, including how to select goals and timeframes for completion. Where applicable, HPOs encouraged centres to develop an action plan for a maximum of one to two practices at a time. Target(s): Nominated supervisors and centre champions prioritisation, investment and perceived capabilities to implement change. Formalised guidance and demonstrated support to implement change. Temporality: Commencement of the intervention. Centres were encouraged to develop an action plan at least twice within the intervention period, immediately following the self-assessment (audit with feedback). Dose: Twice during the intervention period. Implementation outcome: Implementation of healthy eating practices. Justification: Developing a formal implementation blueprint has been used within previous interventions to facilitate improvement in practice within ECEC centres (28).	- Goal setting (outcome, behaviour) - Action planning - Problem solving - Review goals (outcome, behaviour)

	Distribute educational materials	Actor: Web-based program. Action: The Childcare EATS program housed a suite of materials to assist centre implementation of the targeted practices, including: factsheets and resources to facilitate communication with parents; educational materials to improve staff knowledge; example healthy eating learning experiences; professional development and policy templates. Target(s): Nominated supervisors and centre champions to increase staff member knowledge and abilities to implement practices. Temporality: Commencement of the intervention. Centres were encouraged to access resources immediately following action planning (development of a formal implementation blueprint). Dose: Accessed at any time during the intervention period. Implementation outcome: Implementation of healthy eating practices. Justification: The provision of support and resources via web-based programs is highly acceptable amongst ECEC staff and has been used within previous interventions within the ECEC setting (22, 27, 28).	- Demonstration of behaviour - Restructuring the physical environment - Adding objects to the environment - Prompts/cues - Credible source
Health Promotion Officer	Educational outreach visit	Actor: HPO. Action: 1.5-2 hour practical face-to-face training session with a HPO was provided to nominated supervisors and centre champions to introduce the web-based program and support implementation of the healthy eating practices. Target(s): Nominated supervisors and centre champions knowledge and ability to implement change. Temporality: One-off face-to-face training session (1.5-2 hours) at the start of the intervention (two-eight weeks post-baseline). Dose: One-off training session. Implementation outcome: Adoption of the intervention. Justification: Face-to-face training within previous ECEC-based interventions has been highly acceptable and used within previous interventions conducted by the research team (27, 42).	- Instruction on how to perform behaviour - Demonstration on how to perform behaviour
	Identify and prepare a centre champion	Actor: Centre champion. Action: Centre nominated supervisors were asked to identify and prepare a staff member who could dedicate themselves to endorsing and driving implementation of the intervention within their centre and asked to attend the educational outreach visit. Target(s): Centre champions. Staff investment and motivation to change, formalised guidance and demonstrated support for staff. Temporality: Commencement of the intervention period. Dose: Ongoing endorsement and support for use of the web-based program throughout the intervention period.	- Identification of self as role model - Social support (unspecified)

		Implementation outcome: Adoption of the intervention and implementation of healthy eating practices. Justification: Preparing a champion has been identified as an effective strategy to drive implementation and has been used in previous trials by the research team (39, 43, 44).	
	Mandate change	Actor: HPO, nominated supervisor, centre champion. Action: A memorandum of understanding (MoU) was developed to outline the responsibilities and level of commitment expected from both the centre and the HPO in working to implement the targeted healthy eating practices. Centre nominated supervisors and champions discussed the MoU with the HPO and tailored the content of the MoU to suit the needs of the centre. Target(s): Nominated supervisors and centre champions investment and motivation to change, formalised guidance and demonstrated support for staff. Temporality: MoU drafted during the face-to-face educational outreach visit, finalised and signed by the nominated supervisor, centre champion and HPO two weeks following the training. Dose: One-off MoU during the face-to-face educational outreach visit, followed by ongoing advocating and support for use of the web-based program by the nominated supervisor and centre champion to centre staff during the intervention period. Implementation outcome: Adoption of the intervention. Justification: Securing executive support from nominated supervisors has been effective in improving implementation of healthy eating practices in previous ECEC-based interventions (19).	- Commitment - Social support (unspecified)
	Ongoing consultation and local technical assistance	Actor: HPO. Action: A telephone call was provided to nominated supervisors and centre champions to discuss barriers to centre implementation of healthy eating practices and the use of the Childcare EATS program, and to develop strategies to address such barriers. Email and telephone support was provided by HPOs upon centre request. Target(s): Nominated supervisors and centre champions prioritisation and confidence to implement change, formalised guidance and support. Temporality: One telephone call made to centres approximately two months following the face-to-face training session. Dose: Once during the intervention period. Implementation outcome: Adoption of the intervention and implementation of healthy eating practices. Justification: Ongoing consultation has been shown to be effective in improving implementation, staff motivation and problem solving within ECEC-based interventions (45, 46).	- Social support (unspecified) - Verbal persuasion about capability

Control

Centres allocated to the control group received usual care during the intervention period, including general support from HPOs external to the research team upon request to implement the NSW state obesity-prevention programme (i.e., *Munch & Move*). The provision of such support was centrally monitored by the research team, with one centre receiving educational materials to support implementation of healthy eating and physical activity practices prior to baseline data collection.

Data collection and measures

Baseline data collection was conducted between September and December 2019, and follow-up data between September and October 2020. A summary of the study outcomes and the time points of measurement has been provided in Table 4A.2.

Outcomes

Centre and child demographics

At baseline, an online or telephone interview (depending on centre preference) with centre nominated supervisors was conducted to collect centre demographic information, including the type of centre (i.e., preschool or long day care), centre operating hours, number of Aboriginal and/or Torres Strait Islander enrollments and number of children enrolled aged between 2-5 years. Centre area SES and geographic location was determined using centre postcodes. Nominated supervisor demographic information, including age, was also collected during the baseline interviews. An online or telephone interview (depending on centre preference) was conducted with centre champions at follow-up to collect demographic information, including age.

Information recorded on parent consent forms were used to examine child demographics. Parents reported the child's age, sex (as recorded on the child's birth certificate), Aboriginal and/or Torres Strait Islander background and usual number of days attending care.

Feasibility of the evaluation procedures

Feasibility of the evaluation procedures, defined as the extent to which the research can be effectively carried out within the ECEC setting (47) was assessed via parent and centre consent rates, and completion of data collection components.

<u>ECEC centre and child consent rates</u> were assessed using internal records kept by the research team, centre and child consent forms. Centre consent rates were calculated as the number of consenting centres divided by the number of eligible centres that were approached to participate in the study.

Reasons for centres declining to participate and ineligibility were recorded by the staff member conducting the recruitment telephone calls. RAs present on the days of data collection collated all returned child consent forms, including those from parents that did not provide consent for their child to participate in the study. Class lists specific to the days of data collection were obtained from each participating centre to determine the total number of eligible children, with consent rates calculated as the number of consenting children divided by the total number of those eligible.

Completion of data collection components including lunchbox observations and measurements, online and/or telephone interviews with nominated supervisors and observations of the centre nutrition environments, was monitored via internal records kept by the research team. These data collection components were conducted in order to evaluate the originally planned trial outcomes relating to centre nutrition environment and child dietary intake. Centre completion of each individual component of data collection (online and/or telephone interview and assessment of centre nutrition environments) was collated and entered into a tracking spreadsheet by a member of the research team. The number of complete child dietary intake data collection forms completed during centre site visits were counted and included in the tracking spreadsheet.

Uptake, acceptability and appropriateness of the intervention and implementation strategies

Delivery of the implementation strategies was monitored using internal records maintained by the research team. For each centre, the following information was recorded: centre receipt of each implementation strategy (i.e., number of centres that were offered and accepted or declined each strategy); date, duration and type (i.e., email, telephone, face-to-face) of each implementation strategy delivered; the role of centre staff receiving the implementation strategy (i.e., nominated supervisor and/or centre champion); and the delivery of BCTs within each implementation strategy (Table 4A.1).

Engagement with the Childcare EATS web-based program was assessed via Google Analytics (48) embedded within the program. Information collected via the analytics included centre completion of self-assessments (i.e., audit with feedback), development of action plans (i.e., develop a formal implementation blueprint), frequency of centres accessing educational materials, total logins to Childcare EATS and average duration of the logins. Such measures have been reported in previous ECEC web-based interventions (27, 49).

Acceptability of the implementation strategies, defined as the perception among centre staff that the implementation strategies are satisfactory, palatable or agreeable (47), was assessed through online and telephone interviews with nominated supervisors and centre champions at follow-up. Interview items were modified from those developed by Weiner et al. (50) and those used by the research team within previous ECEC-based studies (27, 51). Ten items captured information on the perceived effectiveness (e.g., ease of use, helpful in assessing and improving implementation of practices) of the

Childcare EATS web-based program and usefulness of the implementation support strategies (27, 47, 51). Nominated supervisors responded to each item on a 5-point Likert scale (1=strongly agree; 5=strongly disagree), with the proportion reporting 2 or lower (agree, strongly agree) for each item calculated.

Appropriateness of the intervention, defined as the perceived fit, relevance or compatibility of the intervention for the ECEC setting (50), was assessed during the online or telephone interview with nominated supervisors at follow-up. Four items captured information on the perceived fit and suitability of the healthy eating practices, using modified items by Weiner et al (50). Nominated supervisors responded to each item on a 5-point Likert scale (1=strongly agree; 5=strongly disagree), with the proportion reporting 2 or lower (agree, strongly agree) for each item calculated.

Cost to deliver and receive implementation strategies

The direct cost of each implementation strategy delivered by HPOs, including labor (i.e., HPO preparation, administration and delivery of the strategy) and travel, was calculated. Service delivery costs were recorded by the HPOs delivering the intervention. Costs (in $AUD, 2019/2020) were calculated by multiplying the time spent (in hours) on each implementation strategy by the hourly wage rate of HPOs delivering the intervention. The cost for nominated supervisors and centre champions to receive the implementation strategies delivered by HPOs and embedded within the web-based program was also calculated. Data to calculate centre costs were recorded by the HPOs delivering the intervention, in addition to the time spent in the web-based program captured by the analytics data. Similarly to previous studies examining the cost to receive interventions within the ECEC setting (23), costs were calculated by multiplying the time spent (in hours) receiving each implementation strategy by the estimated hourly wage rate of nominated supervisors and educators (52).

Implementation of targeted healthy eating practices within the intervention group

Self-reported implementation of the five targeted healthy eating practices within the intervention group was assessed via baseline nominated supervisor interview data and self-assessments completed by centres via the web-based program at any time point throughout the intervention. Twenty-six items based on the validated Environment and Policy Assessment and Observation Self-Report (EPAO-SR) (53) and Dodds et al. tools (54) were used to measure implementation of the five healthy eating practices.

Additionally, we also assessed contextual factors influencing centre implementation of healthy eating practices, assessed through online and telephone interviews with nominated supervisors at follow-up. Five interview items were based on constructs within three of the five domains of the Consolidated Framework for Implementation Research (CFIR) (inner setting (compatibility with centre values and

direction); innovation characteristics (perceived complexity and cost); and outer setting (external influences such as policies and regulations) to identify factors associated with implementation (55). Nominated supervisors responded to each item on a 5-point Likert scale (1=strongly agree; 5=strongly disagree), with the proportion reporting 2 or lower (agree, strongly agree) for each item calculated.

Table 4A.2 Study outcomes and time points of measurement

Study outcome	Time point of measurement
Centre and child demographics	Baseline
Feasibility of the evaluation procedures: - ECEC centre and child consent rates - Completion of data collection components	 Baseline Baseline
Uptake, acceptability and appropriateness of the intervention and implementation strategies: - Delivery of the implementation strategies - Engagement with the Childcare EATS web-based program - Acceptability of the implementation strategies - Appropriateness of the intervention	 6 months 6 months 12 month follow-up 12 month follow-up
Cost of implementation strategy delivery	Continuously across study period
Implementation of targeted healthy eating practices within the intervention group	Baseline and 6-months

Statistical analysis

All statistical analyses were undertaken in STATA v14 (56). All data were analysed using descriptive statistics. Chi-square analyses were used to compare characteristics of consenting and non-consenting centres, as well as centre and child characteristics between intervention and control groups at baseline. Centre locality was classified as either urban (i.e., major cities) or rural (i.e., inner regional, outer regional, remote) according to the Australian Statistical Geography Standard (57). The 2016 SEIFA was used to classify centres as being located in the least disadvantaged (high SES) or most disadvantaged (low SES) areas (37). Centre postcodes ranked in the top 50% of NSW were classified as least disadvantaged and the lower 50% of postcodes as most disadvantaged.

RESULTS

A total of 22 centres and 448 children participated in the study, with 11 centres randomised to the intervention group and 11 to control (see Figure 4A.1 for CONSORT diagram). Demographic characteristics of consenting centres and children have been summarised in Table 4A.3. There were no significant differences in centre SES or centre geographic location between consenting and non-consenting centres. Additionally, there were no significant differences in centre or child characteristics between intervention and control groups at baseline.

Figure 4A.1 Study flow diagram

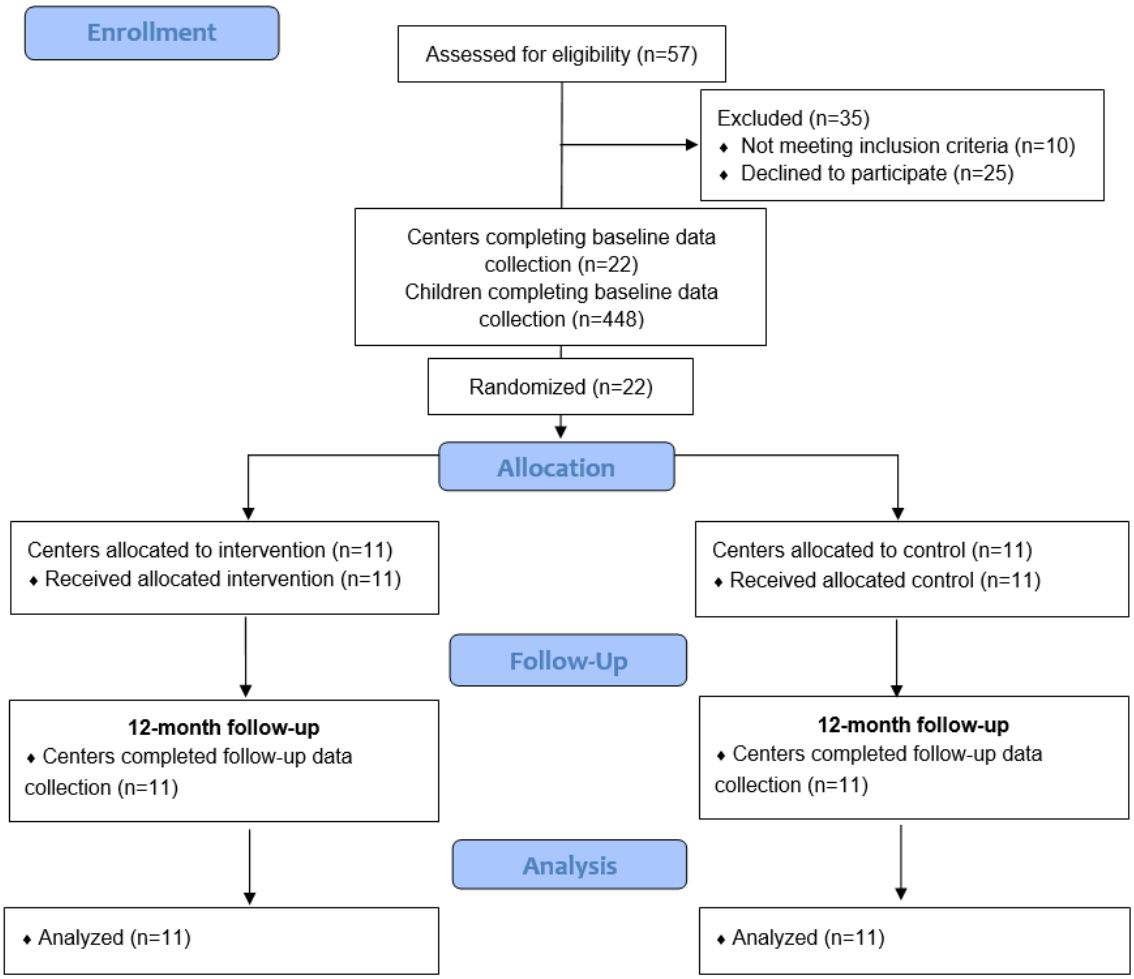

Table 4A.3 Demographic characteristics of participating centres and children

	Intervention N=11	Control N=11
Centre characteristics	n (%)	n (%)
Type of centre:		
- Preschool	10 (90.10)	10 (90.10)
- Long day care	1 (9.90)	1 (9.90)
Number of child enrolments aged 2-5 years mean (SD)	30.73 (11.24)	29.0 (8.63)
Number of Aboriginal child enrolments mean (SD)	5.0 (4.58)	4.64 (3.32)
SEIFA:[a]		
- Most disadvantaged (low SES)	4 (36.36)	4 (36.36)
- Least disadvantaged (high SES)	7 (63.64)	7 (63.64)
Geographic location:		
- Urban (major cities)	8 (72.73)	8 (72.73)
- Rural (inner regional, outer regional, remote)	3 (27.27)	3 (27.27)

Nominated supervisor characteristics		
Age, mean (SD)	37.68 (5.92)	43.91 (10.57)
Centre champion characteristics	**N=6**	
Age, mean (SD)	44.17 (6.40)	-
Child characteristics	**N=246**	**N=202**
Age, mean (SD)	4.68 (0.66)	4.65 (0.68)
Gender: - Female - Male	122 (49.59) 124 (50.41)	88 (43.56) 114 (56.44)
Number children of Aboriginal and/or Torres Strait Islander background	24 (9.76)	20 (9.90)
Number of days attending care mean (SD)	2.63 (0.88)	2.57 (0.74)

[a]The 2016 SEIFA was used to classify centres as being located in the least disadvantaged (high SES) or most disadvantaged (low SES) areas. Centre postcodes ranked in the top 50% of NSW were classified as least disadvantaged and the lower 50% of postcodes as most disadvantaged.

Feasibility of the evaluation procedures

ECEC centre and child consent rates

Of the 85 potentially eligible centres within the sampling frame, 57 centres were approached in random order to participate in the study. Of the 57 centres, 10 (18%) centres were ineligible (NSW Department of Education centre, n=6; involved in another healthy eating or physical activity research trial, n=1; provided food to children, n=3) and 25 (44%) centres declined to participate (lack of time, n=21; study of lessor importance, n=2; lack of staff capacity, n=2). This resulted in an overall study consent rate of 47% (n=22). No centres withdrew from the trial following randomisation.

A potential 670 children were eligible to participate in the lunchbox measurements, 75% of which (n=502) provided consent to participate. The consent rate ranged from 53.3% to 96.0% within participating centres (74.3% children within intervention centres, 75.9% children within control centres).

Completion of data collection components

Baseline lunchbox observations and measurements, conducted to assess the impact of the intervention on child dietary intake, were completed for 100% of consenting children that were in attendance on data collection days at baseline (n=448). The remaining 10.8% of children (n=54) were absent on the data collection days. Baseline observations of the nutrition environment and online or telephone interviews with centre nominated supervisors were completed for 100% (n=22) of participating centres.

Uptake, acceptability and appropriateness of the intervention and implementation strategies

Delivery of implementation strategies

For implementation strategies delivered by the HPO, 100% of centre nominated supervisors or directors were offered and received the educational outreach visit (i.e., face-to-face training session) with the HPO at the commencement of the intervention. The mean duration of the educational outreach visit was 92.73 minutes (SD 21.83). All centres allocated to the intervention (n=11) were invited to nominate and prepare a staff member as centre champion, with 55% of centres (n=6) choosing to nominate a staff member and 83% of these (n=5) also attending the educational outreach visit. The MoU (i.e., mandate change) was drafted with all intervention centres (n=11), with a signed MoU returned by 55% of centres (n=6). Ongoing consultation and local technical assistance (i.e., follow-up support call provided by the HPO) was offered to 100% of intervention centres (n=11), with 91% of centres (n=10) accepting the call. The mean duration of the follow-up support call was 11.9 minutes (SD 4.70).

For implementation strategies within the web-based program, overall, 100% of centres (n=11) were provided access to and undertook audit with feedback (i.e., the self-assessment), developed a formal implementation blueprint (i.e., action plan) and accessed the educational materials via the Childcare EATS web-based program.

All intervention centres (n=11) received the BCTs as intended in four of the seven implementation strategies (Table 4A.4). Additional BCTs (instruction on how to perform the behaviour; problem solving; social support (practical); and action planning) were employed within the ongoing consultation and local technical assistance strategy in 36.6% of centres (n=4) due to the HPO responding to the needs of the centre and tailoring the advice accordingly. Low uptake of the mandate change and identify and prepare a centre champion implementation strategies resulted in only 55% of centres (n=6) receiving the BCTs within these strategies.

Engagement with the web-based program

Intervention centre's engagement with the Childcare EATS web-based program is detailed in Table 4A.5. At six month follow-up, intervention centres had logged in to the program an average of 5.18 (SD 2.52) times, spending an average of 19.90 (SD 11.21) minutes in the program per login. Centres completed an average of 2.90 (SD 2.02) self-assessments and developed an average of 2.09 (SD 1.30) action plans. Six staff members from four intervention centres completed online professional development accessible via the web-based program or the NSW state obesity-prevention programme website (i.e., *Munch & Move*) during the intervention period, compared to no staff members from control centres.

Table 4A.4 Behavioural Change Techniques delivered within implementation strategies

Mode of delivery	Implementation strategy	Behavioural Change Technique	Number of centres
Web-based program	Audit with feedback	Feedback on behaviour	11
		Feedback on outcome of behaviour	11
		Self-monitoring of behaviour	11
	Develop a formal implementation blueprint	Goal setting (outcome, behaviour)	11
		Action planning	11
		Problem solving	11
		Review goals (outcome, behaviour)	11
	Distribute educational materials	Demonstration of behaviour	11
		Restructuring the physical environment	11
		Adding objects to the environment	11
		Prompts/cues	11
		Credible source	11
Health promotion officer	Educational outreach visit	Instruction on how to perform behaviour	11
		Demonstration on how to perform behaviour	11
	Ongoing consultation and local technical assistance	Social support (unspecified)	10
		Verbal persuasion about capability	10
		Instruction on how to perform behaviour*	3
		Problem solving*	1
		Social support (practical)*	1
		Action planning*	3
	Mandate change	Commitment	6
		Social support (unspecified)	6
	Identify and prepare a centre champion	Identification of self as role model	6
		Social support (unspecified)	6

*Additional BCTs employed within the ongoing consultation and local technical assistance implementation strategy beyond that pre-specified in the intervention protocol

Table 4A.5 Centre engagement with Childcare EATS web-based program across 6 months

Engagement	Mean (SD)	Median (interquartile range (IQR))
Total logins	5.18 (2.52)	4.00 (4.00-5.00)
Average login duration (minutes)	19.90 (11.21)	17.44 (10.24-30.03)
Self-assessments completed	2.90 (2.02)	2.00 (1.00-4.00)
Action plans developed	2.09 (1.30)	2.00 (1.00-3.00)
Number of times educational materials were accessed	12.36 (6.71)	10.00 (6.00-18.00)

Acceptability of the intervention and implementation strategies

The web-based program was reported to be an acceptable method of assessing healthy eating practices by the majority of nominated supervisors (91%, n=10) and centre champions (83.3%, n=5) (Table 4A.6). The implementation strategies provided by HPOs, including the educational outreach visit (i.e.,

face-to-face training) and ongoing support (i.e., support call), were considered to be acceptable by nominated supervisors (91-100%). Acceptability of the implementation strategies was lower amongst centre champions (33.3-83.3%).

Appropriateness of the intervention

One hundred percent of nominated supervisors within the intervention group (n=11) agreed or strongly agreed that the healthy eating policies and practices seem fitting, suitable, applicable and a good match (Table 4A.6).

Table 4A.6 Acceptability and appropriateness of the web-based intervention and implementation strategies

Measure (agree or strongly agree)	Nominated supervisors (n=11), n (%)	Centre champions (n=6), n (%)
Using the web-based program is an acceptable method for assessing if our centre is meeting the healthy eating policies and practices.	10 (91)	5 (83.3)
The web-based program was useful in my centre to help meet the healthy eating policies and practices.	11 (100)	5 (83.3)
Using the web-based program improved my centre's performance in meeting the healthy eating policies and practices.	10 (91)	5 (83.3)
I would recommend the web-based program to other ECEC centres.	10 (91)	5 (83.3)
I intend to continue to use the web-based program to help our centre meet the healthy eating policies and practices.	10 (91)	5 (83.3)
I thought the web-based program was easy to use	10 (91)	-
Measure (useful or very useful)		
I found the face-to-face training session (i.e., educational outreach visit) useful.	10 (91)	5 (83.3)
I found the garnering of managerial support (i.e., mandate change) useful.	11 (100)	2 (33.3)
I found the ongoing telephone support (i.e., ongoing consultation and local technical assistance) provided by the health promotion officers useful.	10 (91)	2 (33.3)
I found nominating a centre champion (i.e., identify and prepare a centre champion) useful*	5 (83.3)	-
Appropriateness (agree or strongly agree)		
The healthy eating policies and practices seem fitting.	11 (100)	-
The healthy eating policies and practices seems suitable.	11 (100)	-
The healthy eating policies and practices seem applicable.	11 (100)	-
The healthy eating policies and practices seem like a good match.	11 (100)	-
Contextual factors influencing implementation of healthy eating practices (agree or strongly agree)		
The healthy eating policies and practices are consistent with our centre philosophy	10 (91)	-
The healthy eating policies and practices are consistent with the National Quality Framework	10 (91)	-

The healthy eating policies and practices are costly to implement	0 (0)	-
The healthy eating policies and practices are difficult to implement	4 (36)	-
Centres within our region would be supportive of the healthy eating policies and practices	10 (91)	-

* This item only applied to those centres that nominated a centre champion (n=6)

Cost to deliver and receive implementation strategies

The total cost to the health service for the HPO to deliver the implementation strategies (i.e., educational outreach visit, mandate change and ongoing consultation) was $1351.25 (average per centre: $122.84). Overall, the educational outreach visits cost a total of $1143.08 (average per centre: $103.92), including travel to the centre and follow-up correspondence with centre staff; mandate change cost a total of $43.44 (average per centre: $3.95); and ongoing consultation cost a total of $164.73 (average per centre: $14.98). The total cost to centres for nominated supervisors and centre champions to receive all implementation strategies (i.e. those delivered by the HPO and embedded within the web-based program) was $1516.40 (average per centre: $137.85). The cost to receive the implementation strategies delivered by the HPO was $1052.29 (average per centre: $95.66), whilst the cost to receive the implementation strategies embedded within the web-based program was $464.11 (average per centre: $42.19).

Implementation of targeted healthy eating practices within the intervention group

The proportion of centres implementing the targeted healthy eating practices improved in four of the five practices from baseline to follow-up (Table 4A.7). The greatest improvement was reported in centre educator use of feeding practices that support children's healthy eating, increasing from 18.18% (n=2) to 81.82% (n=9). The proportion of centres supporting families to provide healthier foods consistent with dietary guidelines decreased from 81.82% (n=9) to 54.55% (n=6). At follow-up, 18.18% of centres (n=2) were implementing all five healthy eating practices, while none were at baseline. The mean number of practices implemented per centre increased from 3.36 (SD 1.21) at baseline to 4.36 (SD 1.21) at follow-up. When examining the change in practice implementation between the most (low SES) and least (high SES) disadvantaged centres, the number of most disadvantaged centres supporting families to provide healthier foods consistent with dietary guidelines reduced from 100.00% at baseline (n=4) to 25.00% (n=1) at follow-up, compared to no change in least disadvantaged centres (Table 4A.8).

Ninety one percent of nominated supervisors (n=10) reported the healthy eating practices as being consistent with the philosophy of their centre and consistent with the ECEC settings regulatory standards (i.e., the National Quality Framework) (Table 4A.6).

Table 4A.7 Intervention group implementation of healthy eating practices

Healthy eating practice	Centres implementing at baseline, n (%)	Centres implementing at follow-up, n (%)	Change, n (%)
Provision of intentional healthy eating learning experiences	4 (36.36)	6 (54.55)	2 (18.17)
Comprehensive written nutrition policy that outlines key healthy eating practices	8 (72.73)	10 (90.91)	10 (18.17)
Staff participating in professional development targeting healthy eating	3 (27.27)	6 (54.55)	3 (27.27)
Educator use of feeding practices that support children's healthy eating	2 (18.18)	9 (81.82)	7 (63.64)
Supporting families to provide healthier foods consistent with dietary guidelines	9 (81.82)	6 (54.55)	-3 (27.27)

Table 4A.8 Intervention group implementation of healthy eating practices by SEIFA[a] classification

Healthy eating practice	Most disadvantaged (low SES) centres implementing at baseline, n (%)	Most disadvantaged (low SES) centres implementing at follow-up, n (%)	Change, n (%)	Least disadvantaged (high SES) centres implementing at baseline, n (%)	Least disadvantaged (high SES) centres implementing at follow-up, n (%)	Change, n (%)
Provision of intentional healthy eating learning experiences	2 (50%)	2 (50%)	0 (0.00%)	2 (28.6%)	4 (57.14%)	2 (28.57%)
Comprehensive written nutrition policy that outlines key healthy eating practices	3 (75%)	3 (75%)	0 (0.00%)	5 (71.43%)	7 (100%)	2 (28.57%)
Staff participating in professional development targeting healthy eating	1 (25%)	1 (25%)	0 (0.00%)	1 (14.29%)	5 (71.43%)	4 (57.14%)
Educator use of feeding practices that support children's healthy eating	1 (25%)	4 (100%)	3 (75.00%)	1 (14.29%)	5 (71.43%)	4 (57.14%)
Supporting families to provide healthier foods consistent with dietary guidelines	4 (100%)	1 (25%)	-3 (75.00%)	5 (71.43%)	5 (71.43%)	0 (0.00%)

[a]The 2016 SEIFA was used to classify centres as being located in the least disadvantaged (high SES) or most disadvantaged (low SES) areas. Centre postcodes ranked in the top 50% of NSW were classified as least disadvantaged and the lower 50% of postcodes as most disadvantaged.

DISCUSSION

This study aimed to assess the potential feasibility of a pilot cluster RCT of a web-based healthy eating implementation intervention in ECEC centres to undertake a fully-powered implementation trial. The study also examined the uptake, acceptability, appropriateness and actual cost to deliver the intervention and implementation strategies. Overall, the study findings indicate that the web-based intervention and the majority of implementation strategies are highly feasible, low cost compared to traditional approaches and acceptable to ECEC centre staff, and can improve the implementation of healthy eating practices in ECEC centres.

The study obtained a high overall parental consent rate of 75% for children to participate in lunchbox measurements. However, the variability in parental consent across centres (ranging from 53.3% to 96.0%) is worth noting. This variation may be due to the differing relationships within centres between staff and parents regarding the contents of children's lunchboxes, with previous studies reporting a reluctance from staff to communicate with parents regarding lunchbox contents in fear of having difficult conversations (58, 59). As such, some parents may have been reluctant to consent to lunchbox measurements due to perceived judgement (58, 59), however, the reasons for non-consent were not captured by the research team. Although not dissimilar to previous web-based studies conducted within the ECEC setting, the overall study consent rate among centres was moderate at 47% (27, 60, 61). Similar to previous studies, barriers to centre participation reported by staff included a lack of time and competing priorities (62). As this study attempted to address such barriers through embedding the intervention within usual centre processes (i.e., aligning with ECEC accreditation standards), further consideration needs to be taken for how to better promote the intervention as aligning with current centre priorities during study recruitment. However, once consented to the trial, the study data collection components were highly feasible, with 100% of participating centres completing child lunchbox measurements, centre nutrition environment observations and interviews with nominated supervisors. This indicates that such methods should be retained for a fully-powered implementation trial.

Promising levels of uptake and acceptability of the implementation strategies employed within the study were observed. The level of engagement with the web-based program was consistent with recommendations for centres to complete the self-assessment (audit with feedback) and develop action plans (formal implementation blueprint) twice during the intervention period. Such findings suggest that centres are likely to have received the intended dose of the intervention with the current implementation strategies. The promising levels of engagement may be attributed to the web-based program being easy to use, as reported by nominated supervisors and aligned with usual centre

processes (63). However, large SDs and wide IQRs for the number of logins and login duration indicate high variability in engagement with the web-based program across centres. Despite such variability being consistent with previous studies within the ECEC setting that employed web-based modalities (27), exploration is needed to better understand the reasons behind the relatively lower levels of engagement for some centres.

As the intervention was largely delivered remotely, the overall cost to deliver the implementation strategies was minimal (total of $1351.25; average per centre: $122.84). The web-based intervention, therefore, may be considered a low-cost alternative to support centre implementation compared to traditional, high-intensive modalities described within previous studies (23). However, the study was unable to capture the costs associated with centre staff implementing the healthy eating practices, including time spent disseminating information to parents. As such, future studies should consider conducting a cost-effective analysis, whilst capturing costs associated with centre implementation of practices, to enable researchers, practitioners, funding bodies and centres to determine whether investment in the web-based intervention produced an acceptable return and is a cost-effective approach to supporting the implementation of healthy eating practices at scale. Consistent with previous studies conducted within the ECEC setting (51, 64), high levels of uptake and acceptability were found for the majority of implementation strategies provided by HPOs, particularly the educational outreach visit (100%), and local technical assistance (91%). Despite previous literature suggesting that implementation strategies such as the MoU and centre champions are useful to facilitate the uptake of interventions (19, 39, 44), the relatively low uptake of these strategies is worth exploration. Although there was high acceptability of the centre champion strategy in centres that nominated a champion (83.3%), a potential explanation for the lower uptake of the strategy may be the differing organisational structures within centres. Anecdotally, the uptake of centre champion was higher in larger centres with greater staffing numbers and child enrollments, where the nominated supervisor often engages educational leads. The educational lead takes on additional advocacy roles amongst staff, lending them to the role of centre champion. In smaller centres however, the nominated supervisor often works as the educational lead themselves, acting as the main advocate amongst centre staff. Additionally, the low acceptability of the ongoing telephone support strategy by centre champions (33%) is also worth noting. Given centre supervisors were the target of the telephone support calls, it is likely that centre champions did not directly benefit from the inclusion of this strategy, thus perceived the strategy as less useful. Therefore, the research team should consider additional or alternative strategies, such as a local consensus approach (51) (i.e., whole of centre), to adequately engage with and support all centre staff to ensure uptake of the intervention remains high. This may also include specific implementation strategies for different employee types (e.g. educators, supervisors) to ensure the required level and types of implementation support is provided is sufficient for all staff.

Given the variation in the uptake of the implementation strategies, particularly the MoU and centre champion strategies, an examination of whether implementation of the targeted healthy eating practices was impacted by low uptake of these strategies by some centres would be useful to inform the selection of implementation strategies in future trials. Additionally, future studies should also consider assessing additional centre supervisor and educator characteristics, including their readiness for implementation (e.g. commitment and motivation to implement change) to gain greater insight into how the implementation strategies potentially work. Further, previous research has predominately focused on the most proximal determinants of implementation within the ECEC setting (e.g. staff knowledge of healthy eating), with less focus on other contextual factors that may influence implementation. Conducting qualitative and mixed methods research to examine centre organisational factors, such as staff turnover, intra-organisational dynamics and centre engagement with health promotion programmes, may help researchers to fully understand the key drivers of implementation.

The improvement in implementation of four of the five targeted healthy eating practices within the intervention group is promising, with percentage increases ranging from 18.7% to 63.64%. Such percentage increases are encouraging when compared to previous studies aimed at improving the implementation of practices within the ECEC setting (13). A recent Cochrane systematic review, which examined the effectiveness of strategies aimed at improving the implementation of healthy eating and physical activity policies and practices, reported percentage increases as low as 2.5% (13). Our findings therefore, show great promise for testing in a fully-powered implementation trial. However, a decrease in centres supporting families to provide healthier foods consistent with dietary guidelines, particularly in those centres classified as most disadvantaged, is worth noting given this practice had the highest rates of implementation at baseline. A potential explanation for this reduction may be the competing information relating to COVID-19 distributed to parents during the intervention period (e.g., communication regarding centre safety protocols, changes to child attendance fees), resulting in support for parents to provide foods consistent with sector dietary guidelines being of lesser priority at this time. Information collected by the research team via telephone calls with centre staff indicated that dramatic changes in usual centre processes, including the methods of communication and types of information distributed to parents, occurred as a result of COVID-19. Research suggests a lack of skills, knowledge and confidence to communicate with parents regarding healthy eating (58, 59, 65), may also negatively impact implementation of this practice. Employing strategies, such as ongoing professional development, coaching and training, has been suggested within recent studies to address such barriers and support ECEC staff to engage in positive and effective communication with parents (65). As centres were encouraged to distribute the healthy eating resources to parents via usual their communication methods (e.g. parent communication apps, email, written information), further consideration into the most effective method to facilitate staff communication with parents regarding healthy eating and nutrition may be required. Although the

Childcare EATS engagement data provided important insights into centre use of the web-based program, the methods utilised and the reach of the centre distribution of healthy eating information and resources (e.g. number of parents who received the resources) was unable to be measured. Additionally, we were unable to assess whether parents within the intervention group communicated healthy eating information provided by centre staff to other parents. There was a notable contrast in implementation of this practice between centres classified as most and least disadvantaged. This contrast may potentially be explained by COVID-19 related impacts on resourcing (e.g. staffing, budget and time) within disadvantaged centres, who may have already been experiencing limited resources prior to the pandemic. A better understanding of the barriers faced by centres classified as most disadvantaged in communicating with parents should be sought to enable development of appropriate strategies to support implementation of this practice. However, given the small sample size within the current study, this finding is highly exploratory and should be interpreted with caution. Additionally, collecting contextual data from parents regarding their preferred method to receive healthy eating information from centres may also provide guidance into the most effective way to support parents in packing healthy lunchboxes for children to consume in care.

Findings from this study provides positive data to support the conduct of a fully-powered implementation trial. Importantly, despite the relatively low level of support provided to ECEC centres to use the program, the level of engagement with the web-based program was relatively high, and large changes in practice implementation were observed. Findings from this study suggest that a number of improvements could be made to the intervention, including considering the appropriateness of the MoU and centre champion, and employing strategies to support ECEC centre staff engagement with parents regarding healthy eating. Finally, the inclusion of a nested evaluation within a future trial to assess the impact of the web-based intervention on individual-level outcomes, including child dietary intake and parent lunchbox packing practices, should be considered to gain greater insight into the effectiveness of the intervention beyond centre-level outcomes.

LIMITATIONS

Although unavoidable due to restrictions relating to the COVID-19 pandemic, the inability to assess centre nutrition environments and conduct child lunchbox assessments via direct observation to assess child-level outcomes as originally intended is a limitation of the study. Additionally, although the data regarding the impact of the intervention on centre implementation is promising, these data were only able to be collected within intervention centres with no comparison to the control group, and as such, should be interpreted with caution. Finally, as the study was conducted within one region of New South Wales, the generalisability of the findings beyond the region may be limited.

CONCLUSIONS

This pilot study provides positive data to support the conduct of a larger trial assessing the impact of the web-based intervention on ECEC centre implementation of healthy eating practices. Findings of this pilot study indicate that the web-based intervention is highly feasible, acceptable, appropriate and low cost. As this study is one of few examining the potential impact of a web-based intervention within the ECEC setting, a fully-powered implementation trial is warranted to establish the true effects and examine the impact of the intervention at scale.

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CHAPTER FOUR PART B

PRIORITISING SCALABILITY DURING THE EVALUATION OF A WEB-BASED INTERVENTION TO IMPROVE THE IMPLEMENTATION OF EVIDENCE-BASED HEALTHY EATING PRACTICES IN ECEC CENTRES

A version of this Chapter has been submitted for publication in *Nutrition & Dietetics*

Additional materials in Appendix 4B.1

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INTRODUCTION

Public health nutrition interventions must have the ability to be delivered on a population level to result in real-world health improvements. Increasingly, the literature highlights a need to consider the scalability of an intervention during the development and evaluation of public health programmes (1, 2). Scalability is defined as *the ability of an intervention shown to be efficacious on a small scale to be expanded under real-world conditions to reach a greater proportion of the eligible population, whilst retaining effectiveness* (3). Several characteristics of interventions have been identified as influencing scalability. Milat et al. summarised the characteristics of the scale-up context and implementation requirements in 10 domains, including strategic and political contextual factors; evidence of effectiveness, costs and benefits; fidelity and adaptation; reach and acceptability; delivery settings and workforce; implementation infrastructure; and the sustainability of the intervention (3). Without the consideration of such factors, a recent review found that the effects of interventions often attenuated when progressing to scale, resulting in little to no impact on targeted health outcomes (4). Recognising this, international organisations, including the World Health Organization (2), recommend considering and addressing factors influencing scalability in the development and evaluation of public health nutrition interventions.

To date, the majority of research efforts (whilst still limited) have focused on the characteristics of interventions that facilitate population-wide implementation, with little focus on the attributes of implementation strategies in supporting scale-up of public health interventions, including those in ECEC (5). A recent Cochrane systematic review conducted by the research team examined strategies to improve the implementation of healthy eating policies and practices within ECEC centres, and also extracted process-level data that broadly align with the domains of scalability outlined above by Milat et al (3, 5). Of the 18 studies that aimed to improve the implementation of healthy eating policies and practices, only five reported on acceptability and nine reported on reach, whilst none reported on adoption, sustainability or appropriateness (5). No studies examined the cost to deliver implementation strategies - crucial information for policy makers and funders to determine if sufficient financial resource exists to execute the tested implementation strategies (5). Further, only two studies tested the impact of the intervention at scale (defined within the review as more than 50 centres), with mixed effects (5). As such, evidence from within the review provides little direction into the types of implementation strategies that should be selected in order to assist the delivery of ECEC-based implementation interventions at scale.

Therefore, to increase the potential population-level impact of a web-based intervention aimed at improving the implementation of evidence-based healthy eating policies and practices in Early

Childhood Education and Care (ECEC) centres, this paper describes a novel approach undertaken to evaluate the potential scalability of a suite of implementation strategies employed within the intervention. Such assessments help inform the suitability of an intervention for further scaling up and any modifications that need to be made to support broader dissemination of an intervention.

METHODS

Context

A pilot web-based intervention was developed to improve the implementation of evidence-based healthy eating policies and practices in ECEC centres (Chapters Three and Four Part A). The intervention aimed to be simple, consistent with local infrastructure, aligned with the delivery workforce and delivered at low cost. The implementation strategies were designed to be primarily delivered via a web-based program, including audit with feedback, development of a formal implementation blueprint and educational materials. Additional support, including an educational outreach visit, mandating change and technical assistance, were provided by health promotion officers employed within each New South Wales (NSW) local health district to support the implementation of state-government funded obesity-prevention initiatives within community-based settings (e.g. ECEC centres).

Scalability instrument

We examined the literature to identify scalability tools and frameworks which could be adapted to evaluate selected attributes of the implementation strategy rather than the intervention. Several frameworks and tools exist to provide guidance to researchers and practitioners to develop interventions and appraise their potential scalability, with a recent systematic review by Charif et al. identifying 21 tools designed to assess the scalability of public health innovations (6). From this, we selected and adapted the Intervention Scalability Assessment Tool (ISAT), which was developed by Milat et al. to assist practitioners, policy makers and researchers in determining the scalability of a health programme or intervention (7). The ISAT tool consists of 10 domains and aims to stimulate thinking and promote consideration of the implementation and feasibility factors relating to all potential scale-up aspects, including fidelity and adaptations, reach and acceptability, delivery settings and agents, and implementation infrastructure and training (7). A detailed description of the ISAT tool is presented in Appendix 4B.1, with an overview of the ISAT domains provided below in Table 4B.1. Adapting the ISAT tool to focus on selected attributes of the implementation strategy rather than the intervention enabled the research team to evaluate the potential scalability of the implementation strategies.

Data collection procedures

The collection of data to assess the scalability of the implementation strategies occurred in two phases:

a. Pilot implementation trial

Characteristics of scalability, including effectiveness, uptake, cost and acceptability of the implementation strategies, were assessed as part of the pilot implementation trial conducted in NSW ECEC centres. The methodology and data collection procedures for the pilot implementation trial has been reported in detail within Chapter Three and Four Part A. Briefly, implementation of the healthy eating practices within the 11 ECEC centres allocated to the intervention group was assessed via nominated supervisor interview data and self-assessments completed by centres via the web-based program. The direct cost for health promotion officers to deliver each implementation strategy, including labor and travel, was calculated (in $AUD, 2019/2020) by multiplying the time spent (in hours) on each implementation strategy by the hourly wage rate of HPOs delivering the intervention. Delivery and uptake of the implementation strategies was monitored using internal records maintained by the research team. Engagement with the Childcare EATS web-based program was assessed via analytics embedded within the web-based program. Acceptability of the implementation strategies was assessed through online and telephone interviews with nominated supervisors and centre champions at follow-up.

Outcome data collected to assess these scalability characteristics were incorporated into the scalability assessment described below.

b. Scalability assessment

An assessment using the ISAT was conducted by an internal working group, consisting of research team members (dietitians, health behaviour and implementation researchers) and experienced health promotion officers (HPOs). Specifically, to assess scalability, the working group collectively completed questions across the 10 ISAT domains, followed by an assessment at the end of each domain to enable a score to be calculated (7). Following the ISAT process, each domain was scored by the working group on a 4-point Likert scale, ranging from not at all (0 points) to a large extent (3 points) (see Table 4B.1). A consensus approach to scoring each domain was employed by the working group.

Data analysis

All statistical analyses were undertaken in STATA v14 (8). All data were analysed using descriptive statistics.

RESULTS

Findings from the pilot implementation trial indicated that the implementation strategies are highly amenable to scale-up. For example, the implementation of four healthy eating practices increased in the intervention group, ranging from 18.7% to 63.64%. The implementation strategies were relatively low cost to deliver (total $1351.25), and uptake was high (100%) for all implementation strategies embedded within the web-based program. Engagement with the web-based program was consistent with what was hypothesised by the research team (centres logged into the program an average 5.18 times). Lastly, almost all centres (91%) reported that using the web-based program was useful in helping centres to meet healthy eating practices and the implementation support strategies were highly acceptable (91-100%) to centre supervisors.

Results from the scalability assessment indicated that the web-based implementation strategy was highly amenable to support scale-up and received the maximum score (3 points) across six domains (Table 4B.1). The strategic and policital context and evidence of effectiveness domains received the lowest scores (2 points).

Table 4B.1 Scalability of the implementation strategies according to the ISAT domains

ISAT Domain	Characteristics of the implementation strategy	ISAT Score (out of 3)
The problem	- Within ECEC centres, the implementation of several healthy eating practices is associated with improved child dietary intake in care (9). - Despite such association, current implementation of practices by centre staff is inadequate (10, 11). - Health promotion staff within the local health district partnered with the research team, and identified that inadequate implementation of healthy eating practices was an important problem. Addressing the problem through this intervention aligned with the remit of the health service.	3.0
The program/ implementation strategies	- The implementation strategies were employed to support ECEC centre staff to implement healthy eating practices, thus improving child dietary intake, via a web-based program.	3.0
Strategic and political context	- The healthy eating practices align with standards set by the Australian ECEC regulatory authority and practices specified within a state-government funded obesity prevention initiative (12). - The healthy eating practices align with priorities of non-government organisations, including Early Childhood Australia (13).	2.0
Evidence of effectiveness	- An RCT within the United States examined the impact of a similar web-based program employing a suite of implementation strategies on centre nutrition environments, and reported non-significant improvements in the provision of food and beverages (14). However, impact has not been assessed in the Australian context.	2.0

Implementation strategy costs and benefits	- Studies have indicated that web-based modalities are a potentially less costly approach to supporting centres to improve the implementation of healthy eating practices compared to traditional approaches (15).	3.0
Fidelity and adaption	- As the implementation strategies were primarily delivered online, there was likely to be high fidelity with delivery of these strategies components and limited need for adaptation.	3.0
Reach and acceptability	- Our research found that 100% of centres within the study region had the necessary infrastructure to use a web-based program (16). - Research conducted within the setting found that the use of web-based programs to support practice change is highly acceptable, and having access to a web-based program which houses implementation strategies, including educational materials, is well supported by centre staff (16, 17).	2.5
Delivery setting and workforce	- The implementation strategies align with the health service remit to provide support to centres to implement healthy eating practices specified within a state-government funded obesity-prevention initiative (12). - Employing a web-based program to facilitate ongoing support to centres potentially increases the capacity of health promotion staff by replacing traditional high-intensity approaches.	3.0
Implementation infrastructure	- The web-based program was designed to be embedded within usual processes using existing infrastructure. - Implementation strategies employed within the program align with sector accreditation standards and centre quality improvement plans. - To supplement the implementation strategies embedded within the web-based program, a small amount of health promotion officer support was provided (e.g. training session and telephone support). - The need for resources to address barriers to local-level implementation was addressed through implementation strategies employed within the web-based program (e.g. audit and feedback, educational materials).	3.0
Sustainability of the implementation strategy	- The web-based program was designed to be integrated into usual centre processes, as such, ensuring ongoing delivery following the withdrawal of implementation support provided by health promotion officers. - The web-based program is free to centres and low-cost to the health service to implement. - The implementation strategies leverage off existing infrastructure (e.g. resources, staffing).	2.7

DISCUSSION

This study describes a process of assessing the scalability of implementation strategies employed within a web-based implementation intervention to inform broader dissemination. The novel approach undertaken by the research team to assess the scalability of the implementation strategy was a pragmatic way of providing guidance to researchers and practitioners for the planning of future scalable interventions. The findings of the scalability assessment highlight a need for stronger evidence of effectiveness, policy and context support to ensure scalability of the web-based program.

Within Australia, funding to support the implementation of health promotion programmes within community-based settings, including ECEC centres, predominately occurs at a state and territory level. Such funding is often reliant on the alignment of the health promotion programme with the priorities of the state government (18). For example, childhood obesity was selected as a Premiers Priority within the state of NSW (i.e. where the pilot implementation trial was conducted), with government funding provided to local health district health promotion units to support the implementation of obesity-prevention programmes as a result (12, 18). The web-based program was developed by the research team in collaboration with health promotion staff to support the implementation of such a programme within ECEC centres. Therefore, if shown to be effective in a fully-powered implementation trial, the web-based program could potentially be scaled up on a state-level and integrated within the health service support model for ECEC centres, supported by state government funding. However, such political and contextual support does not exist in all Australian states and territories. Therefore, the implementation strategies originally intended to be delivered by health promotion officers (e.g. educational outreach visit, ongoing support) may not be viable if the web-based program was scaled to other Australian jurisdictions. As such, the research team need to examine whether the impact of the web-based program is reliant on those implementation strategies delivered by health promotion officers, and if so, are alternative implementation strategies available that could be effectively delivered in those jurisdictions where health promotion officer support is not available. In addition to alternative implementation strategies, the long-term delivery and funding support for those jurisdictions with limited or no state-government resources needs to be investigated by the research team in order to ensure the scalability and sustainability of the web-based program.

Given the limited evidence base regarding the scalability attributes of implementation strategies, this study provides important insight and begins to address the current gap in the evidence. Encouragingly, the field of implementation science is rapidly evolving, evidenced by the number of included studies within the Cochrane systematic review described above doubling in three years (5). Taxonomies to encourage consistent use of implementation terminology (e.g. the Expert Recommendations for Implementing Change taxonomy) (19), measurements of implementation constructs (20) and frameworks to guide the reporting of implementation strategies employed within studies (e.g. the Proctor Framework) have also been developed (21). This progression will assist in the definition, communication and measurement of implementation strategies and outcomes within future studies, thus providing greater insight into the potential scalability attributes of implementation strategies employed within interventions.

This process needs to be considered in the following context. Scalability was only assessed in one NSW local health district with a small number of health promotion practitioners and ECEC centres. Additionally, as there is no valid way of evaluating the scalability of implementation strategies, an

adapted version of an existing tool (i.e. the ISAT) was employed by the research team. Only select scalability domains deemed relevant internally by the research team were assessed during the pilot-RCT which means that some components were not assessed in this process. Finally, risk of bias could be better minimised in future assessments by including a sample of health promotion and ECEC centre staff (external to the research team) in the assessment process. Notwithstanding this, we recommend that a similar process to this is applied to other community and public health nutrition interventions to address some of the challenges with scaling up existing interventions.

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CHAPTER FIVE

STRATEGIES TO IMPROVE THE IMPLEMENTATION OF HEALTHY EATING, PHYSICAL ACTIVITY AND OBESITY PREVENTION POLICIES, PRACTICES OR PROGRAMMES WITHIN ECEC CENTRES

A version of this Chapter was published in the *Cochrane Database of Systematic Reviews*

Additional materials in Appendices 5.1–5.7

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ABSTRACT

Introduction

Despite the existence of effective interventions and best-practice guideline recommendations for Early Childhood Education and Care (ECEC) centres to implement evidence-based policies, practices and programmes to promote child healthy eating, physical activity and prevent unhealthy weight gain, many centres fail to do so.

Objectives

The primary aim of the review was to examine the effectiveness of strategies aimed at improving the implementation of policies, practices or programmes by ECEC centres that promote child healthy eating, physical activity and/or obesity prevention.

The secondary aims of the review were to:

1. Examine the cost or cost-effectiveness of such strategies;
2. Examine any adverse effects of such strategies on ECEC centres, centre staff or children;
3. Examine the effect of such strategies on child diet, physical activity or weight status.
4. Describe the acceptability, adoption, penetration, sustainability and appropriateness of such implementation strategies.

Search methods

We searched the following electronic databases on February 22 2019: Cochrane Central Register of Controlled trials (CENTRAL), MEDLINE, MEDLINE In Process, Embase, PsycINFO, ERIC, CINAHL and SCOPUS for relevant studies. We searched reference lists of included studies, handsearched two international implementation science journals, the World Health Organization International Clinical Trials Registry Platform (www.who.int/ictrp/) and ClinicalTrials.gov (www.clinicaltrials.gov).

Selection criteria

We included any study (randomised or non-randomised) with a parallel control group that compared any strategy to improve the implementation of a healthy eating, physical activity or obesity prevention policy, practice or programme by staff of centre-based ECEC centres to no intervention, 'usual' practice or an alternative strategy. Centre-based ECEC centres included preschools, nurseries, long daycare centres and kindergartens catering for children prior to compulsory schooling (typically up to the age of five to six years).

Data collection and analysis

Two review authors independently screened study titles and abstracts, extracted study data and assessed risk of bias; we resolved discrepancies via consensus. We performed meta-analysis using a random-effects model where studies with suitable data and homogeneity were identified; otherwise, findings were described narratively.

Main results

Twenty-one studies, including 16 randomised and five non-randomised, were included in the review. The studies sought to improve the implementation of policies, practices or programmes targeting healthy eating (six studies), physical activity (three studies) or both healthy eating and physical activity (12 studies). Studies were conducted in the United States (n = 12), Australia (n = 8) and Ireland (n = 1). Collectively, the 21 studies included a total of 1945 ECEC centres examining a range of implementation strategies including educational materials, educational meetings, audit and feedback, opinion leaders, small incentives or grants, educational outreach visits or academic detailing, reminders and tailored interventions. Most studies (n = 19) examined implementation strategies versus usual practice or minimal support control, and two compared alternative implementation strategies. For implementation outcomes, six studies (one randomised controlled trial (RCT)) were judged to be at high risk of bias overall.

The review findings suggest that implementation strategies probably improve the implementation of policies, practices or programmes that promote child healthy eating, physical activity and/or obesity prevention in ECEC centres. Of the 19 studies that compared a strategy to usual practice or minimal support control, 11 studies (nine RCTs) used score-based measures of implementation (e.g. ECEC centre nutrition environment score). Nine of these studies were included in pooled analysis, which found an improvement in implementation outcomes (SMD 0.49; 95% CI 0.19 to 0.79; participants = 495; moderate-certainty evidence). Ten studies (seven RCTs) used dichotomous measures of implementation (e.g. proportion of ECEC centres implementing a policy or specific practice), with seven of these included in pooled analysis (OR 1.83; 95% CI 0.81 to 4.11; participants = 391; low-certainty evidence).

Findings suggest that such interventions probably lead to little or no difference in child physical activity (four RCTs; moderate-certainty evidence) or weight status (three RCTs; moderate-certainty evidence), and may lead to little or no difference in child diet (two RCTs; low- certainty evidence). None of the studies reported the cost or cost-effectiveness of the intervention. Three studies assessed the adverse effects of the intervention on ECEC centre staff, children and parents, with all studies suggesting they have little to no difference in adverse effects (e.g. child

injury) between groups (three RCTs; low-certainty evidence). Inconsistent quality of the evidence was identified across review outcomes and study designs, ranging from very low to moderate.

The primary limitation of the review was the lack of conventional terminology in implementation science, which may have resulted in potentially relevant studies failing to be identified based on the search terms used.

Authors' conclusions

Current research suggests that implementation strategies probably improve the implementation of policies, practices or programmes by ECEC centres, and may have little or no effect on measures of adverse effects. However such strategies appear to have little to no impact on measures of child diet, physical activity or weight status.

INTRODUCTION

Description of the condition

Internationally, the prevalence of being overweight or obese has increased across every region of the world in recent decades (1). Currently, over 1.9 billion adults and 340 million children are overweight or obese (2). While obesity rates in high-income countries remain higher, prevalence rates in low and middle-income countries are accelerating (3). In Africa, for example, the prevalence of being overweight among children under five years is expected to increase from 4% in 1990 to 11% by 2025 (4). Excessive weight gain increases the risk of a variety of chronic health conditions. Between the years 2010 and 2030, up to 8.5 million cases of diabetes, 7.3 million cases of heart disease and stroke, and 669,000 cases of cancer attributable to obesity have been projected in the United States (U.S.) and United Kingdom (U.K.) alone (5). In Australia, between the years 2011 and 2050, 1.75 million lives and over 10 million premature years of life will be lost due to excessive weight gain (6).

Description of the intervention

Physical inactivity and poor diet are key drivers of excessive weight gain (7). As excessive weight gain in childhood tracks into adulthood, interventions targeting children's diet and physical activity have been recommended to mitigate the adverse health effects of obesity on the population (7). A recently published World Health Organization report into population-based approaches to childhood obesity prevention identified centre-based ECEC centres (including preschools, long daycare centres and kindergartens that provide educational and developmental activities for children prior to formal compulsory schooling) as an important setting for public health action to reduce the risk of unhealthy

weight gain in childhood (7). Such settings provide an opportunity to access large numbers of children for prolonged periods of time (7). Further, randomised and non-randomised studies have identified a number of interventions, delivered in ECEC centres, which have increased child physical activity and fundamental movement skill proficiency, improved child diet quality and prevented excessive weight gain (8-10). As such, regulations and best practice guidelines for the ECEC sector recommend implementation of a number of healthy eating and physical activity policies and practices, such as restricting sedentary screen time opportunities; ensuring meals provided by ECEC centres or foods packed by parents for consumption in care are consistent with dietary guidelines; and the provision of programmes to promote physical activity and fundamental movement skill development (11-13).

Despite the existence of evidence-based best-practice guidelines for ECEC centres, implementation of obesity prevention policies and practices that are consistent with such guidelines is poor (11, 14). In the U.S., a menu audit in 83 ECEC centres determined that the menus did not provide the recommended amount of carbohydrates, dietary fibre and iron, whilst providing excessive amounts of sodium (15). ECEC centre adherence to dietary guidelines in other countries has also been reported to be poor (16, 17). Similarly, adherence to best-practice recommendations for physical activity is also suboptimal. For example, only 14% of U.S. ECEC centres provided 120 minutes of active play per day, 57% to 60% did not have a written physical activity policy (11, 18), and in 18% of ECEC centres, children were seated for more than 30 minutes at a time (11). In Australia, it has been reported that just 58% of centre-based ECEC centres had written healthy eating and physical activity policies (14), and 60% of child lunch boxes contained more than one serving of high-fat, salt or sugar foods or drinks (19). Similarly in New Zealand, it has been reported that only 35% of ECEC centres had a written physical activity policy (20).

Without adequate implementation across the population of ECEC centres, the potential public health benefits of initiatives to improve healthy eating or physical activity, or prevent obesity, will not be fully realised. 'Implementation' is described as the use of strategies to adopt and integrate evidence-based health interventions and to change practice patterns within specific settings (21). Implementation research, specifically, is the study of strategies designed to integrate health policies, practices or programmes within specific settings (for example, primary care, community centres or ECEC centres) (22). The National Institute of Health recognises implementation research as a fundamental component of the third stage of the research translation process ('T3') and that it is a necessary prerequisite for research to yield public health improvements (21). While staff of centre-based ECEC centres are responsible for providing educational experiences and an environment supportive of healthy growth and development, including initiatives designed to reduce the risk of excessive weight gain, it may be the ECEC centres themselves, government or other agencies (such as

for licensing and accreditation requirements) that undertake strategies aimed at enhancing the implementation of such initiatives.

There are a range of potential strategies that can improve the likelihood of implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes in ECEC centres. The Cochrane Effective Practice and Organisation of Care (EPOC) taxonomy is a framework for characterising educational, behavioural, financial, regulatory and organisational interventions (23); it includes three categories with 22 subcategories within the topic of 'implementation strategies'. Examples of such subcategories include continuous quality improvement, educational materials, performance monitoring, local consensus processes, and educational outreach visits (23).

How the intervention might work

The determinants of policy and practice implementation are complex and the mechanisms by which support strategies facilitate implementation are not well understood. Implementation frameworks have identified a large number of factors operating at multiple macro and micro levels that can influence the success of implementation (24). However, few studies have been conducted in the ECEC setting to identify key determinants of implementation in this setting. A study by Wolfenden et al. of over 200 ECEC centres in Australia examined associations between the existence of healthy eating and physical activity policies and practices and 13 factors suggested by Damschroder's Consolidated Framework for Implementation Research to impede or promote implementation (14). The study reported that implementation policy and practice implementation was more likely when centre managers, management committee and parents were supportive, and where external resources to support implementation were accessible. Applied implementation frameworks, such as the Theoretical Domains Framework (25), suggest that strategies to facilitate implementation may be most likely to be effective with a thorough understanding of the local implementation context and barriers, and when theoretical frameworks are applied to select implementation support strategies to address key determinants of implementation. For example, knowledge barriers to implementation may be best overcome with education meetings or materials, while activity reminders, such as decision support systems, may be particularly important in instances where staff forgetfulness is identified as a local implementation barrier.

Why it is important to do this review

A number of large systematic reviews have been undertaken to assess the effectiveness of such implementation strategies in improving the professional practice of clinicians. For example, Ivers et al. reviewed the effectiveness of audit and feedback on the behaviour of health professionals and the health of their patients, and found such strategies generally resulted in small but important

improvements in professional practice (26). Other reviews have examined the impact of printed education materials (27), reminders (28), education meetings and workshops (29, 30) incentives (31), and other strategies on improving professional practice and implementation of evidence-based interventions by clinicians. Public health implementation research in nonclinical community settings, while still sparse (32), is emerging (33, 34). Systematic reviews of the effects of strategies to implement interventions targeting risks of chronic disease in settings such as workplaces (35), sporting clubs (36) and schools (37) report an acceleration in the number of published implementation studies over recent years. Such an increase is consistent with an increase in implementation research occurring more broadly in the field (38).

Similarly, our 2016 Cochrane systematic review examining the effects of implementation strategies in ECEC identified just 10 studies, providing low-certainty evidence. Since the conduct of this review, we are aware of a number of studies that are currently underway or have been completed (39-42). Given the current uncertainty of the existing evidence base, the importance of ECEC as a setting for health promotion, and the need among policy makers and practitioners for evidence-based implementation strategies for this setting, an update of the review is timely.

OBJECTIVES

The primary aim of the review was to examine the effectiveness of strategies aimed at improving the implementation of policies, practices or programmes by ECEC centres that promote child healthy eating, physical activity and/or obesity prevention.

The secondary aims of the review were to:

1. Examine the cost or cost-effectiveness of such strategies;
2. Examine any adverse effects of such strategies on ECEC centres, centre staff or children;
3. Examine the effect of such strategies on child diet, physical activity or weight status; and
4. Describe the acceptability, adoption, penetration, sustainability and appropriateness of such implementation strategies.

METHODS

Criteria for considering studies for this review

Types of studies

Any study (randomised, including cluster-randomised, or non-randomised) with a parallel control group that compared:

1. A strategy to improve the implementation of any healthy eating, physical activity or obesity prevention policy, practice or programme in centre-based ECEC centres compared with no intervention or 'usual' practice;
2. Two or more alternative strategies to improve the implementation of any healthy eating, physical activity or obesity prevention policy, practice or programme in centre-based ECEC centres.

There was no restriction on the length of the study follow-up period, language of publication or Country of origin.

Types of participants

Centre-based ECEC centres (and staff thereof) such as preschools, nurseries, long daycare centres and kindergartens that cater for children prior to compulsory schooling (typically up to the age of five to six years). We excluded studies of ECEC centres provided in the home and specialised daycare centres.

Types of interventions

Any strategy with the primary intent of improving the implementation of policies, practices or programmes in centre-based ECEC centres to promote healthy eating, physical activity or prevent unhealthy weight gain was eligible. To be eligible, strategies must have sought to improve the implementation of policies, practices or programmes by usual ECEC centre staff. Strategies could have included quality improvement initiatives, education and training, performance feedback, prompts and reminders, implementation resources, financial incentives, penalties, communication and social marketing strategies, professional networking, the use of opinion leaders, or implementation consensus processes. Interventions may have been singular or multi-component.

Types of outcome measures

Primary outcomes

We included any measure of either the completeness or the quality of the implementation of ECEC centre policies, practices or programmes (for example, the percentage of ECEC centres implementing a food service consistent with dietary guidelines or the mean number of physical activity practices implemented). To assess the review outcomes, data may have been collected from a variety of sources including educators, managers, cooks or other staff of centre-based ECEC centres; or administrators, officials or other health, education, government or non-government personnel responsible for encouraging or enforcing the implementation of health-promoting initiatives in ECEC centres. Such data may have been obtained from audits of centre records, questionnaires or surveys of staff, centre

managers, other personnel or parents; direct observation or recordings; examination of routine information collected from government departments (such as compliance with food standards or breaches of ECEC centre regulations) or other sources. Additionally, children, parents or ECEC centre staff may have provided information regarding child diet, physical activity or child weight status.

Secondary outcomes

1. Estimates of absolute costs or any assessment of the cost-effectiveness of strategies to improve the implementation of policies, practices or programmes in ECEC centres.
2. Any reported adverse consequences of a strategy to improve the implementation of policies, practices or programmes in ECEC centres. This could include impacts on child health (for example, an increase in child injury following the implementation of physical activity-promoting practices) or child development, centre operation or staff attitudes (for example, impacts on staff motivation or cohesion) or the displacement of other key programmes, curricula or practices.
3. Any measure of child diet, physical activity (including sedentary behaviours) or weight status. Such measures could be derived from any data source including direct observation, questionnaire, or anthropometric assessments. We excluded studies focusing on malnutrition/malnourishment.
4. Any measure of acceptability, adoption, penetration, sustainability and appropriateness of the implementation support strategy (43). Such measures are typically included in the experimental arm of the study only, that is, those exposed to an implementation strategy or intervention. As such, we reported within-group findings of these measures for completeness, to improve external validity and enable end-user assessments of potential utility of strategies to implement an evidence-based intervention. The definition of these outcomes were adapted, based on those defined by Proctor, to be as follows:
    - Acceptability: The perception among implementation stakeholders that a given policy, practice or programme or strategies to support its implementation is agreeable, palatable or satisfactory (43). Measures assessed at the individual or organisational level were included such a surveys of staff or managers of ECEC centres regarding their experience of features of the intervention or implementation strategy.
    - Penetration: The integration of a policy, practice or programme or strategies to support its implementation within a centre setting or its sub settings. Penetration could be measured from the perspective of the provider, centre or child individual. We included any measure of penetration at the individual or organisational level (43). For example, the proportion of eligible ECEC centres that received implementation support strategies, or the proportion of childrens' exposure to targeted intervention.
    - Adoption: The intention, including the initial decision, or action to try and implement a policy, practice or programme (43). Adoption could be measured from the perspective of the

provider or centre. These could include decisions by managers of ECEC centres to take up a potentially effective intervention, or decisions by individual ECEC staff to deliver potential intervention components.

- Sustainability: The extent to which a policy, practice or programme is maintained (43). Measures of sustainability must require successful implementation in part or in full, of an intervention, programme or centre that is then sustained for a period of at least six months. This could include the proportion of ECEC centres maintaining implementation of targeted policy practices or programmes 12 months following the provision of implementation support.
- Appropriateness: The perceived fit, relevance or compatibility of policy, practice or programme or strategies to support its implementation for a given setting, provider or consumer, and/or the perceived fit of the intervention to address a particular problem (43). Measures of appropriateness assessed at the individual or organisational level will be included, such as surveys of staff or managers of ECEC centres regarding their perception of the congruence of the implementation of a targeted policy, practice or programme with their skill set or work expectations.

Search methods for identification of studies

We conducted searches for peer-reviewed articles in electronic databases. We also undertook handsearching within relevant journals and reference lists of included studies.

Electronic searches

For this update, we conducted searches in the following electronic databases on February 22, 2019: the Cochrane Central Register of Controlled trials (CENTRAL) (2019) via Cochrane Library; MEDLINE (1946 to February 22, 2019), MEDLINE In Process (February 22, 2019), PsycINFO (1950 to February 22, 2019) and Embase (1947 to February 22, 2019) via OVID; ERIC (February 22, 2019) via Proquest; CINAHL (February 22, 2019) via EBSCO; and SCOPUS (February 22, 2019) via SCOPUS.

We adapted the MEDLINE search strategy for the other databases and we included filters used in other systematic reviews for population (ECEC centres) (44), physical activity (45), healthy eating (46), and obesity (47). A search filter for intervention type (implementation interventions) was based on previous reviews (48), and a glossary of terms in implementation and dissemination research (49). See Appendix 5.1 for the detailed search strategy.

Small amendments to the original search strategy were made to improve the sensitivity of the search, which was performed by an experienced librarian (DB). After removal of duplicates, citations were exported and managed in Covidence.

Searching other resources

We searched the reference lists of all included studies for citation of other potentially relevant studies. We conducted handsearches of all publications for the past three years in the journal Implementation Science and the Journal of Translational Behavioural Medicine, as they are the leading implementation journals in the field. Furthermore, we conducted searches of the World Health Organization International Clinical Trials Registry Platform (www.who.int/ictrp/) and ClinicalTrials.gov (www.clinicaltrials.gov). We included studies identified in such searches, which have not yet been published, in the 'Characteristics of ongoing studies' table (Appendix 5.2). We also made contact with the authors of included studies, experts in the field of implementation science and key organisations to identify any relevant ongoing or unpublished studies or grey literature publications.

Data collection and analysis

Selection of studies

Two review authors (from a pool of three authors: JJ, CB and MF) independently screened abstracts and titles. Review authors were not blind to the author or journal information. We conducted the screening of studies using a standardised screening tool developed based on the Cochrane Handbook for Systematic Reviews of Interventions (50), which we piloted before use. We obtained the full texts of manuscripts for all potentially eligible studies for further examination. For all studies, we recorded information regarding the primary reason for exclusion and documented this in the 'Characteristics of excluded studies' table (Appendix 5.3). We included the remaining eligible studies in the review. We resolved discrepancies between review authors regarding study eligibility by consensus. In instances where the study eligibility could not be resolved via consensus, a third review author made a decision.

Data extraction and management

Two review authors (from a pool of five authors: JJ, MF, RW, AG and CB), unblinded to author and journal information, independently extracted information from the included studies. We recorded the information extracted from the included studies in a data extraction form that we developed based on the recommendations of the Cochrane Public Health Group Guide for Developing a Cochrane Protocol (51). We piloted the data extraction form before the initiation of the review. We resolved data extraction discrepancies between review authors by consensus and, where required, via a third review author.

We extracted the following information:

1. Study eligibility as well as the study design, date of publication, ECEC centre type, country, the demographic/ socioeconomic characteristics of centres and participants, the number of experimental conditions, and information to undertake an assessment of study risk of bias.
2. Characteristics of the implementation strategy, including the duration, number of contacts, description of implementation strategies, theoretical underpinning of the strategy (if noted in the study), information to allow classification against the EPOC taxonomy (Table 5.1), and to enable an assessment of the overall quality of evidence using the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) approach, as well as data describing consistency of the execution of the intervention with a planned delivery protocol.
3. Study primary and secondary outcomes, including the data collection method, validity of measures used, effect size and measures of outcome variability.
4. Source(s) of research funding and potential conflicts of interest.

Assessment of risk of bias in included studies

Overall risk of bias

Within each included study two review authors (MK and FT) assessed risk of bias independently for each review outcome using the 'Risk of Bias' tool described in the Cochrane Handbook for Systematic Reviews of Interventions (52). We determined an overall risk of bias ('high', 'low' or 'unclear') for individual studies and outcomes. For each included study, we assessed risk of bias as 'high', 'low' or 'unclear' for the following domains: sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective outcome reporting, and 'other' potential sources of bias. We included an additional domain 'potential confounding' to assess the risk of bias in non-randomised trial designs (52). Confounding was defined as the risk that an ‘unmeasured characteristic' shared by those allocated to receive the implementation intervention (or implementation strategy), rather than the intervention itself, was responsible for reported outcomes (53). We also included additional domains for cluster-randomised controlled trials (RCT), which assessed 'recruitment to cluster', 'baseline imbalance', 'loss of clusters', 'incorrect analysis' and 'compatibility with individually randomised controlled trials' (52). Where required, a third review author adjudicated discrepancies regarding the risk of bias that could not be resolved via consensus (LW). We documented the risk of bias of the included studies in 'Risk of Bias' tables (Appendix 5.4).

We made an overall 'Risk of bias' assessment for an outcome within a study (across domains). As the nature of the experimental manipulations of studies of implementation strategies is such that blinding of participants and personnel is unlikely to be possible, we classified outcomes within a study as at an

overall 'high risk' when the study was judged to be at high risk of bias for that outcome on more than one of the following: sequence generation (selection bias), allocation sequence concealment (selection bias), incomplete outcome data (attrition bias), and, in instances where self-report measures of outcome were employed, blinding of outcome assessment. We assigned a low risk of bias to a study when the study was judged to be at low risk of bias for a study outcome on all key criteria.

We also assessed risk of bias for an outcome across studies. Consistent with other Cochrane reviews of public health interventions (54), we judged an outcome as i) low risk if most information for the outcome was generated from studies at low risk of bias ii) unclear risk of bias if most information was from studies at low or unclear risk of bias; or iii) high risk of bias if the proportion of information from studies at high risk of bias was sufficient to affect the interpretation of results.

Measures of treatment effect

We were able to undertake meta-analysis for implementation outcomes given there was a sufficient number of studies considered suitably homogenous. For binary outcomes, we calculated the standard estimation of the risk ratio (Odds ratio) and a 95% confidence interval. For continuous data, we calculated a standardised mean difference (SMD), given use of different continuous outcome measures reported in the included studies. We interpreted the magnitude of effect size using the benchmarks suggested by Cohen, considering an SMD of 0.2 a small effect; 0.5 a medium effect; and 0.8 a large effect (55). We have described all other secondary outcomes narratively.

Unit of analysis issues

Clustered studies

We examined clustered studies for unit of analysis errors and recorded these if they occurred in the 'Risk of Bias' tables. No studies included in meta-analysis of implementation outcomes used clustered designs. These designs, however, were utilised in the assessment of individual level child outcomes such as measures of effect on child diet or physical activity.

Dealing with missing data

We contacted authors of included studies to provide additional information if any outcome data were unclear or missing. All information received was included in the results of the review. We noted any instances of potential selective or incomplete reporting of outcome data in the 'Risk of Bias' tables. We performed meta-analysis using an intention-to-treat principle. Missing data did not preclude inclusion of any studies in meta-analysis, and as such, the potential impact of missing data on the pooled estimates of intervention effects were not investigated in sensitivity analysis.

Assessment of heterogeneity

For studies included in meta-analysis, we explored heterogeneity via forest plots and the I^2 statistic (50). We described study participants, intervention, outcomes, and comparators of all included studies in the results and documented such information in the 'Characteristics of included studies' table (Appendix 5.4).

Assessment of reporting biases

The comprehensive search strategy for this review helped to reduce the risk of reporting bias. We also conducted comparisons between published reports and study protocols, and trial registers, where such reports were available. Instances of potential reporting bias were documented in the 'Risk of Bias' tables.

Data synthesis

Two authors (CB, LW) were responsible for entering data into Review Manager 5 (RevMan 5) software. Where studies with suitable data were identified, we performed meta-analysis using a random-effects model in RevMan 5. Meta-analysis was undertaken using the generic inverse variance method. We did not pool data from randomised and non-randomised trial designs. Similarly, we did not attempt to pool data from non-randomised studies of different study designs. We reported measures of treatment effect from included studies that were adjusted for potential confounding variables over reported estimates that were not adjusted for potential confounding. Where studies used multiple follow-up periods, we used data from the final (most recent) study follow-up. We included data from the primary implementation outcome in meta-analyses. In instances where the authors of included studies did not identify a primary implementation outcome, we used the outcome on which the study sample size and power calculation was based. In its absence, for studies using score-based measures of implementation, and reporting total and subscale scores, we assumed the total score represented the primary implementation outcome. Otherwise, we attempted to calculate a relative effect size for each implementation outcome measure, rank these based on effect size and used the measure reporting the median effect size to include in any pooled analysis. We calculated the effect size by subtracting the change from baseline of the primary implementation outcome for the control or comparison group from the change from baseline in the experimental or intervention group. If data to enable calculation of the change from baseline were unavailable, we used the differences between groups post-intervention. For score-based measures, we calculated a standardised ('d') measure of effect size for each outcome to rank the effect size. Where there were an even number of implementation outcomes, one of the two measures at the median was randomly selected and used for inclusion in meta-analysis. We reverse scored implementation measures that did not represent an improvement (for example, the proportion of centres without a nutrition policy).

We synthesised findings by outcome, and within the study, synthesised effects by comparison. We included a 'Summary of intervention, measures and absolute intervention effect size table', where we reported the employed implementation strategies classified using the EPOC taxonomy (23), the comparison, the primary implementation outcome measures, the effect sizes on these measures (or median effect size and range of effects where multiple measures of the same outcome are reported) for each study (Table 5.2).

We included a 'Summary of findings' table to present the key findings of the review (Summary of findings for the main comparison) (Table 5.3). We generated the table based on the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions and the EPOC Group and included i) a list of all primary and secondary outcomes in the review, ii) a description of intervention effect, iii) the number of participants and studies addressing each outcome, and iv) a grade for the overall quality of the body of evidence for each outcome. In particular, the table provides key information concerning the quality of evidence, the magnitude of the effect of the interventions examined, and the sum of available data on the main outcomes. 'Summary of findings' tables were produced using data from RCTs only as the included non-randomised trials did not provide greater certainty evidence, nor did they include outcomes that were not also reported in included RCTs. Similarly, 'Summary of findings' tables were produced for studies reporting the effects of interventions versus usual care or a minimal support comparison group, as this was considered of primary interest to end-users.

Two review authors (CB, RH) rated the overall quality of evidence for each outcome using the GRADE system (56), with any disagreements resolved via consensus or, where required, by a third review author (LW). The GRADE system defines the quality of the body of evidence for each review outcome regarding the extent to which one can be confident in the review findings. The GRADE system required an assessment of methodological quality, directness of evidence, heterogeneity, precision of effect estimates, and risk of publication bias. We used the GRADE quality ratings (from 'very low' to 'high') to describe the quality of the body of evidence for each review outcome and we included these in 'Summary of findings for the main comparison'. We assessed the quality of evidence separately for randomised and non-randomised trials. Where there were multiple measures of the same outcome, we assessed the quality of evidence for each measure separately. In such instances, we selected the measure of the outcome with the greatest collective (across study) sample size to present in the 'Summary of findings' tables to represent the GRADE assessment of that outcome. However, we also noted the GRADE assessments of other measures of the outcome as comments in the 'Summary of findings' table for completeness.

Subgroup analysis and investigation of heterogeneity

In the published protocol (57), subgroup analyses and box plots were planned to explore heterogeneity if the I^2 value was greater than 75%. As measures of heterogeneity did not reach this threshold, subgroup analyses were not undertaken. Nonetheless, clinical and methodological heterogeneity of included studies was described narratively. To describe the impact of implementation strategies delivered 'at scale' (defined as involving 50 or more ECEC centres), we performed subgroup analyses narratively for the primary implementation outcomes. Specifically, this was undertaken for included studies that sought to improve implementation of policies, practices or programmes across 50 or more centres.

Sensitivity analysis

Sensitivity analysis was planned by removing studies with a high risk of bias and by removing outliers contributing to statistical heterogeneity following visual inspection of the forest plots (i.e. where the confidence intervals of a study did not overlap with other included studies). However, none of the studies included in meta-analysis were judged to be at high risk of bias, nor were outliers identified following inspection of forest plots.

RESULTS

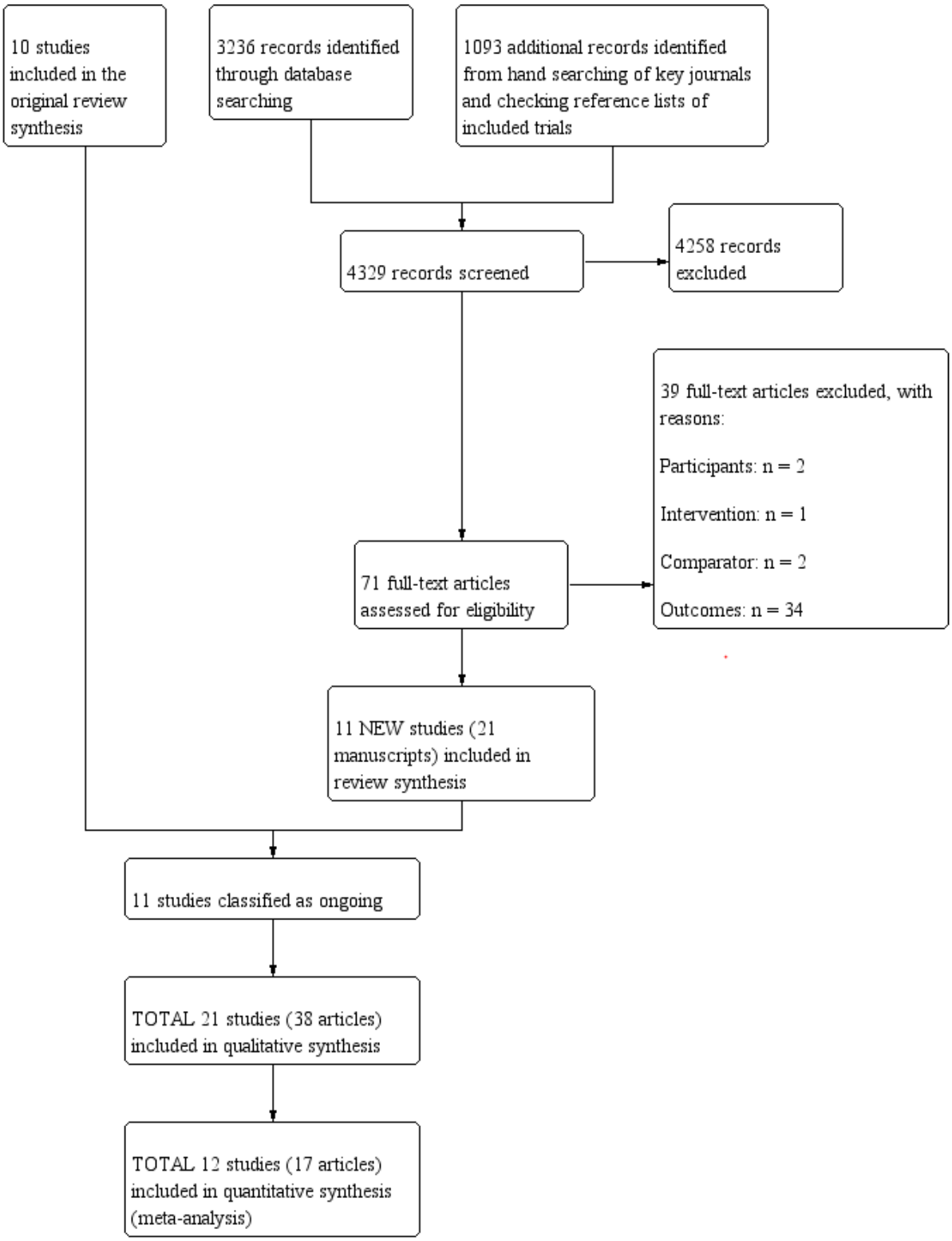
Description of studies

See Appendices 5.2 to 5.4.

Results of the search

The electronic search for this update, conducted on 22 February 2019, yielded 3236 citations (Figure 1). We identified an additional 1093 records from handsearching key journals and checking reference lists of included studies. We identified no additional records through our contact with the authors of included studies, experts in the field of implementation science and key organisations. Following screening of titles and abstracts, we obtained the full texts of 71 manuscripts for further review, of which we included as part of this update 21 manuscripts describing 11 individual studies. We contacted the authors of four included studies to provide additional information where any outcome data were unclear or missing. All information received by authors was included in the results of the review. As 10 studies were included in the original version of this review (58-67) this update brought the total number of included studies to 21 studies. Additionally, 11 studies were identified as ongoing studies through searches of clinical trial registration databases that have not yet been published.

Figure 5.1 Study flow diagram



Included studies

Types of studies

The included studies were predominantly conducted in the U.S. (n = 12) (41, 42, 58, 60, 63, 66-73) and Australia (n = 8) (39, 59, 61, 62, 64, 74-76), but there was also one study from Ireland (65). Studies were conducted between 1995 and 2018, although two studies did not report the years of data collection (60, 63). There was evidence of some heterogeneity in the participants, interventions, outcomes and study design characteristics of included studies. All but one included study (73) reported receiving funding support to undertake the study. Funding support for such studies were from government or charitable foundations. No industry funding was reported.

Participants

Of the 21 included studies, 15 recruited ECEC centres located in disadvantaged areas or specifically serving disadvantaged, low-income or minority children (41, 42, 58, 59, 61-63, 65, 67-72, 74, 75). The socioeconomic characteristics of the centre locality or children attending the ECEC centres were not described in the remaining six studies. The number of ECEC centres participating in the studies included in the review varied. The largest study recruited 583 ECEC centres (preschools) (59), and a further eight studies sought to improve implementation of policies, practices or programmes in 50 or more centres (39, 61, 65, 66, 68, 71, 74-76). Six studies recruited between nine and 20 centres (58, 60, 62, 63, 67, 70). Twelve of the 21 included studies were conducted in high-income countries by two research groups in the U.S. and Australia (39, 42, 58-62, 66, 73-76).

Interventions

Six studies targeted the implementation of healthy eating policies or practices only (42, 59, 67, 70, 75, 76), three targeted the implementation of physical activity policies and practices only (61, 62, 73), and 12 targeted both healthy eating and physical activity policies and practices (39, 41, 58, 60, 63-66, 68, 69, 71, 72, 74).

All studies used multiple implementation strategies, with the exception of one study (76). The strategies tested across studies examined only a small number of those described in the EPOC taxonomy that could be applied to improve implementation in the setting. The definitions of each of the EPOC subcategories used to classify implementation strategies employed by studies included in the review are provided in Table 5.1. Using the EPOC taxonomy descriptors for tested implementation strategies, 17 of the 21 studies tested educational meetings and educational materials (41, 42, 58-67, 69, 70, 73-75). The remaining studies testing educational meetings and educational materials in combination with other strategies such as audit and feedback (41, 42, 58, 59, 65, 74, 75),

educational outreach visits or academic detailing (41, 60, 63, 64, 66, 73-75), small incentives (41, 63, 64, 67) or opinion leaders (39, 59, 61, 75).

Twelve studies reported that strategies to support implementation were theoretically based (39, 59, 60, 62, 66, 69, 70, 72-76). The theories adopted in these studies included components of social cognitive theory (60, 66, 72, 73), practice change and capacity building theoretical frameworks (59), theory of planned behaviour (76), consolidated framework for implementation research (39, 74), theoretical domains framework (75) and social-ecological models of health behaviour change (62, 69, 70).

Intervention duration for the included studies ranged from six to eight weeks (76) to three years (67). The duration of the majority of interventions were six to 12 months (39, 41, 58, 60, 62, 63, 66, 68, 69, 71, 74, 75) and four studies had a duration of longer than 12 months (59, 67, 70, 72).

Table 5.1 Definition of EPOC subcategories utilised in the review

EPOC subcategory	Definition
Educational materials	Distribution to individuals, or groups, of educational materials to support clinical care, i.e. any intervention in which knowledge is distributed. For example, this may be facilitated by the internet, learning critical appraisal skills; skills for electronic retrieval of information, diagnostic formulation; question formulation.
Educational meetings	Courses, workshops, conferences or other educational meetings.
Educational outreach visits or academic detailing	Personal visits by a trained person to health workers in their own settings, to provide information with the aim of changing practice.
Small incentives or grants	Transfer of money or material goods to healthcare providers conditional on taking a measurable action or achieving a predetermined performance target, for example incentives for lay health workers.
Audit and feedback	A summary of health workers' performance over a specified period of time, given to them in a written, electronic or verbal format; the summary may include recommendations for clinical action.
Opinion leaders	The identification and use of identifiable local opinion leaders to promote good clinical practice.
Tailored interventions	Interventions to change practice that are selected based on an assessment of barriers to change, for example, through interviews or surveys.
Reminders	Manual or computerised interventions that prompt health workers to perform an action during a consultation with a patient, for example, computer decision support systems.
Local opinion leaders	The identification and use of identifiable local opinion leaders to promote good clinical practice.
Local consensus processes	Formal or informal local consensus processes, for example, agreeing a clinical protocol to manage a patient group, adapting a guideline for a local health system or promoting the implementation of guidelines.
Clinical Practice Guidelines	Clinical guidelines are systematically developed statements to assist healthcare providers and patients to decide on appropriate healthcare for specific clinical circumstances (U.S. IOM).

Outcomes

A variety of implementation outcome measures were used to assess the implementation strategies across included studies. Nineteen studies included continuous measures of implementation outcomes including policy or environment scores (39, 42, 58, 60, 65, 66, 68, 69, 71-75), minutes of policy or programme implementation (61, 62, 64), frequency of policy or programme implementation (62, 64), or quantity of food or beverages or macronutrients provided to children (59, 67, 70, 76).

Eleven studies reported a dichotomous measure of implementation, each of which reported the percentage of staff or ECEC centres that implemented a policy, practice or programme (39, 41, 58, 59, 61-64, 68, 71, 74, 75). Implementation was primarily assessed using telephone interviews or surveys/questionnaires completed by ECEC centre staff (39, 42, 59-61, 63, 64, 72-76), audits of centre documents conducted by researchers (59, 67, 75) or by direct observation (41, 58, 62, 65, 66, 68-71).

The validity of six of the ten studies utilising survey/questionnaire based instruments to assess implementation was not reported (39, 59, 61, 63, 64, 72). Outcome assessments were conducted at various time points following intervention completion. Four studies conducted outcome assessments immediately following intervention completion (70, 73-75), whilst other studies included follow-up assessments of five months (64) to four years following intervention completion (65).

Nine studies included child behavioural or weight-related outcomes (41, 58, 62, 67, 69, 72-75). Of the nine studies, four measured child diet (67, 72, 74, 75), five measured child physical activity (58, 62, 72-74) and five measured child weight status (41, 58, 67, 69, 72). Three of the 21 included studies reported on potential adverse effect outcomes, which included negative feedback received by the ECEC centre (75) and occurrence of child injury (62, 74). Eight studies included a measure of acceptability (39, 42, 60-62, 64, 73, 74), and 12 studies measured penetration of the intervention and implementation strategies (41, 58, 61-66, 73-76). None of the 21 studies reported intervention costs or cost-effectiveness analyses.

Study design characteristics

Sixteen of the included studies were RCTs trials (or cluster-RCTs) (39, 41, 42, 58, 60, 62-66, 69, 70, 73-76), and five were non-randomised trials with a parallel control group (59, 61, 67, 68, 71, 72).

Nineteen studies compared an implementation strategy to usual practice or minimal support control (39, 41, 42, 58-62, 64, 66-76). Two studies directly compared two different implementation strategies (63, 65).

Excluded studies

Thirty-nine studies were excluded following review of 71 full texts (Figure 1) for the following reasons: participants n = 2; intervention n = 1; comparator n = 2; outcomes n = 34. We excluded a study based on 'inappropriate outcomes' if it: did not measure implementation outcomes, did not measure implementation outcomes for both intervention and control groups, or did not measure between-group differences in implementation outcomes.

Risk of bias in included studies

See Characteristics of included studies in Appendix 5.4.

For the primary implementation outcomes, 'Risk of bias' assessment for each criterion for each study is presented in Figure 2 and summarised within the Characteristics of included studies tables. Figure 3 illustrates the overall risk of bias of each study for primary implementation outcomes (across all domains). 'Risk of bias' assessments are described in detail below. Risk of bias assessments for secondary outcomes of each study are presented in Appendix 5.6.

Figure 5.2 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study

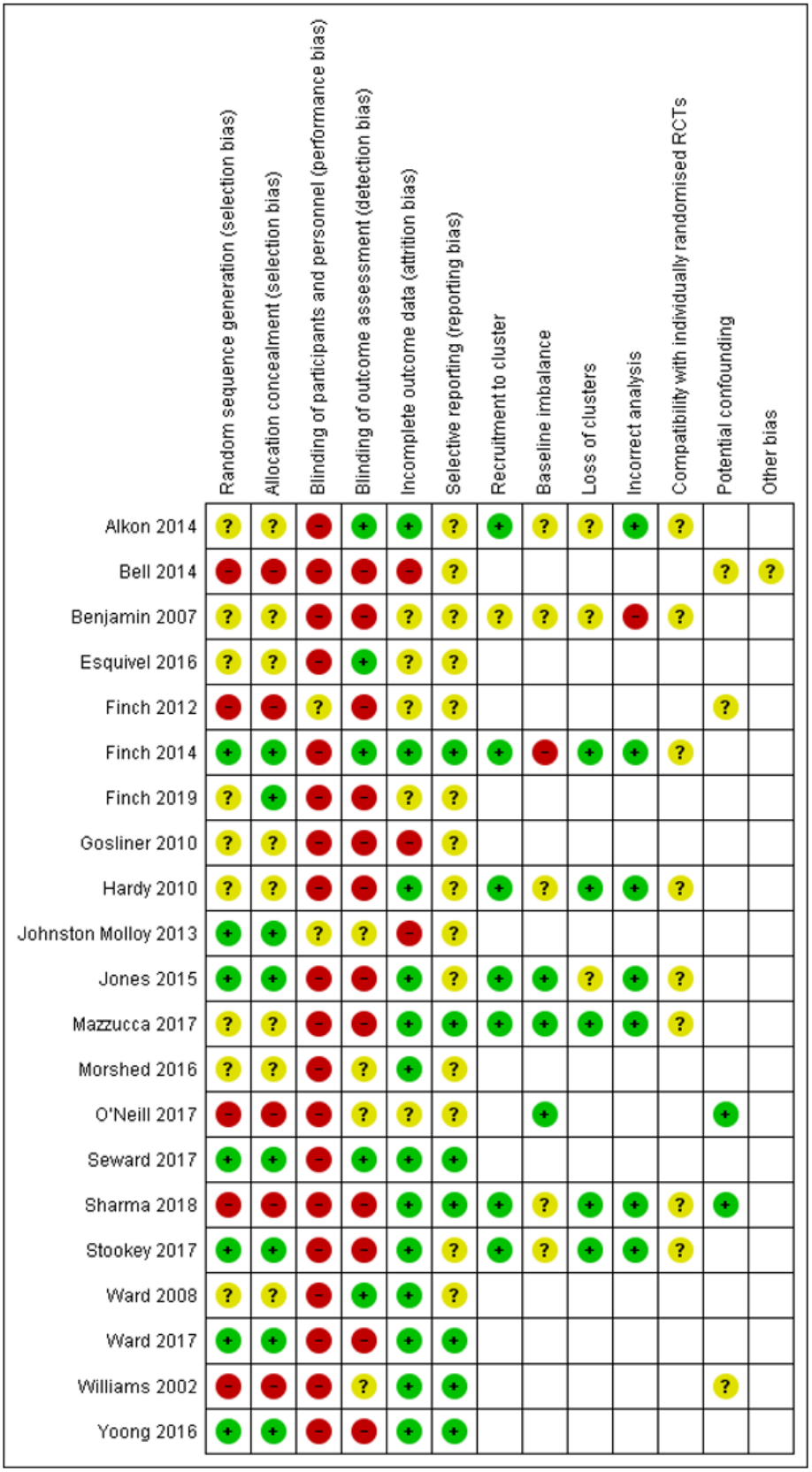
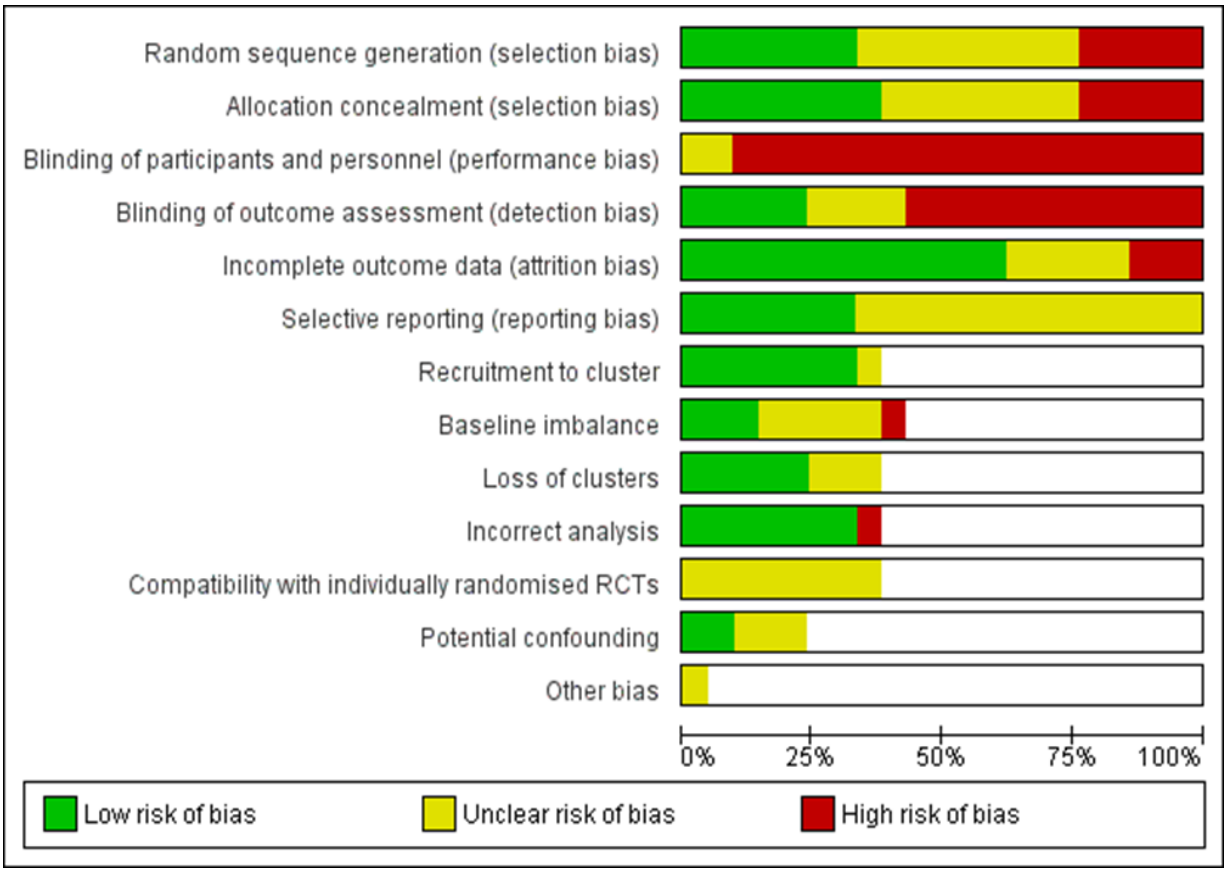


Figure 5.3 'Risk of bias graph': review authors' judgements about each risk of bias item presented as percentages across all included studies



Allocation

Risk of selection bias differed across studies. Seven studies were low risk as computerised random number functions or tables were used to generate random sequences and allocation was undertaken automatically in a single batch, preventing allocation from being pre-empted (41, 42, 62, 65, 74-76). While the study conducted by Finch et al. (39) also undertook these procedures, participating centres were removed following randomisation and it is unclear whether this affected the randomisation. For the five studies with non-randomised designs, the risk of selection bias was high (59, 61, 67, 68, 71, 72). For the remaining eight studies, such bias was unclear as these studies did not report on methods for sequence generation or allocation.

Blinding

For almost all studies (n = 19), the risk of performance bias was high due to participants and research personnel not being blind to group allocation. For the remaining two studies, the risk of performance bias was unclear as in both studies the control group also received some form of intervention (61, 65). Detection bias differed across studies based on whether outcome measures were objective (low risk) or self-reported (high risk), and whether research personnel were blind to group allocation when

conducting outcome assessment (low risk). For five studies, the risk of detection bias was low (58, 62, 66, 69, 75). For the remainder of the studies, the risk of detection bias was either high (n = 12) or unclear (n = 4) due to insufficient information on whether data collection staff were blind to group allocation.

Incomplete outcome data

For just over half the studies (n = 13), the risk of attrition bias was low as either all or most participating centres were followed up and/or sensitivity analysis was conducted to assess the impact of missing data (41, 42, 58, 62, 64, 66, 67, 70, 72-76). For two studies, the risk of such bias was high due to a large difference in the proportion of participating centres lost to follow-up between groups (59, 65). Risk of attrition bias was also high for the study conducted by Gosliner et al., as participants who did not complete the intervention were excluded from the analysis (63). For the remaining studies, the risk of attrition bias was unclear as insufficient information was provided regarding the treatment of missing data.

Selective reporting

For fourteen studies, a published protocol paper or trial registration record was not identified and therefore it was unclear whether reporting bias had occurred. For seven studies, the risk of reporting bias was low as protocol papers were available and all a priori determined outcomes were reported (42, 62, 67, 72, 73, 75, 76). For the study conducted by Esquivel et al., risk of reporting bias was also unclear as there were secondary outcomes listed in a protocol paper that did not appear to have been reported (69).

Other potential sources of bias

For the eight studies that were cluster-RCTs, we assessed the potential risk of additional biases (41, 58, 62, 64, 68, 72-74).

For the potential risk of recruitment (to cluster) bias, seven studies were low risk as either a random or census approach was used for recruitment (41, 58, 62, 64, 72-74). For the remaining study (60), it was unclear if such bias existed due to insufficient detail regarding participant recruitment. Regarding risk of bias due to baseline imbalances, for five studies the risk was unclear (41, 58, 60, 64, 72). One study was at high risk due to baseline imbalances in centre characteristics, with no mention of adjustments within the analysis (62) and two studies were at low risk due to no baseline imbalances (73, 74).

Five studies were at low risk for loss of clusters as either all children were followed up or there was no loss of clusters (41, 62, 64, 72, 73). For two studies, risk of bias was unclear due to insufficient information regarding the treatment of clusters that were lost and the impact of this loss (58, 60). For

the study conducted by Jones et al., risk of bias was also unclear as follow-up data were only collected from a random sample of clusters (74).

For risk of bias due to incorrect analysis, almost all studies (n =7) were low risk (41, 58, 62, 64, 72-74), while the remaining study was high risk as no statistical analysis was undertaken due to the small sample size (60).

For all eight cluster-RCTs, risk of bias in regards to compatibility with individually RCTs was unable to be determined (41, 58, 60, 62, 64, 72-74).

For the five studies with non-randomised designs (59, 61, 67, 68, 71, 72), we also considered the potential risk of bias due to confounding factors. For three studies (59, 61, 67), it was unclear whether confounders were adjusted for. For the remaining two studies (68, 71, 72), known confounders were adequately adjusted for in the outcome analysis.

Risk of bias for an outcome within a study (across domains)

For implementation outcomes, six studies were judged to be at overall high risk of bias (59, 61, 63, 67, 68, 71) and two at low risk of bias (62, 75). The remaining 13 studies were judged to be at an unclear overall risk of bias. Of the five studies reporting physical activity outcomes, one study was at overall high risk (72), two at low risk (62, 74) and the remaining at unclear risk of bias (58, 73). Of the four studies reporting dietary intake outcomes, two were at low risk of bias (74, 75) and two were at high risk of bias (67, 72). Of studies reporting measures of child weight status, one study was judged to be at high risk of bias (67), three studies (58, 69, 72) were judged to be at unclear risk of bias and one study (41) was judged as at low risk of bias for those outcomes. Finally, all three studies reporting adverse events were judged to be at unclear risk of bias for those outcomes (62, 74, 75).

Risk of bias for an outcome across studies

Across included studies, implementation outcomes, physical activity outcomes, weight status outcomes and adverse outcomes were assessed as being at unclear risk of bias, while dietary intake outcomes were assessed as being at high risk of bias.

EFFECTS OF INTERVENTIONS

Studies comparing a strategy to improve the implementation of any healthy eating, physical activity or obesity prevention policy, practice or programme in centre-based ECEC centres compared with no intervention, 'usual' practice or minimal support control

Continuous outcomes

Score-based measures of implementation

Score-based measures of implementation were the most common continuous outcomes in studies comparing an implementation strategy with usual practice or minimal support control and were reported in 11 studies including nine RCTs. Pooled analysis providing moderate-certainty evidence including all nine RCTs with score-based measures of implementation (39, 42, 58, 60, 66, 69, 73-75) reported an improvement (SMD 0.49; 95% CI 0.19 to 0.79; I2 = 54%; P < 0.001; participants = 495 centres; equivalent to a mean difference of 0.88 on the Environment and Policy Assessment and Observation (EPAO) scale) favouring groups receiving implementation support strategies (Appendix 5.5). Visual inspection of funnel plots suggested the potential for publication bias. Sensitivity analysis was not performed as none of the RCTs contributing to the meta-analysis were assessed as being at high risk of bias for these outcomes. As an I2 value greater than 75% was set in the protocol a priori as the threshold for investigating heterogeneity, and owing to the relatively small number of included trials in the pooled analysis, statistical heterogeneity was not explored quantitatively.

The two non-randomised trials using score-based measures of implementation both reported positive improvements in implementation (68, 71, 72) (participants = 79 ECEC centres, two studies, very low-certainty evidence). The first, a non-randomised trial conducted in the U.S. by Neelon and O'Neill in 2017, evaluated the impact of the introduction of new physical activity standards on ECEC centres physical activity practices in a sample of 34 South Carolina ECEC centres, where it was mandatory, in comparison to 30 centres located in North Carolina - a state not making such policy changes (68, 71). The EPAO tool was used by trained researchers to assess physical activity practices and environments prior to and nine months following implementation of the standards. Within South Carolina centres, where the mandatory standards were introduced, the total Physical Activity Environment Score increased from 8.6 (standard error, 0.3) to 9.7 (standard error, 0.3) from baseline to follow-up while increasing marginally from 8.9 (standard error, 0.4) to 9.1 (standard error, 0.4) in North Carolina centres (P = 0.06) (68, 71).

The second, a non-randomised trial undertaken in the U.S. in 25 ECEC centres, examined the impact of an implementation strategy comprised of educational meetings, reminders and academic detailing

to improve the implementation of a classroom nutrition curriculum, structured physical activities and distribution of health information to families (72). A score-based measure (a per cent implementation index) using data collected from teacher surveys was used to assess improvement in programme implementation. The study reported improvements in implementation favouring centres allocated to receive an implementation strategy (mean difference 15.17, P = 0.002).

Time or frequency-based measures

Three studies reported minutes of policy or programme implementation (61, 62, 64) or frequency of policy or programme implementation (62, 64) (low-certainty evidence), the findings of which were mixed.

Two of the three studies were RCTs (participants = 49 centres, two studies, low-certainty evidence). The first, undertaken by Hardy et al. was a cluster-RCT evaluating the *Munch & Move* programme in one state of Australia (New South Wales) (64). All 61 government centres (preschools) in the study region were invited to participate in the trial, of which 29 consented and were randomised. Centres allocated to the implementation support group received educational materials, educational meetings, educational outreach visits and small grants to implement the programme. Those in the comparison group received usual care. To assess policy and practice implementation, interviews with all centre managers occurred at baseline and immediately following the five-month intervention. The frequency of centre provided in fundamental movement skill activities for children increased from 1.3 sessions per week to 3.2 sessions per week in the intervention group and remained unchanged in control centres (difference at follow-up of 1.5, 95% CI 0.01 to 2.9, P = 0.05). There were no meaningful differences between groups in the frequency of structured play sessions per week (adjusted difference 0.02, 95% CI -1.5 to 1.5), unstructured play sessions per week (adjusted difference not reported), minutes per session of structured play (adjusted difference 0.09, 95% CI -11.6 to 11.8), unstructured play (adjusted difference 7.7, 95% CI -15.6 to 31.0) and fundamental movement skill sessions (adjusted difference 3.4, 95% CI -9.7 to 16.5). The effect sizes for differences between groups on any of the four measures of healthy eating policy or practice implementation including food-based activities, rules around food and food policies were not presented, although authors states these were non-significant.

The second, by Finch et al., was an RCT with 20 centre-based ECEC centres in New South Wales, Australia (62). The intervention primarily sought to determine the effectiveness of a physical activity intervention, implemented by ECEC centre staff on the physical activity levels of children attending ECEC. Secondary outcomes included assessment of the effectiveness of implementation strategies and the impact of the intervention on rates of child injury. The trial reported a difference between groups (P < 0.02) in time spent in structured physical activities (intervention centres increased from

23.67 (SD ± 6.03) minutes at baseline to 52.40 (SD ± 45.29) minutes at follow-up; control centres decreased from 37.80 (SD ± 13.33) at baseline to 27.00 (SD ± 1.41) at follow-up). There were at times large differences between groups in the number of occasions of fundamental movement skill development activity sessions (intervention +0.8 sessions, control +0.2 sessions), the number of times staff participated in active play (intervention +1.4 times, control -1.6 times); or the number of times staff provided positive statements about physical activity (intervention +1.7 times, control -10.4 times), although the effects were uncertain as confidence intervals crossed the line of no effect (P = 0.07 to 0.08). The difference between groups in nine other measures of policy and practice implementation including: total minutes of fundamental movement skill development activity sessions, number of times staff prompted physical activity, total minutes of television viewing, total minutes of seated time, or the number of physical activity-promoting resources or equipment were small and uncertain.

The final study, a non-randomised trial (participants = 392 centres, one study, very low-certainty evidence) examined a strategy to increase implementation of physical activity-promoting policies and practices in centre-based ECEC centres (61). All centres located within the Hunter New England geographic area of New South Wales, Australia (n = 338) were invited to participate in the intervention and received support to implement a number of policies and practices to promote child physical activity in care. A 10% sample of centres in the rest of the state (n = 268) were randomly selected to serve as a comparison group. Centres in the comparison region had the opportunity to receive government support to implement *Munch & Move* (described above), a programme targeting similar policies and practices but utilising a less intensive series of implementation support (64). Implementation of physical activity practices was assessed at baseline and between eight and 12 months post-intervention via a telephone interview administered to centre managers. At follow-up there was no clear difference between groups in time spent in structured physical activities (intervention +0.2 hours, control +0.1 hours, P = 0.65).

Quantity of food measures

Five studies reported quantity of food or beverages or macronutrients provided to children as implementation outcomes (58, 59, 67, 70, 76), the findings of which were mixed.

Three of these studies were RCTs (participants = 171 centres, three studies, low-certainty evidence). Morshed et al. conducted an RCT of 16 Head Start ECEC centres in American Indian and predominantly Hispanic communities in rural New Mexico (70). Centres allocated to receive implementation support were provided with education materials including eight nutrition curriculum modules intended for implementation over two school years and educational meetings for food service staff occurring quarterly and aimed at supporting policy and behavioural changes to food purchasing

and menus. Specifically, ECEC centre staff were supported to implement a range of practices including increasing structured physical activity time, providing opportunities for children to try new fruits and vegetables, and increasing the variety of fruits, vegetables, whole grain foods and low-fat dairy products served to children. Centres allocated to the control followed usual classroom activities and did not receive any implementation support from the research team. Data were collected prior to, and immediately following, the two-year implementation period via weighing foods served to children by research staff at participating centres. The intervention decreased fat provided through milk (change relative to control = 0.82; 95% CI 0.71 to 0.94, P value not reported). There was little difference between group servings of fruit, vegetables, wholegrain servings, discretionary fats, and added sugar, with estimates of change in the group allocated to receive implementation support relative to control ranging from 0.94 (95% CI 0.65 to 1.37) to 1.09 (95% CI 0.92 to 1.30) across these measures.

An RCT by Alkon et al. assessed the impact of an implementation strategy including educational materials, educational meetings and audit and feedback on the types and portions of all foods and beverages served to children in ECEC centres (58). Assessments were conducted by direct observations conducted by researchers using the Diet Observation in Child Care (DOCC) tool, a validated instrument (58). At follow-up, there was considerable variation between groups on 10 measures of the portions of foods and beverages offered to children at meals and snack time (range -2.7% to 133%).

In an RCT of 77 ECEC centres, Yoong et al. investigated the impact of providing printed educational materials on ECEC centre cooks provision of fruit and vegetables on their food service menu (76). The educational materials included a mailed two-page education resource and the menu planning checklist and incorporated coloured visuals outlining recommended serving sizes (endorsed by a reputable health promotion organisation). Outcome data assessing servings of fruit and vegetables provided on menus were collected via a telephone interview with ECEC centre cooks. At follow-up, both centres allocated to receive implementation support and those that were not reported providing a mean of 2.9 servings of vegetables on their menus. The mean servings of fruit was higher among centres receiving implementation support at follow-up (mean = 3.8, SD = 1.1) compared to the comparison group (mean = 3.3, SD = 0.8; P = 0.057).

The two non-randomised trials provided very low-certainty evidence regarding the effects of implementation strategies on measures of food provision (participants = 440 centres, two studies, very low-certainty evidence). In Australia, Bell et al. conducted a non-randomised trial to determine the impact of an implementation intervention to improve healthy eating policies and practices in centre-based ECEC centres (59). All centres in one geographic region of the state of New South Wales, Australia (Hunter, New England) were offered the intervention (n = 287) and provided

implementation support. A random sample of 10% of ECEC centres located in all other regions of New South Wales were invited to participate in the evaluation and served as a control group (n = 296). The study was conducted in the context of the *Good for Kids. Good for Life* programme but occurred over a different period to the study by Finch et al (61). Centres allocated to the control group received usual care that may have included exposure to a government ECEC programme to support healthy eating and physical activity offered to centres. An audit of menus found intervention centres were more likely to have fewer high-fat, salt or sugar processed meal items (intervention -0.9 items, control -0.2 items, P = 0.001), fewer sweetened drinks (intervention -0.4 items, control -0.1 items, P < 0.001) and more servings of vegetables (intervention +1.0 servings, control +0.2 servings, P < 0.001) than control centres.

Williams et al. conducted a non-randomised trial of a ECEC (preschool) education and food service intervention conducted in Head Start centres in upstate New York (67, 77-81). The primary aim was to reduce the saturated fat content of centre meals and to reduce consumption of saturated fat by children. Six centres received either a food service intervention with nutrition classroom education curricula or an identical food service intervention with a classroom safety component. Both of these groups received implementation support to improve food service. Three other ECEC centres with food operations not amenable to modification served as a control and received safety education curricula. Implementation of menus with nutrient content consistent with guideline recommendations was assessed by obtaining menu recipes and food labels over a five-day period. The study found within-group reductions in grams of saturated fat of food listed on menus, reducing from 11.3 grams (standard deviation (SD) ± 1.9) to 7.6 grams (SD ± 1.7) at the 18-month follow-up (P < 0.05). Within-group changes were also identified for percentage of energy (kcal) from fat, reducing from 31.0 (SD ± 2.6) to 27.6 (SD ± 2.8) at six months (P < 0.05) and to 25.0 (SD ± 2.6) at 18 months (P < 0.01). Similarly, the percentage of energy (kcal) from saturated fat reduced from 12.5 (SD ± 1.4) to 10.3 (SD ± 1.4) at six months and to 8.0 (SD ± 1.2) at the 18-month follow-up (P < 0.05) within the intervention group. There were no clear changes in these measures within the control group, or within either the intervention and control group for the other 15 nutrients measured at 18 month follow-up. Statistical comparisons between groups were not conducted.

Dichotomous outcomes

Ten studies comparing an implementation strategy to usual care or no implementation support reported a dichotomous measure of implementation (39, 41, 58, 59, 61, 62, 64, 68, 71, 74, 75). Pooling of data from the seven RCTs reporting these outcomes (39, 41, 58, 62, 64, 74, 75) (39, 41, 58, 62, 64, 74, 75) in meta-analysis found low-certainty evidence of an improvement in implementation favouring the group receiving implementation support in the proportion of centres or staff

implementing a policy or practice (OR 1.83; 95% CI 0.81 to 4.11; I^2 = 51%; P = 0.14; participants = 391 centres) (Appendix 5.5).

Sensitivity analysis was not performed as none of the RCTs contributing to the meta-analysis was assessed as being at high risk of bias for these outcomes. As the I^2 value was 51%, subgroup analyses were not performed to investigate heterogeneity.

The three non-randomised trials provided very low-certainty evidence regarding the effects of implementation strategies on percent of centres or staff implementing a policy or practice. Two Australian non-randomised trials (59, 61) examined the impact relative to usual practice comparison of implementation strategies including educational materials, educational meetings, audit and feedback, opinion leaders and small incentives versus usual practice control. In the first non-randomised trial by Finch et al. (61), data collected via telephone interview revealed centre managers in the intervention region were more likely to report a physical activity policy (intervention +28%, control +4%, P < 0.01) with a physical activity policy that referred to limits on small screen recreation (intervention +37%, control +5%, P < 0.01) and with staff trained in physical activity (intervention +47%, control +6%, P < 0.01). There were no clear differences between intervention and control centres at follow-up in the proportion that conducted daily fundamental movement sessions with recommended components (intervention +8%, control -1%, P = 0.08); with a policy that referred to physical activity training for staff (intervention +23%, control +8%, P = 0.07), where all staff usually participate in free active play (intervention +7%, control +8%), where all staff usually provide verbal prompts for physical activity (intervention +2%, control +3%), where children watch small screen recreation less than once per week (intervention -1%, control -2%), and where children participate in seated activities for no longer than 30 minutes at a time (intervention +1%, control +3%) (P = 0.65 to 0.95).

The second Australian non-randomised trial by Bell et al. reported a number of improvements in implementation assessed using dichotomous measures (59). Relative to the centres in the control group, data from interviews with centre managers found an increase in the proportion of centres providing only water and plain milk to children (non-sweetened drinks). Within the intervention group, this increased from 68% at baseline to 95% at follow-up, compared with changes from 58% to 82% in control centres (P = 0.02). The proportion of centres where parents participated in healthy eating programmes or policy development increased from 65% at baseline to 77% at follow-up for intervention centres compared with a change from 65% to 59% in the control group (P < 0.01). There were no clear differences between groups in three other policies or practices examined and assessed via telephone interview with centre managers. Furthermore, consistent with dietary guidelines, intervention centres were more likely than control centres to have no sweetened drinks listed on their menu (intervention +46%, control +10%, P < 0.001) and the appropriate servings of fruit (intervention

+34%, control +4%, P= < 0.001) and vegetables (intervention +20%, control +4%, P = 0.01) listed on the menu. The differences between groups in centre guideline adherence to recommendations regarding provision of high-fat, salt and sugar processed foods or water were small and uncertain (intervention effect sizes +9% to +10%, P = 0.11 to 1.00).

The final non-randomised trial, undertaken in the U.S., assessed the effects of an implementation strategy including educational meetings and guidelines, on the implementation of dietary and physical activity practices of centres (68, 71). Implementation of these were assessed against sector standards using a tool based on the EPAO and incorporating observations and menu reviews undertaken at the centre by trained data collectors. The study reported little difference across 13 dichotomous measures of implementation with odds ratios ranging from 1.35 (95% CI: 0.88 to 1.44; P = 0.63) to 0.89 (95%CI: 0.75 to 1.22; P = 0.09).

Studies comparing alternative strategies to improve the implementation of any healthy eating, physical activity or obesity prevention policy, practice or programme in centre-based ECEC centres

The two studies that compared the effects of two alternate implementation strategies reported mixed effects. One study used a continuous implementation outcome measure, and the other a dichotomous measure.

Continuous outcomes

Johnston Molloy et al. conducted a randomised (participants = 42 centres; low-certainty evidence), parallel-group trial testing two training-based interventions to improve implementation of healthy eating and health-related activity practices in Irish full daycare centres (preschools) (65). Centres were randomised to a 'manager and staff trained' group which received education materials, manager and staff educational meetings, and audit and feedback (n = 31) or a 'manager trained' only group receiving educational materials, manager (only) educational meetings, and audit and feedback (n = 30). Eighteen centres in the 'manager and staff training' group and 24 in the 'manager trained' group provided follow-up data and were included in the main analysis. The total Preschool Health Promotion Activity Scored Evaluation did not differ between groups (absolute difference in median scores between 'manager and staff trained' versus 'manager trained' only group = -2), with median total scores improving from 15 to 34 in the 'manager and staff trained group' and 13 to 34 in the 'manager trained' only group (P = 0.84). Similarly, there were no clear between-group differences on any of four reported subscale measures of nutrition environment, food service, meals or snacks.

Dichotomous outcomes

Gosliner et al. conducted an RCT (participants= 13 centres; very low-certainty evidence) with staff from ECEC centres in the U.S. to assess the impact of an intervention on the healthy eating and physical activity environment of ECEC centres (63). ECEC centres that were participating in a health education and policy development project (*Child Health and Nutrition Center Enhancement*) were matched on city of location and randomised to an intervention or control group. All centres received multi-strategic implementation support including educational materials, educational meetings, educational outreach visits or academic detailing with small incentives or grants ('comparison'). Staff of intervention centres additionally received a wellness programme consisting of individual health assessments (conducted by the research team); monthly newsletters and information with pay-checks promoting healthy eating and nutrition; a group walking programme where staff received collective incentive rewards as they reached milestones; and staff follow-up support visits.

At 10-month follow-up, a number of improvements on measures of implementation favouring the intervention group receiving the wellness programme were reported. Specifically, staff at intervention centres were more likely to report providing fruit 'more often' to children in children's meals or snacks during the past year (74% of staff) compared to staff at comparison centres (41% of staff) (P = 0.004). Similarly, staff at intervention centres were more likely to report providing vegetables 'more often' to children in children's meals or snacks during the past year (64% of staff) compared to staff at comparison centres (38% of staff) (P = 0.03). There were no clear differences between groups in the provision of sweetened beverages (intervention 7%, control 8%) and sweetened foods (intervention and comparison 5%) (P values not reported). At children's celebrations during the past year, staff at intervention centres were more likely to report providing fresh fruit (39% of staff) compared to staff at control centres (24% of staff) (P = 0.05). Further, intervention staff reported providing fewer sweetened beverages (7% of staff) compared to comparison (27% of staff) (P = 0.05) and fewer sweetened foods (intervention 15%, control 34%; P = 0.025). There were no differences between groups in the provision of vegetables at children's celebrations (intervention 32%, control 24%; P value not reported).

Subgroup analyses of strategies to improve implementation 'at scale'

Three studies sought to implement policies or practices 'at scale', defined as more than 50 centres (59, 61, 66). The RCT of multiple strategies to implement the *Nutrition and Physical Activity Self-Assessment in Child Care (NAPSACC*) programme by Ward et al. was conducted in 56 intervention centres and reported improvements in total EPAO score among centres receiving implementation support (MD 1.01, 95% CI 0.18 to 1.84) (66).

A non-randomised trial of implementation support provided to more than 200 ECEC centres reported improvement, favouring the intervention group, in the proportion of intervention centres with a physical activity policy (percentage change in telephone interview measure: intervention +28%, control +4%, $P < 0.01$) with a physical activity policy that referred to limits on small screen recreation (percentage change in telephone interview measure: intervention +37%, control +5%, $P < 0.01$) and with staff trained in physical activity (percentage change in telephone interview measure: intervention +47%, control +6%, $P < 0.01$), but not on eight other measures (61). Across all 11 practices, the median improvement of intervention relative to control was 2.5% (range -4% to 41%).

Similarly, Bell et al. found, relative to the centres in the control group, increases among centres receiving implementation support in the proportion of centres providing only water and plain milk to children (non-sweetened drinks) and a number of measures of the proportion of centre menus with foods consistent with dietary guidelines (59). Across 10 such measures, however, the median effect was 9.5% (range 2% to 36%). An audit of menus revealed that intervention centres had fewer high-fat, salt or sugar processed meal items (intervention -0.9 items, control -0.2 items, $P= 0.001$), fewer sweetened drinks (intervention -0.4 items, control -0.1 items, $P < 0.001$), and more servings of vegetables (intervention +1.0 servings, control +0.2 servings, $P < 0.001$).

Table 5.2 Summary of intervention, measures and absolute intervention effect size in included studies

Study	Implementation strategies	Comparison group	Primary implementation outcomes measures	Effect size
Alkon 2014	Educational materials, educational meetings and audit and feedback	Usual practice	Score: nutrition and physical activity policy quality using the CHPHSPC and healthy eating and physical activity practices using the EPAO assessed via observation (5 measures)	Median (range)[c]: 1.4 (0 to 4.29)
			% of staff or centres implementing a practice: centres with a healthy eating or physical activity policy (2 measures)	Median (range): 33%% (22% to 44%)[c]
			% of foods offered to children (10 measures)	Median (range): 7.7% (133% to -2.7%
Bell 2014	Educational materials, educational meetings, audit and feedback, opinion leaders, and small incentives or grants	Usual practice	% of staff or centres implementing a practice: percentage of centres implementing healthy eating policies and practices and menus consistent with nutrition recommendations (10 measures)	Median (range): 9.5% (2% to 36%)
			Quantity of food served (servings/items): mean number of items or servings of healthy/unhealthy foods on centre menus (4 measures)	Median (range): 0.5 servings/ items (-0.4 to 0.8)
Benjamin 2007	Educational materials, educational meetings, and audit and feedback	Usual practice	Score: nutrition, physical activity environments assessed via questionnaire (NAPSACC) completed by centre managers (total score)	Mean difference (95% CI)[c]: 5.10 (-2.80 to 13.00)
Finch 2012	Educational materials, educational meetings, audit and feedback, opinion leaders and small incentives	Usual practice	% of staff or centres implementing a practice: percentage of centres implementing physical activity policies and practices (11 measures)	Median (range): 2.5% (-4% to 41%)
			Minutes of centre or staff implementation of a policy of practice: time (hours/day) spent on structured physical activities (1 measure)	Mean: 6 minutes
Finch 2014	Educational materials, educational meetings, audit and feedback, opinion leaders and small incentives	Usual practice	Frequency of staff or centre implementation of a practice: occasions of implementation of fundamental movement skill activities, staff role modelling and verbal prompts and positive comments (4 measures)	Median (range): 2.6 (12.1 to 0.6)

			Minutes of centre or staff implementation of a policy of practice (per session or day): minutes of fundamental movement skill activities, structured time, television viewing or seated time (4 measures)	Median (range)[c]: 4.3 minutes (-12 minutes to 39 minutes)
			% of staff or centres implementing a practice: centres with seated time > 30 minutes or with an activity policy (2 measures)	Median (range): 5 (30 to -20)
			Mean number of resources or equipment per centre (3 measures)	Median (range): -0.1 (-0.6 to -0.1)
Gosliner 2010	Educational materials, educational meetings, educational outreach visits or academic detailing with small incentives or grants with staff wellness programme	Educational materials, educational meetings, educational outreach visits or academic detailing	% of staff or centres implementing a practice: provision of food items by staff 'more often' assessed via staff-completed questionnaire (8 measures)	Median (range): 17% (0% to 23%)
Hardy 2010	Educational materials, educational meetings, educational outreach visits or academic detailing with small incentives or grants	Usual practice	Minutes of centre or staff implementation of a policy of practice: minutes (per week or session) of structured and unstructured play or fundamental movement skills activities (3 measures)	Median (range): 7.7 minutes (6.5 minutes to 10.1 minutes)
			Frequency of staff or centre implementation of a practice: frequency (per week or day) of structured or unstructured play, and of fundamental movement skill activities (3 measures)	Median (range): 0.2 (-0.9 to 1.9)
			% of staff or centres implementing a practice: conduct of food-based activities, development of new rules around food and drink bought from home, and the provision of health information to families (3 measures)	Median (range)[c]: 11% (-7% to 31%)
Johnston Molloy 2013	Educational materials, manager and staff educational meetings and audit and feedback	Educational materials, manager educational meetings, audit and feedback	Score: on the Health Promotion Evaluation Activity Scored Evaluation form assessed via observation (total score)	Difference in median score [b]: -2

Ward 2008	Educational materials, educational meetings, and audit and feedback	Usual practice	Score: healthy eating and physical activity practices using the EPAO assessed via observation (total score)	Mean difference (95% CI)[c]: 1.01 (0.18 to 1.84)
Williams 2002	Educational materials, educational meetings, educational outreach visits or academic detailing with small incentives or grants	Usual practice	Quantity of food served (servings/grams): grams of saturated fat assessed via menu audit (one measure)	Median (range): 17% (0% to 23%)
O'Neill 2017	Educational meetings, release of practice guidelines	Usual practice	% of staff or centres implementing a practice: percent of centres implementing a practice consistent with standards for the setting (13 measures) Score: physical activity environment using the EPAO assessed via researcher observation (1 measure - total score)	Median (range): OR = 1.01; 95% CI: 0.87 to 1.29 (OR 1.35 to 0.89) Mean difference: 0.9 (P = 0.06)
Jones 2015	Audit with feedback, educational material, educational meetings, opinion leaders, local consensus approach, educational outreach or academic detailing. Other: employment of communication strategies	Usual practice	Score: mean number of policies and practices implemented (1 measure) % of staff or centres implementing a practice: proportion of centres implementing all seven healthy eating and physical activity policies and practices (1 measure)	Mean difference: 0.4 (P = 0.05) Main analysis OR: 1.33 (0.64, 2.76)
Seward 2017	Audit with feedback, educational materials, educational meetings, opinion leaders, educational outreach or academic detailing	Usual practice	Score: mean number of food groups compliant with guidelines % of staff or centres implementing a practice: proportion of centres fully compliant with healthy eating guidelines for all food groups (7 measures)	Mean difference: 1.57 (0.82, 2.33) OR median (range): OR 6.26; 95% CI 1.26 to 43.40 (OR 1 to 16.54)
Yoong 2016	Educational materials	Usual practice	Quantity of food served: number of fruit and vegetable servings on the centre menu assessed via questionnaire (2 measures)	Mean difference median (range): 0.25 (0.0 to 0.50)
Esquivel 2016	Educational materials, educational meetings. Other: monthly employee wellness	Waiting-list control (delayed intervention)	Score: nutrition and physical activity environments using the EPAO assessed via researcher observation (total score)	Mean difference: 1.1
Mazzucca 2017	Educational materials, educational meetings, educational outreach or	Usual practice	Score: physical activity environment assessed using modified EPAO assessed via centre self-report (7 measures)	Median/mean differences (range): 0.4 (-0.7 to 0.9)

	academic detailing, reminders, tailored interventions			
Morshed 2016	Educational materials, educational meeting	Usual practice	Quantity of food served: number of fruit, vegetable, and wholegrain servings, grams of discretionary fat, teaspoons of added sugar, and grams of fat from milk provided assessed via researcher observation (6 measures)	Relative change estimate: OR (95% CI): 1.00 (0.81 to 1.24) (OR 1.09 to 0.82)
Sharma 2018	Educational meetings, educational outreach or academic detailing, reminders	Usual practice	Score: implementation index assessed via teacher-completed survey (1 measure)	Mean difference: 15.17
Stookey 2017	Audit with feedback, educational materials, educational meetings, educational outreach or academic detailing, incentives, tailored interventions	Waiting-list control (delayed intervention)	% of staff or centres implementing a practice: children's exposure to three healthy eating and physical activity practices: use of physical activity curriculum, staff usually join in physically active play; pitchers of drinking water visible in the classroom (1 measure)	OR (95% CI): 6.5 (1.1 to 40.6)
Ward 2017	Audit with feedback, educational materials, educational meetings	Waiting-list control (delayed intervention)	Score: nutrition environment assessed using the EPAO assessed via centre self-report (total score)	Mean difference: 0.73
Finch 2019	Educational materials, audit with feedback, continuous quality improvement, educational outreach or academic detailing, opinion leaders, tailored interventions	Usual practice	Score: mean number of policies and practices implemented (1 measure) % of staff or centres implementing a practice: proportion of centres implementing all six policies/practices (1 measure)	Mean difference: 0.1; 95% CI −0.4 to 0.6 OR (95% CI): 0.51 (0.16 to 1.58)

[a]Effect size calculated first using the primary outcome (where a single primary outcome was reported); otherwise using a total score (when total and subscale scores were provided); otherwise using the median effect size across measures (where more than one outcome measure was reported and not specified as primary); [b]Mean not reported. Represents the difference in median score between manager and staff-trained versus manager only-trained group; [c]Additional data obtained from study authors where unclear or missing; CHPHSPC: Californian Childcare Health Programme Health and Safety Checklist DOCC: Diet Observation in Child Care; EPAO: Environment and Policy Assessment and Observation; NAPSACC: Nutrition and Physical Activity Self-Assessment for Child Care

Table 5.3 Summary of findings

Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within ECEC centres						
Patient or population: children up to the age of 6 years **Settings:** centre-based ECEC centres that cater for children prior to compulsory schooling **Intervention:** any strategy (educational materials, educational meetings, audit and feedback, opinion leaders, small incentives or grants, educational outreach visits or academic detailing, reminders and tailored interventions) with the primary intent of improving the implementation (by usual centre staff) of policies, practices or programmes in centre-based ECEC centres to promote healthy eating, physical activity or prevent unhealthy weight gain **Comparison:** usual practice or minimal support control (19 studies) or alternate intervention (2 studies)						
Outcomes	**Anticipated absolute effects* (95%CI)** **Risk with usual care or waiting list control**	**Risk difference with implementation strategy**	**Relative effect (95% CI)**	**No of participants (studies)**	**Certainty of the evidence (GRADE)**	**Comments**
Implementation of policies, practices or programmes that promote child healthy eating, physical activity and/ or obesity prevention	Mean score of 10.09 on the EPAO scale[a]	SMD of 0.49 is equivalent to a mean difference of 0.88 on the EPAO scale (95% CI 0.34 to 1.42)	SMD = 0.49 (0.19 to 0.79)	495 participants (ECEC centres), 9 RCTs; reporting score-based measures	⊕⊕⊕⊖ Moderate[b]	Including nine RCTs reporting score-based measures, all conducted in high-income countries. In addition to score-based measures of implementation reported here, the included RCTs also reported improvement (effect uncertain) in the per cent of centres or staff implementing a policy or practice (OR 1.83, 95% CI 0.81 to 4.11; participants = 391 ECEC centres; low-certainty evidence), mixed effects for two RCTs reporting time or frequency-based measures (participants = 49 ECEC centres; low-certainty evidence) and mixed effects for three RCTs reporting quantity measures of implementation (foods served to children) (participants = 171 ECEC centres; low-certainty evidence). Implementation strategies probably improve the implementation of policies, practices or programmes that promote child healthy eating, physical activity and/ or obesity prevention.
Cost or cost-effectiveness of strategies to	-	-	-			No studies were found that looked at the cost or cost-effectiveness of strategies to improve the implementation of policies, practices or programmes in ECEC centres

improve the implementation of policies, practices or programmes in ECEC centres						
Adverse consequences of strategies to improve the implementation of policies, practices or programmes in ECEC centres	-	-	-	148 participants (ECEC centres), 2 RCTs; reporting continuous outcomes (rates of child injury)	⊕⊕⊖⊖ Low [b,c]	Including two RCTs, both conducted in high-income countries. Across the two RCTs that reported continuous measures of adverse effects (rates of child injury) there were no clear differences reported between groups in rates of child injuries. Similarly, there was no difference between groups in a single trial reporting dichotomous outcomes (reported complaints received by centres) (participants = 45 ECEC centres; very low-certainty evidence). Strategies to improve the implementation of policies, practices or programmes that promote child healthy eating, physical activity and/or obesity prevention may have little to no impact on measures of adverse consequences.
Measures of child diet [e]	-	-	-	134 participants from 182 ECEC centres), 2 RCTs, reporting continuous (serving-based measures) of dietary intake	⊕⊕⊖⊖ Low[c,d]	Including two RCTs, both conducted in high-income countries. Findings regarding beneficial effects for this outcome were mixed across the two RCTs. Strategies to improve the implementation of policies, practices or programmes that promote child healthy eating, physical activity and/or obesity prevention may lead to little or no difference in child diet intake.
Measures of child physical activity	-	-	-	53 ECEC centres (2 RCTs) reporting dichotomous observational	⊕⊕⊕⊖ Moderate[c]	Including two RCTs, both conducted in high-income countries. The two trials reporting dichotomous observation-based measures of physical activity reported little to no improvement in student physical activity. Additionally, two trials using continuous and objective measures of child physical activity (e.g. pedometers)

				outcomes[g] (no. children not reported)		(participants = 420 children from 46 centres; high-certainty evidence) reported little to no improvement in student physical activity. Strategies to improve the implementation of policies, practices or programmes that promote child healthy eating, physical activity and/or obesity prevention probably lead to little or no difference in child physical activity.
Measures of child weight status	-	-	-	298 children from 66 ECEC centres (2 RCTs) reporting continuous measures of BMI/ zBMI	⊕⊕⊕⊖ Moderate[c]	Including two RCTs, both conducted in high-income countries. The two trials reporting zBMI or BMI measures of weight status found mixed effects on this outcome. Additionally, one RCT reported a dichotomous measure of weight (% of children within different weight-related categories) and found no differences between groups (participants = 209 children from 18 ECEC centres, low-certainty evidence). Strategies to improve the implementation of policies, practices or programmes that promote child healthy eating, physical activity and/or obesity prevention may lead to little or no difference in child weight status.

GRADE Working Group grades of evidence
High quality: We are very confident that the true effect lies close to that of the estimate of the effect
Moderate quality: We are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low quality: Our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect
Very low quality: We have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect

[a]Risk with usual care or waiting list control calculated as the mean Environment and Policy Assessment and Observation (EPAO) score for the control group as reported in Ward 2017; [b]Downgraded one level for risk of bias: studies assessed as high and unclear risk of bias for the majority of domains; [c]Downgraded one level for inconsistency: narrative synthesis indicated a high level of inconsistency in results across studies and outcomes measured within studies; [d]Downgraded one level for imprecision: total sample size < 400; [e]Measures of child diet: included child consumption of food groups (e.g. fruit and vegetables) measured via weighed food records and researcher observations; [f]Measures of child physical activity: included frequency and duration of child physical activity (e.g. step count), measured via pedometers, accelerometers and researcher observations; [g]Dichotomous observational outcomes: included type and intensity of child physical activity (e.g. very active, walking, sedentary), measured via researcher observations

Secondary outcomes

Estimates of absolute costs or assessments of cost-effectiveness

None of the included studies reported on the costs or any cost analyses for the interventions.

Reported adverse consequences

Three studies explicitly assessed whether the intervention had unintended adverse effects (62, 74, 75). Both the RCTs by Finch and Jones found little difference in the number of child injuries in the month prior to assessment among intervention and comparison ECEC centres as reported by ECEC managers at baseline and follow-up (62, 74) (participants = 148 ECEC centres; two studies reporting continuous outcomes (child injury rates); low-certainty evidence). In the study by Finch et al., the rate of injury per month at intervention centres at baseline was 0.18 (95% CI 0.09 to 0.27) and 0.17 (95% CI 0.08 to 0.27) at follow-up, and at control centres was 0.12 (95% CI 0.04 to 0.20) at baseline and 0.11 (95% CI 0.03 to 0.19) at follow-up (P = 0.85) (62). Similarly, in the trial by Jones et al., the rate of serious child injuries at intervention centres was 0.72 (95% CI 0.39 to 1.05) and 0.90 (95% CI 0.52 to 1.29) at control centres during the previous 12 months (P = 0.47) (74). The rate of staff injuries was also assessed in the trial by Jones and there was little difference between groups with 0.77 (95% CI 0.49 to 1.06) injuries on average at intervention centres compared with 0.84 (95% CI 0.42 to 1.26) at control centres during the previous 12 months (P = 0.80) (74).

In an RCT of a strategy to improve food centres through implementation of healthy eating guidelines in ECEC, Seward et al. assessed negative feedback regarding the centre menu from centre educators, children and parents in the last month as reported by the centre cook at follow-up (participants = 45 ECEC centres; one study reporting dichotomous outcomes; very low-certainty evidence) (75). There was no clear difference in negative feedback received from educators in intervention centres (7 (32%)) and control centres (4 (25%)) (P = 0.62); from children in intervention centres (7 (32%)) and control centres (1 (6%)) (P = 0.07); and parents in intervention centres (2 (9%)) and control centres (0 (0%)) (P = 0.954).

Effects on child diet, physical activity or weight status

Diet

Four of the 21 studies assessed the impact of the intervention on child dietary intake (67, 72, 74, 75).

Of the two RCTs (participants = 134 children from 182 ECEC centres; two studies reporting continuous serving-based measures of dietary intake; low-certainty evidence), one study used weighed food record methodology to assess the effectiveness of a multi-strategy implementation intervention on the aggregate servings of the core food groups and ‘discretionary’ foods consumed by children in

care at baseline and follow-up (75). Results from the RCT identified an improvement in consumption in the intervention centres, relative to control, for vegetables (adjusted difference = 0.70; 95% CI 0.33 to 1.08; P < 0.001) and fruit (adjusted difference = 0·41; 95% CI 0.09 to 0.73; P = 0.014). Differences between groups in aggregate servings of discretionary servings (adjusted difference = -0.54; 95% CI -0.14 to 0.05, P = 0.073) and dairy servings (adjusted difference = -0.02, 95% CI -0.48 to 0.43), servings of breads and cereals (adjusted difference = 0.26, 95% CI -0.67 to 1.21, P = 0.56) and meat food groups (adjusted difference = 0.13, 95% CI −0.12 to 0·38, P = 0.296) were small and uncertain.

The second RCT by Jones et al. used direct observation to evaluate the effects of an intervention aimed at improving the implementation of healthy eating and physical activity policies on the mean number of servings consumed by children for each food group within the Australian Guide to Healthy Eating at follow-up (74). Results at 12-month follow-up showed little difference between groups in the mean number of vegetable servings (intervention 0.1, SD 0.3; control 0.2, SD 0.6, P = 0.32), fruit (intervention 1.1, SD 1.1; control 0.8, SD 0.7, P = 0.14), grain servings (intervention 1.6, SD 0.5; control 1.4, SD 0.8; P = 0.28) consumed by children in care. No differences were reported in the mean number of meat and alternatives (intervention 0.1, SD 0.2; control 0.1 SD 0.3; P = 0.67), milk, yoghurt and cheese (intervention 0.7 SD 0.6; control 0.7 SD 0.7; P = 0.97) and discretionary food servings (intervention 0.7 SD 0.6; control 0.7, SD 0.7; P = 0.79) consumed by children in care.

The non-randomised trial by Williams et al. also used observational measures comparing child education curricula and a one-day food service modification training for cooks with a child curricula only control (67). Specifically, child dietary intake was assessed via direct observation during meal and snack periods (participants = 709 children from nine centres, one study, very low-certainty evidence). The intervention was primarily focused on reducing fat, saturated fat and energy. The study found that children attending intervention centres consumed less energy (-81.33 kcal), fat (-3.6 grams), saturated fat (-1.86 grams), as well as less fat as a percentage of energy (-4.48), and saturated fat as a percentage of energy (-2.87) relative to the control at the six-month follow-up during attendance at care (all P < 0.001). At the 18-month follow-up, the saturated fat (-2.56 grams) and fat as a percentage of energy (-10.92), and saturated fat as a percentage of energy (-5.15), remained lower relative to the control group (P < 0.001 to 0.01). The study also assessed changes in 13 other nutrients. Of these, intake of iron and magnesium were found to be higher among children in intervention compared with control centres at the 18-month follow-up.

The remaining study, a non-randomised trial (participants = 848 children from 25 centres, one study, very low-certainty evidence) with serial cross-sectional data collection, used parent self-report to assess the impact of a centre-based healthy eating and physical activity programme on changes in the frequency of child intake of various healthy and unhealthy foods at baseline and follow-up (72). Sharma et al. found little to no changes in frequency of fruit, 0.005 (95% CI -0.13 to 0.13, P = 0.940),

vegetables, -0.003 (95% CI -0.14 to 0.14, P = 0.996) and sports drink, 0.14 (95% CI -0.002 to 0.29, P = 0.054). Differences were found in the frequency of child intake of French fries, 0.21 (95% CI 0.09 to 0.33, P = 0.000) and sugar-sweetened beverages -0.52 (95% CI -0.70 to -0.35, P = 0.000).

Physical activity

Five studies assessed the impact of the intervention on child physical activity, providing little evidence of benefit (58, 62, 72-74), one of which was a non-randomised trial (72).

Two of the five studies used objective methods, including child-worn pedometers and accelerometers, to assess changes in child physical activity (participants = 420 children from 46 centres; two studies; high-certainty evidence). In the RCT of a multi-component intervention of 20 ECEC centres by Finch et al., there was no improvement, relative to control, in the step counts per minute as assessed by pedometer for children attending intervention centres (62). Mean child step counts in the intervention group were 17.20 (95% CI 15.94 to 18.46) at baseline and 16.12 (95% CI 14.86 to 17.30) at follow-up, and in the control group step counts were 13.78 (95% CI 12.76 to 14.80) at baseline and 13.87 (95% CI 12.57 to 15.17) at follow-up. Mazzucca et al. assessed difference between groups in total child physical activity, minutes per hour of being sedentary and different intensities of physical activity through accelerometers worn by children for five days at baseline and follow-up (73). Results of the trial indicated that children in the intervention arm averaged 480.2 ± 9.3 counts per minute at follow-up compared to 459.7 ± 9.4 counts per minute in the control group controlling for baseline (P = 0.12). Additionally, the trial reported small and uncertain difference (P = 0.13) in vigorous physical activity in children in the intervention group compared to those in the control, (5.6 versus 5.4 min/hr, respectively). No other differences were reported by authors in the amount of sedentary behaviour, total physical activity, or moderate to vigorous physical activity (MVPA).

Two studies used formal observational methods to assess changes in child physical activity (participants = 53 ECEC centres; two studies; moderate-certainty evidence). In an RCT of a multi-component intervention to facilitate implementation of the *NAPSACC* programme, Alkon et al. found no significant changes in the intensity or type of physical activity of children in care as assessed by the Observation System for Recording Activity in Preschools (OSRAP) tool (effect sizes and P value not reported) (58). There was, however, a nonsignificant change in the intervention group in the proportion of sedentary/quiet time, from 60% at baseline to 56% at follow-up, and a nonsignificant increase in the control group from 53% at baseline to 58% at follow-up (P value not reported). Jones et al. assessed differences between groups in the proportion of children engaged in sedentary, walking or very active physical activity during all observations, structured physical activity and outdoor free play sessions through researcher observation at follow-up (74). Results of the RCT identified small and uncertain differences between groups in the proportion of children engaged in very active

(intervention, 26.1%, 95% CI 22.5 to 29.8; control, 21.3%, 95% CI 17.7 to 24.9), walking (intervention, 29.1%, 95% CI 26.5 to 31.7; control, 29.5%, 95% CI 27.2 to 31.8) or sedentary (intervention, 44.8%, 95% CI 41.5 to 48.1; control, 49.2%, 95% CI 45.8 to 52.5) (P = 0.49) physical activity during all observations. Similarly for structured physical activity observations, small and uncertain differences between groups were observed in very active, (intervention, 40.3, 95% CI 29.5 to 51.0; control, 32.9, 95% CI 23.1 to 42.6), walking (intervention, 18.2, 95% CI 10.4 to 26.1; control, 25.7, 95% CI 19.0 to 32.5) or sedentary (intervention, 41.5, 95% CI 31.1 to 51.9; control, 41.5, 95% CI 31.3 to 51.4) (P = 0.64) physical activity. For outdoor free play observations, small and uncertain differences were observed between groups in the proportion of children engaged in very active (intervention, 22.2, 95% CI 19.4 to 25.1; control, 18.4, 95% CI 15.3 to 21.5), walking (intervention, 32.1, 95% CI 29.7 to 34.5; control, 30.5, 95% CI 27.9 to 33.0) or sedentary physical activity (intervention, 45.7, 95% CI 42.4 to 49.0; control, 51.1, 95% CI 48.1 to 54.2) (P = 0.47).

One non-randomised trial (participants = 848 children, one study, very low-certainty evidence) used parent self-report to compare the days children spent participating in more than 60 minutes of physical activity and the days playing outside for more than 30 minutes at baseline and follow-up (72). There was no difference between groups for mean number of days participating in more than 60 minutes of physical activity (P = 0.824). Similarly, the difference between groups for mean number of days spent playing outside for more than 30 minutes for children was unclear (P = 0.435).

Weight status

Five studies assessed the impact of the intervention on child weight status (41, 58, 67, 69, 72). All five studies objectively assessed child weight status through the collection of weight and height data by research staff or health workers during data collection, which was then used to calculate changes in mean BMI z-scores and BMI percentiles. Across these studies, the reported effects on BMI/zBMI were mixed.

Of the five studies that assessed child weight status, three studies were RCTs (41, 58, 69). Analyses of the impact of the intervention aiming to improve implementation of healthy eating and physical activity practices on centre-level child adiposity revealed a reduction in body mass index (BMI) z-score relative to the control group (coefficient -0.26, standard error (SE) 0.1, P = 0.02) in the trial by Alkon et al. (low-certainty evidence) (58). Two RCTs assessed changes in child weight status through mean changes in BMI percentiles and BMI z-scores (moderate-certainty evidence) (41, 69). Stookey et al. assessed annual mean changes in child BMI percentile and BMI z-score at baseline and follow-up periods after conducting an intervention to improve implementation of healthy eating and physical activity practices (41). Mean BMI percentiles for children in the intervention group were 1.7 (SD 0.6) at baseline and -0.07 (SD 0.7) at follow-up, whilst BMI percentiles in the control group were 1.0 (SD

0.7) at baseline and -2.1 (SD 0.7) at two-year follow-up. Mean BMI z-scores in the intervention group decreased from 0.05 (SD 0.02) at baseline to -0.04 (SD 0.02), and in the control group decreased from 0 (SD 0.02) to -0.09 (SD 0.02) at two-year follow-up. The statistical significance of annual mean changes in BMI percentiles and z-score for both groups was not reported. Esquivel et al. assessed the impact of a ECEC centre policy intervention on mean child BMI z-scores (69). Mean BMI z-scores increased for children in the intervention group from 0.51 (SD 1.14) at baseline to 0.60 (SD 1.16) at follow-up (P = 0.50), and in the control group increased from 0.25 (SD 1.14) at baseline to 0.35 (SD 1.17) at follow-up (P = 0.48) following the seven-month intervention. The remaining two studies that assessed child weight status were non-randomised trials (very low-certainty evidence) (67, 72). Sharma et al. found lower mean child BMI z-scores (-0.26, 95% CI -0.50 to -0.01, P = 0.041) and mean BMI percentiles (-6.5, 95% CI -12.4 to -0.69, P = 0.028), in intervention centres compared to control centres following a two-year study which focused on implementing a ECEC centre-based healthy eating and physical activity programme (72). An intervention focused on improving ECEC menus by Williams et al. assessed change in child weight to height ratio at six-month follow-up. The study found no clear intervention effect (f-value 1.18, P value not reported) (67).

Implementation acceptability, adoption, penetration, sustainability and appropriateness

Acceptability

Acceptability of implementation strategies was measured in eight of 21 included studies (39, 42, 60-62, 64, 73, 74). All eight studies measured intervention acceptability utilising self-report methods, including telephone interviews, surveys and focus groups conducted by implementation support staff with ECEC centre nominated supervisors and staff.

Across studies, measures of the acceptability of educational materials by ECEC staff (e.g. factsheets, newsletters, activity handbooks and policy templates), ranged from 60% to 100% (39, 42, 60-62, 74), and educational outreach or academic detailing (e.g. training workshops) ranged from 88% to 100% (60-62, 64, 74). Five studies examined acceptability of the ongoing support provided throughout the intervention (39, 42, 61, 73, 74). Across studies, such support delivered via telephone was considered acceptable by 83% to 98% of ECEC staff (39, 42, 61, 73, 74) while 98% to 100% reported such support via face-to-face methods was acceptable (74).

Penetration

Penetration of implementation strategies within intervention ECEC centres was examined in 12 of the 21 included studies (41, 58, 61-66, 73-76). Of the 12 studies that measured penetration, three studies used self-report methods (41, 63, 76), including interviews and surveys with ECEC centre staff, and five studies used internal records from implementation and research staff (58, 62, 73-75). The

remaining four studies (61, 64-66) did not report how the penetration of intervention components was measured.

Across studies, measures of the penetration of educational materials (e.g. factsheets, newsletters, activity handbooks and policy templates) ranged from 37% to 100% (41, 61, 63, 74-76). Eight studies examined penetration of educational outreach or academic detailing, ranging from 8% to 100% of ECEC centres (41, 58, 61-63, 65, 74, 75). Four studies measured penetration of ongoing support within the intervention (61, 73-75). Across these studies, the penetration of support delivered via telephone and email ranged from 69% to 78% (61, 73), and penetration of face-to-face support ranged from 76% to 96% (74, 75).

Adoption

None of the included studies reported on the adoption of the interventions.

Sustainability

None of the included studies reported on the sustainability of the interventions.

Appropriateness

None of the included studies reported on the appropriateness of the interventions.

DISCUSSION

Summary of main results

This review sought to assess the impact of strategies to support the implementation of policies, practices or programmes to promote physical activity, healthy eating or prevent excessive weight gain among children in centre-based ECEC centres. The review identified 21 studies, most of which were RCTs testing multi-component implementation support strategies. Collectively, the findings suggest that implementation strategies are likely to improve the implementation of policies, practices or programmes that promote child healthy eating, physical activity and/or obesity prevention in ECEC centres. Meta-analysis of RCTs reporting score-based measures of implementation (e.g. physical activity environment and policy assessment observation) found effects favouring implementation support strategies on these outcomes. Meta-analysis of RCTs reporting dichotomous outcomes (e.g. proportion of centres implementing a policy or practice), reported an 80% increase in the odds of implementation favouring ECEC centres that received implementation support. While this effect is uncertain as the 95% confidence intervals are inclusive of values of no effect, the point estimate was relatively large. There was little evidence that interventions, and the strategies employed to implement

them improved child diet, physical activity or weight status. No studies reported cost or cost-effectiveness outcomes.

There were a number of challenges in conducting and synthesising the findings of included studies. Classification of implementation strategies was difficult. The Cochrane Effective Practice and Organisation of Care (EPOC) Group taxonomy has been developed to describe strategies to improve implementation or professional practice of health services or practitioners, which were often not relevant for the ECEC setting (23). Other strategies employed by included studies to facilitate implementation, including small incentives such as lotteries or wellness initiatives, did not fit with the current EPOC taxonomy descriptors. To address such issues, we included full descriptions of studies, study context and implementation strategies. Despite the existence of other taxonomies that have been developed to consider community based interventions (82), a revision of the EPOC taxonomy and descriptors to align more with the implementation strategies used in non-clinical settings may improve EPOC strategy coverage and facilitate classification for studies undertaken in ECEC and other community settings. Interpretation of the findings therefore represents a challenge.

The lack of effectiveness of reported on measures of child diet, physical activity or weight status is concerning. There may be a number of possible explanations for the equivocal impacts found in this review on these outcomes. First, the interventions implemented in the included studies may not be effective in improving child health behaviours. In many studies, prior evidence supporting the efficacy of the intervention being implemented was not reported or was unclear (41, 65, 72). Ineffective interventions cannot improve child health outcomes, regardless of how well they are implemented in ECEC centres. Second, the efficacy of interventions in ECEC centres are often established in ideal research conditions. Even in circumstances when there is strong evidence supporting the efficacy of interventions, systematic reviews suggest intervention effect sizes typically attenuate when evaluated in more real world contexts (9, 83, 84) due to a range of study, intervention and contextual factors. As implementation studies, by nature, are undertaken in more naturalistic environments, the effects of interventions may be reduced to the point that they no longer provide therapeutic benefit.

Finally, the findings may suggest the level of implementation achieved was insufficient to accrue improvement on such child health outcomes. If this is the case, more effective implementation approaches are required. Further, enhancing implementation, however, may represent a challenge. ECEC centres report a broad range of factors that impede implementation including a lack of support from ECEC executive committees, the centre manager or parents (14), staff members' own healthy eating or physical activity behaviours, self-efficacy in facilitating healthy eating or physical activity of children, and negative staff attitudes (85-87). Furthermore, for the implementation of physical activity policies, practices and programmes in particular, structural barriers, such as a preference for child-

directed rather than teacher-led structured physical activity by ECEC centre staff, a lack of space, inclement weather or lack of broader policy framework (85, 86), have been noted as implementation barriers. The selection of 'simple' interventions that may be more amenable to implementation, or interventions with larger effects may improve the likelihood that interventions, and strategies to implement them produce meaningful health outcomes for children.

Overall completeness and applicability of evidence

Twelve of the 21 included studies were conducted by two research groups in the U.S. and Australia (39, 42, 58-62, 66, 73-76). Furthermore, all of the included studies were conducted in high-income countries. The applicability of study findings to lower and middle-income countries, where the operational, philosophical and cultural contexts may differ substantially, is unknown (88). Future research, conducted by a greater range of research groups in different research contexts, would strengthen the applicability of the evidence base.

Quality of the evidence

GRADE assessments varied by outcomes reported in the review, but were typically low. Risk of performance bias (due to lack of blinding of participants or personnel), detection bias (due to use of self-assessment measures in some studies) and reporting bias (due to a lack of prospective registration or published study protocols) were particularly prevalent among included studies. The comparison groups used limited the directness of the assembled evidence. A number of studies included comparison groups that included some active implementation support (63, 65), or 'usual' implementation support (41, 59, 61, 74-76), which may not have been well defined. Finally, there were concerns regarding the precision of the estimates of included studies for the primary outcomes of this review. Most studies included samples of fewer than 15 per study arm, which is likely to be insufficient to detect small but meaningful effects. Similarly, 13 of the 21 studies included a measure of implementation as the primary study outcome (42, 58-61, 63, 65, 66, 68, 69, 71, 74-76), and only seven of these performed a sample size calculation to justify the included sample (39, 42, 61, 68, 71, 74, 76).

Potential biases in the review process

The review included a comprehensive search strategy for peer-reviewed and grey literature and examined over 11,000 citations. We also sought relevant studies from screening of citations of included studies, and from contact with experts in the field. While the search strategy was rigorous, as this is a field in which terminology for implementation constructs are developing, it is possible that not all studies that report implementation outcomes were identified. For example, it has been

estimated that 15% of studies use implementation strategies that cannot be classified using implementation taxonomies (89). Potentially relevant studies may have been missed based on the implementation strategy search terms used in this review. However, a previous review conducted by the Agency for Healthcare Research and Quality failed to identify any studies of implementation strategies targeting healthy eating and physical activity in the ECEC setting (48), and contact with other experts in the field did not yield any additional studies to those identified in the primary search. Such findings provide some evidence to suggest that the search strategy may have provided reasonable coverage of the relevant literature. Nonetheless, we will assess the appropriateness of search terms in future updates of the review to ensure that the search terms are inclusive of relevant implementation terminology and newly released taxonomies. The method for describing effects across studies may have also introduced bias. In instances where a primary implementation outcome was not identified in included studies, we utilised a median effect size across implementation outcomes. Such analyses are inconsiderate of the robustness of individual measures, and may mask important effects on single implementation outcomes. Consideration of the narrative description of each study included in the review is therefore important when interpreting study findings.

Agreements and disagreements with other studies or reviews

Similarly to findings of this review, other recent systematic reviews examining the effectiveness of implementation strategies in community settings, including workplaces (35), schools (37) and sporting clubs (36), have reported a relatively small evidence base, and limited reporting of cost and cost-effective analyses. The findings of this review, however, provide more certainty regarding the effectiveness of strategies to improve implementation of health promotion policies and practices in this setting, compared to reviews of studies in other community organisations. Consistent with systematic reviews of implementation strategies in clinical settings, the findings of this review suggest that multi-strategic approaches can be effective in improving implementation (90). Unlike reviews of health care, however (26, 29, 30), the limited number of studies and heterogeneity of strategies used did not enable isolation of the effects of individual implementation strategies, or specific combinations thereof.

AUTHORS CONCLUSIONS

Implications for practice

The review highlights the limited evidence base to guide policy makers and practitioners interested in supporting the implementation of healthy eating, physical activity or obesity prevention policies, practices and programmes in centre-based ECEC centres. Collectively, the findings suggest that implementation strategies can have a positive impact on the implementation. With a small number of

studies to date and in the absence of high-quality evidence, formative work to achieve a comprehensive understanding of the setting, context and barriers to implementation, and careful selection of support strategies to address these, may be particularly important for practitioners to maximise the potential for successful implementation (91).

Implications for research

The findings of this review suggest that there is considerable scope to improve the evidence base to guide future efforts to support implementation of healthy eating, physical activity and obesity prevention programmes in centre-based ECEC centres. The limited number of studies is surprising given the large numbers of studies testing interventions to improve healthy eating, physical activity or obesity prevention interventions in recent systematic reviews in this setting (9, 10, 92). The findings confirm bibliographic studies that indicate that studies examining the effects of strategies to implement evidence-based programmes or polices represent a fraction of public health research studies (33, 93, 94). Greater investment in research, and research infrastructure to support studies to improve dissemination and implementation of effective ECEC -based interventions, is therefore warranted (95). Additionally, the review identified a number of ongoing studies in the area, which will further contribute to the evidence base (see Appendix 5.4).

In many instances, the studies included in the review had small samples (58, 60, 62-64, 67, 69, 70, 72), which may be unable to detect important improvements in policy or practice, a commonly faced challenge reported in the development of the implementation science literature, or they used self-reported measures of implementation. The cost of practice improvements was not assessed in any included studies and only nine studies assessed the impact of interventions on child health behaviours or weight status (41, 58, 62, 67, 69, 72-75). Comprehensive evaluations of future efforts to improve the implementation of health-promoting initiatives targeting excessive weight gain or its determinants in this setting are required to address the limitations identified within the existing evidence base. The use of hybrid designs in future studies, in which implementation outcomes as well as impacts on health behaviours or weight status have been recommended, is one means of achieving this (96).

Half of the included studies developed implementation support strategies without the aid of relevant theory or theoretical frameworks (41, 42, 58, 61, 63-65, 67, 68, 71). Perhaps unsurprisingly, the use of the range of potential strategies, as described in the EPOC taxonomy, was relatively limited by the included studies, and focused often on one-off training or resource provision. Commonly employed modalities, such as face-to-face training, are resource and time intensive, which are unlikely to be amenable to scale. As such, a clear need to identify strategies that are effective, cost-effective and scalable, exists. The factors that influence policy or practice implementation are typically complex. Improvements in implementation may require ongoing changes to systems and processes rather than

fixed discrete support. However, none of the studies included strategies to address other fiscal, political, regulatory or governance factors that could potentially influence the success of implementation efforts. The use of comprehensive theoretical frameworks could assist in considering a broad range of implementation barriers and designing appropriate support strategies to address these (24, 40). Further, future theoretically informed research to identify the mechanism by which support strategies may facilitate implementation would be of particular value to guide future strategy design (97).

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CHAPTER SIX

A SUMMARY OF THESIS FINDINGS, AND IMPLICATIONS FOR FUTURE POLICY, PRACTICE AND RESEARCH

Additional materials in Appendices 6.1–6.2

CHAPTER OVERVIEW

This thesis sought to describe the development, and investigate the potential impact of a web-based implementation intervention to improve Early Childhood Education and Care (ECEC) centre nutrition environments and child dietary intake.

Specifically, the objectives of this thesis were to:

1. Examine the association between ECEC centre healthy eating practices in influencing children's healthy eating behaviours (Chapter Two);
2. Assess the impact and scalability of a web-based implementation intervention aiming to increase child intake of fruit and vegetables within ECEC centres (Chapter Three and Four);
3. Systematically review strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices and programmes within ECEC centres (Chapter Five).

This Chapter seeks to provide a summary of the thesis Chapters and key findings from the studies conducted to address the thesis aims. This Chapter ends with a discussion on the implications of the findings for future policy, practice and research.

SUMMARY OF THESIS FINDINGS

Chapter One: Thesis introduction

Chapter One summarised the rising prevalence of overweight and obesity globally and within Australia, and discussed the increasing burden of disease resulting from the heightened prevalence. Globally, the prevalence of adult obesity (aged ≥18 years) nearly tripled between 1975 and 2016, with 39% of adults estimated to be overweight or obese in 2016 (1). The 2019 Global Burden of Disease study estimated that overweight and obesity resulted in over five million premature deaths and 160 million daily-adjusted life years (DALY) globally, with one DALY representing the loss of the equivalent of one year of full health (2). The prevalence of childhood overweight and obesity has also increased dramatically in recent decades. In 2016, an estimated 41 million children aged 0-5 years were overweight or obese, a substantial rise from 32 million children in 1990 (3). Promisingly, research has indicated that the prevalence of childhood overweight and obesity has potentially begun to plateau in several countries, including Australia, New Zealand, Switzerland and Germany (4-6).

Poor dietary behaviours, including inadequate intake of fruit and vegetables and excessive intake of energy-dense discretionary foods (i.e. foods high in saturated fat, sodium and added sugar), are leading modifiable risk factors of overweight and obesity in childhood (1). To reduce the risk of unhealthy weight gain in children, evidence-based dietary guidelines outlining the types and quantities

of food and beverages to be consumed have been developed for children aged 0-5 years (7-9). Despite the existence of these guidelines, population studies conducted internationally and within Australia have found that children do not meet fruit and vegetable recommendations, whilst over-consuming energy-dense discretionary foods (10-16). Given dietary behaviours developed during childhood track into adulthood (17), nutrition interventions in the early years are recommended (18).

The ECEC setting provides a unique opportunity to influence the development of children's dietary behaviours. Internationally and within Australia, a substantial proportion of children aged 0-6 years attend formal ECEC (i.e. preschool and long day care) for large periods of time (19-21). Chapter One summarised the findings of previous research, which identified numerous components of the ECEC nutrition environment associated with improved child dietary intake, including educators role modelling healthy food choices, staff completion of professional development in nutrition and comprehensive centre nutrition policies (22-25). In response to this, evidence-based policies and practices have been developed, which acknowledge the potential for the ECEC setting to positively influence child dietary intake (26-28). However, evidence has indicated that the implementation of healthy eating policies and practices within the ECEC setting is poor (29-32).

In order for interventions that are aiming to improve the implementation of healthy eating policies and practices to result in population-wide health improvements, they must be scalable (i.e. delivered to a large number of ECEC centres whilst retaining effectiveness). Research suggests, however, that current interventions are designed and delivered in ways that are not amenable to scale up (33). Chapter One concluded by discussing the potential for web-based modalities to provide scalable support to ECEC centres to improve the implementation of healthy eating policies and practices. Despite the promise of using such modalities, only two randomised controlled trials (RCT) have been conducted to test the potential impact of web-based interventions in improving the implementation of healthy eating policies and practices within ECEC centres (34, 35). Although findings of the RCTs were encouraging, both studies were conducted in menu-based centres, that is where centres provide food for children to consume in care (34, 35). The impact of such interventions within centres where parents pack food from home in children's lunchboxes, which represent a substantial proportion of Australian ECEC centres, is unknown.

Based on the evidence summarised and gaps in existing research identified, the introductory Chapter concluded that there is a need for further research in this setting to identify effective strategies that can be implemented at scale to improve the implementation of policies and practices in lunchbox ECEC centres that enhance child dietary intake.

Chapter Two: The association between Australian ECEC centre healthy eating practices and children's healthy eating behaviours: A cross-sectional study within lunchbox centres

Although evidence exists supporting the association between ECEC centre healthy eating practices, such as comprehensive centre nutrition policies regarding food provision and educator role modelling healthy food choices, and child dietary intake in care, the majority of previous studies have been conducted within menu-based centres (22-25). As such, it is unknown whether such associations exist within lunchbox centres, or if other healthy eating practices specific to lunchbox centres (e.g. educators monitoring children's lunchboxes for compliance with dietary guidelines) are likely to influence child dietary intake within these centres.

Chapter Two aimed to address this evidence gap through a cross-sectional study conducted with 448 children from 22 ECEC centres in the Hunter New England region of New South Wales (NSW), Australia. The study aimed to: (1) Describe the foods and beverages consumed by children in care; and (2) Assess the association between centre healthy eating practices and child consumption of fruit and vegetable servings, added sugar (grams (g)), saturated fat (g) and sodium (milligrams (mg)) in care. Child dietary intake was assessed via weighed measurements of lunchbox foods and beverages conducted during a two-day centre site visit. A modified version of the validated Environment and Policy Assessment and Observation (EPAO) tool consisting of an observation of centre environments and review of centre documentation (e.g. nutrition policies) was used to assess centre healthy eating practices (36). The association between healthy eating practices and measures of child dietary intake was assessed using multilevel mixed-effects linear regressions, including a random intercept effect for the centre to account for potential clustering, as well as fixed effects for socioeconomic status and centre locality to account for centre characteristics associated with child dietary intake.

Results of the lunchbox measurements found that children consumed a mean of 0.80 (SD 0.69) servings of fruit, and 0.27 (SD 0.51) servings of vegetables. Children consumed a mean of 8.06g (SD 8.44) of added sugar, 5.57g (SD 3.96) of saturated fat and 668.60mg (SD 328.57) of sodium. Findings from the multilevel mixed-effect linear regressions identified that educators observing children's lunchboxes for consistency with dietary guidelines was significantly associated with increased child dietary intake of fruit (estimate 0.07; SE 0.03; 95%CI 0.02, 0.13; P = 0.01). Additionally, the study found a significant association between centre provision of intentional healthy eating learning experiences (estimate -0.56; SE 0.19; 95%CI-0.97, 0.16; P = 0.01), and centre use of feeding practices supportive of children's healthy eating (estimate -2.02; SE 0.92; 95%CI -3.95, 0.09; P = 0.04) with reduced child dietary intake of saturated fat. The availability of foods packed within children's lunchboxes was also significantly associated with the consumption of such foods (P < 0.01).

The finding that several healthy eating practices, particularly monitoring children's lunchboxes for consistency with dietary guidelines, the provision of healthy eating learning experiences, and the use of supportive educator feeding practices, were associated with improved child dietary intake in care provided evidence for the development of an intervention to support ECEC centres to implement such practices.

Chapter Three: A pilot randomised controlled trial of a web-based implementation intervention to increase child intake of fruit and vegetables within ECEC centres

International and national research indicates that current implementation of ECEC evidence-based healthy eating policies and practices is inadequate (29-32). Web-based approaches provide a potentially effective, scalable and less costly approach to support ECEC centres to implement healthy eating policies and practices (34, 35, 37). Chapter Three described the study methods of a pilot cluster RCT of a web-based implementation intervention to improve child dietary intake in ECEC centres. The study aimed to assess the feasibility of assessing the impact of a web-based program together with health promotion officer (HPO) support, on centre implementation of healthy eating policies and practices.

The 6-month cluster RCT was conducted in 22 ECEC centres within the Hunter New England region of NSW, Australia. Centres were randomly allocated to either a usual care group or an intervention group. Centres allocated to the intervention group received access to a web-based program in addition to HPO support to implement five evidence-based healthy eating practices to improve child dietary intake in care. These practices included: (1) Supporting families to provide healthier foods consistent with dietary guidelines; (2) Provision of intentional learning experiences about healthy eating to children; (3) Use of feeding practices that support children's healthy eating; (4) Staff participation in professional development in healthy eating; and (5) Having a comprehensive written nutrition policy that outlines key healthy eating practices.

The Behavioural Change Wheel (38) was used to identify components of the web-based program in addition to other support strategies employed by HPOs to change ECEC staff behaviour to create supportive nutrition environments. Behavioural change techniques were employed within the intervention to address barriers and enablers to ECEC staff behaviour change (38). Implementation support strategies, defined according to the Expert Recommendations for Implementing Change taxonomy (39), were selected to address barriers to intervention implementation and were incorporated within the web-based program and provided by HPOs. Strategies employed by the web-based program included: audit with feedback; development of a formal implementation blueprint; and the distribution of educational materials. Strategies employed by the HPOs included: identifying and

preparing a centre champion; conducting an educational outreach visit; mandating change via a memorandum of understanding; and providing ongoing consultation and local technical assistance.

The study primary outcomes included the feasibility of the intervention, in addition to uptake, acceptability and appropriateness of the intervention and implementation strategies. Feasibility was assessed through ECEC centre and parent recruitment, and consent rates for each component of data collection. Uptake of the implementation strategies was assessed via Google Analytics (40) and internal records maintained by the research team. Acceptability and appropriateness of the intervention and implementation strategies was assessed via interviews with centre supervisors at follow-up. The cost for health promotion staff to deliver the implementation strategies was calculated by multiplying the time spent (in hours) delivering each strategy by the hourly wage of the HPOs. The cost for centre staff to receive the implementation strategies (i.e. delivered by HPOs and embedded within the web-based program) was calculated by the time spent (in hours) by the hourly wage of nominated supervisors and centre champions. Secondary study outcomes included the implementation of healthy eating practices, assessed via a one-day observation of the centre nutrition environment and review of centre documentation conducted by a trained research assistant at baseline and follow-up. Child dietary intake of fruit and vegetable servings, added sugar, saturated fat and sodium, and food and beverages packed within children's lunchboxes was assessed via lunchbox measurements conducted by two research assistants at baseline and follow-up. The impact of the web-based intervention on the primary and secondary outcomes described above was reported in thesis Chapter Four Part A.

Chapter Four:

- **Part A: Feasibility of a web-based implementation intervention to improve child dietary intake in Early Childhood Education and Care: a pilot randomized controlled trial**
- **Part B: Prioritising scalability during the evaluation of a web-based intervention to improve the implementation of evidence-based healthy eating practices in ECEC centres**

Thesis Chapter Four Part A reported the conduct and findings from the pilot implementation trial described in Chapter Three, whilst Chapter Four Part B described a novel approach undertaken to evaluate the potential scalability of the suite of implementation strategies employed within the trial. This trial originally intended to pilot the potential impact of the web-based implementation intervention, while examining the impact of the intervention on child dietary intake in care. However, due to restrictions impacting follow-up data collection as a result of COVID-19, centre site visits and child dietary assessments could not be undertaken as originally proposed. Therefore, Chapter Four Part A reported on the main implementation outcomes as originally proposed.

1. *Feasibility:* Twenty-two of the 57 centres approached for the study (47%) provided consent to participate, with all centres (n=22) completing the study data collection components.

2. *Uptake of the implementation strategies*: high uptake was observed for implementation strategies provided by HPOs (91-100%) and the web-based program (100%). Fifty-six percent of intervention centres (n=6) returned a signed memorandum of understanding and nominated a staff member as centre champion. Intervention centres logged in to the web-based program an average of 5.18 (SD 2.52) times, spending an average of 19.90 (SD 11.21) minutes in the program per login.
3. *Acceptability and appropriateness of the intervention and implementation strategies*: The web-based program and implementation strategies were highly acceptable (91-100%), and 100% of centres considered the intervention to be suitable and applicable.
4. *Cost for HPOs to deliver the implementation strategies:* The direct cost for HPOs to deliver the implementation strategies was $1351.25 (average per centre: $122.84). The total cost to centres for nominated supervisors and centre champions to receive all implementation strategies was $1516.40 (average per centre: $137.85).
5. *Implementation of healthy eating practices within the intervention group:* Implementation of four out of the five healthy eating practices improved in the intervention group, ranging from 18.7% to 63.64%.

Findings reported in Chapter Four Part A suggest that the web-based intervention and the majority of implementation strategies were highly feasible, low cost and acceptable to centre staff – important characteristics for successfully delivering the intervention at scale. The pragmatic and novel approach described in Chapter Four Part B to evaluate the potential scalablity of the implementation strategy further highlighted the amenability of the strategy for scale up. Using an adapted version of the Intervention Scalability Assessment Tool (ISAT) developed by Milat et al. (41), a working group consisting of research team members and experienced health promotion staff completed an assessment to determine the potential scalability of the implementation strategies. In addition to the promising findings reported within the pilot implementation trial (Chapter Four Part A), findings from the scalability assessment indicated that the implementation has several attributes that are amenable to large scale application, receiving the maximum score in six of the 10 ISAT domains (41). Given limited research efforts to date have focused on the attributes of implementation strategies in supporting scale-up of public health interventions, findings from Chapter Four Part B are particularly novel.

Collectively, the findings from Chapter Four provide important insight for the development of future ECEC-based interventions to improve the implementation of evidence-based healthy eating policies and practices at scale. Promisingly, the study found large improvements in implementation of four of the five practices, despite the relatively low level of support provided to centres to use the web-based program. However, a decrease in centres supporting families to provide healthier foods consistent with dietary guidelines was of concern given parents are those responsible for increasing the

availability of healthier foods in children's lunchboxes. This decline could potentially be explained by prioritising the distribution of important COVID-19 information to parents during the intervention period. It may also suggest that more potent strategies are required to support centres to engage with parents, thus improving implementation of this practice. As this was a pilot trial, a fully-powered implementation trial addressing such limitations, whilst considering the usefulness of those implementation strategies that experienced lower uptake, and incorporating targeted strategies to actively engage parents is required to provide an estimate of the impact of the implementation intervention at scale.

Chapter Five: Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within ECEC centres

Without adequate implementation of evidence-based ECEC healthy eating policies and practices, the true public health benefits of such policies and practices will not be fully realised. Chapter Five described an updated Cochrane systematic review conducted to examine the effectiveness of strategies aimed at improving the implementation of healthy eating, physical activity and obesity-prevention policies, practices and programmes within ECEC centres. Due to the increasing amount of implementation research being conducted in the ECEC setting, an update of the original Cochrane systematic review by Wolfenden et al. published in 2016 was required to reflect the current state of the evidence (33). Consistent with the original review, studies with a parallel control group that compared any strategy to improve the implementation of a healthy eating, physical activity or obesity prevention policy, practice or programme by ECEC centres to no intervention, 'usual' practice or an alternative strategy were included. A search of electronic databases in addition to a handsearch of key implementation journals, trial registries and reference lists of included studies was undertaken. The review was conducted following Cochrane systematic review methodology (42), with two authors independently screening titles and abstracts, extracting data and assessing risk of bias. Meta-analyses were performed using a random-effects model where studies with suitable data and homogeneity were identified.

In addition to the 10 trials included in the 2016 review, a further 11 trials were identified as eligible. Collectively, the 21 trials sought to improve the implementation of policies and practices targeting healthy eating (six trials), physical activity (three trials) or both healthy eating and physical activity (12 trials). A range of implementation strategies were tested in the 21 trials, including educational meetings and educational materials (tested within 17 of the 21 studies). Nine studies using score-based measures of implementation were included in pooled analysis, indicating a significant improvement in implementation outcomes (SMD 0.49; 95%CI 0.19-0.79; $I^2 = 54\%$; $P < 0.001$; moderate-certainty evidence). Ten studies used dichotomous measures of implementation, with seven

of these included in pooled analysis indicating a non-significant improvement in implementation (OR 1.83; 95%CI 0.81-4.11; I^2 = 51%; P = 0.14; low-certainty evidence).

Findings of the review suggest that overall, the implementation support strategies tested across the 21 studies did improve the implementation of policies and practices within ECEC centres. Despite showing promise, the majority of studies (n=20) employed face-to-face training and other resource-intensive implementation strategies to support centre staff to implement policies and practices. Although potentially effective within smaller studies, the feasibility of employing such resource-intensive support strategies at scale is minimal. Additionally, only two studies within the review sought to implement healthy eating policies and practices at scale (i.e. studies with a sample size of at least 50 centres), both of which had mixed effects on implementation. As such, it is evident that there is considerable scope for further high-quality research to determine the strategies required to improve the implementation of healthy eating policies and practices within the ECEC setting at scale, similar to the web-based intervention developed within this thesis.

IMPLICATIONS FOR FUTURE POLICY, PRACTICE AND RESEARCH TO IMPROVE THE IMPLEMENTATION OF EVIDENCE-BASED HEALTHY EATING PRACTICES WITHIN THE ECEC SETTING AT SCALE

The findings and limitations detailed within this thesis provide substantial guidance for the development of future ECEC-based interventions aimed at improving the implementation and impact of evidence-based healthy eating policies and practices. As the ambition of this program of work is to contribute to the achievement of population-wide improvements in public health nutrition, we have first couched our reflections on the implication for research and practice in-terms of maximising the impact that can be achieved 'at scale' by considering attributes of both the intervention and implementation strategy. We then discuss the implications of involving parents within ECEC-based nutrition interventions in order to maximise the impact of such interventions on centre implementation of healthy eating practices, thus child dietary intake, in care.

Maximising impact by considering attributes of an intervention

Research over recent decades has identified numerous public health nutrition interventions that have been effective in improving child dietary outcomes (43). However, in order for public health nutrition interventions to result in real-world health improvements, they must have the ability to be delivered on a population level. Scalability is defined as *the ability of an intervention shown to be efficacious on a small scale to be expanded under real-world conditions to reach a greater proportion of the eligible population, whilst retaining effectiveness* (44). Leading health agencies, including the WHO,

encourage the scaling up of efficacious public health interventions in order to maximise return on investment (18). Despite such recommendations, many nutrition interventions have been designed and trialled under research conditions, and require resources, expertise and infrastructure for delivery that are not readily available in the ECEC setting (43). This includes much of the research underpinning the 'evidence' based practices for early childhood nutrition examined in Chapter Two. Such interventions often require considerable adaptation by end-users to suit the local context and target population groups, or to align with the infrastructure available to deliver across populations (i.e. organisational, human and financial) (44-46).

Adaptations to interventions as part of the scale-up process may lead to an attenuation in their effects (47, 48). For example, a recent systematic review by McCrabb et al. described the differences in effects of 10 obesity-prevention interventions prior to and following scale-up (48). The review found that all interventions were adapted prior to scale-up, and the effects of scaled-up interventions were typically 75% or less of those reported in the pre-scaled trials of their effectiveness (48). Adaptations and effect attenuation are also evident in ECEC-based interventions that have been delivered at scale. For example, a cluster RCT by Adams et al. (2010) of a healthy eating and physical activity promotion programme in Australian preschools reported significant improvements in fruit and vegetable consumption, as well as a significant decrease in child intake of energy dense nutrient poor foods (49). However, an evaluation of its impacts during a subsequent state-wide roll-out of the programme resulted in no significant improvements in any child dietary intake outcomes assessed (50). Similarly, despite positive findings from an RCT by Ward et al. (2008) regarding healthy food provision to children by staff of U.S. ECEC centres, such effects were not evident in an evaluation of the scale-up of an adapted version of the programme in 82 ECEC centres in North Carolina (51, 52).

This highlights the need to consider intervention scalability during the development and evaluation of public health programmes, thus ensuring ECEC-based interventions are amenable to scale and ultimately selected by end-users (53). It also points to an important deficiency of research undertaken in this thesis, that is, the lack of formal appraisal of the 'scalability' of the healthy eating practices prior to their selection and inclusion as the focus of implementation efforts in Chapters Three and Four. Several scalability frameworks exist to provide guidance to researchers and practitioners to appraise the potential scalability of interventions, and have identified numerous characteristics likely to influence scalability (41, 53-55). For example, the Intervention Scalability Assessment Tool (ISAT) developed by Milat et al. summarises the characteristics of the scale-up context and implementation requirements in 10 domains, including: strategic and political contextual factors; evidence of effectiveness, costs and benefits; fidelity and adaptation; reach and acceptability; delivery settings and workforce; implementation infrastructure; and the sustainability of the intervention (41). However, few studies report data on measures of these outcomes to enable such an appraisal. For example, a 2019 Cochrane systematic review by Brown et al. examined the effectiveness of obesity-prevention

interventions targeting children, with 22 of the 153 RCTs conducted within the ECEC setting (56). In addition to extracting data to examine the effect of the interventions on child weight outcomes, authors of the review sought to extract process-level outcomes, many of which broadly align with the domains of scalability described above (56). Disappointingly, only half of the studies conducted within the ECEC setting reported data on such outcomes, with seven (32%) studies reporting on intervention fidelity and four studies reporting on intervention cost (18%) (56). Given the lack of reporting on characteristics of scalability within existing interventions, end-users are instead forced to select interventions for testing and subsequent implementation at scale without sufficient evidence to enable them to do so.

In the context of this thesis, the collection of local-level data to assess the scalability of a range of practices may have led to selection of different healthy eating policies or practices subject to the implementation trial in Chapters Three and Four. Importantly, it may also explain, in part, the difference in the relative improvements in implementation of the five practices targeted following the provision of implementation support in this study. Specifically, effects were greater for healthy eating practices that are likely to be considered scalable and less complex, such as staff completion rates of professional development targeting nutrition which was delivered online. Given one of the five healthy eating practices failed to result in improvement in the context of a small pilot, it may be less amenable to implementation at scale. In the absence of data on the scalability attributes of ECEC-based nutrition interventions, the collection of such evidence as part of this thesis may have made an important contribution to the existing evidence base. To improve the selection of interventions to maximise their potential to be implemented at scale, the consolidation and updating of evidence of the characteristics of scalability for ECEC-based nutrition interventions needs to occur.

This could be achieved by conducting a living systematic review to collate data from original reports and process evaluations of current ECEC-based nutrition interventions that include an assessment of the characteristics of scalability. Living systematic reviews are underpinned by continual, active monitoring of the evidence (e.g. monthly database searches) and immediately incorporate any new relevant evidence that is identified (57). Currently, no continual collation of such evidence through the form of a living systematic review or other resource exists for the characteristics of scalability of ECEC-based (or broader) interventions. Equivalent resources are available, however, for other programmes of work (58). For example, the National Cancer Institute's (NCI) Evidence-Based Cancer Control Programs (EBCCP) contains a database of cancer-prevention programmes which is continually updated to reflect the current state of the evidence (58). The NCI recently redesigned the database following a focused needs assessment with stakeholders to advance usability and stimulate the uptake of evidence-based intervention programmes. The database is now categorised into broad area topics (e.g. screening, informed decision making), and details the population focus, delivery location and description of each programme (58, 59). Given this current evidence gap, and the

potential usefulness of an analogous resource, the National Centre of Implementation Science is considering the development of such a resource to facilitate the informed scale-up of chronic disease prevention programmes in community settings, including those pertaining to nutrition interventions in ECEC (60).

Given the inadequate reporting of the characteristics of scalability within existing studies, a clear need for the development of standard definitions of these concepts and measures exists. Specifically, researchers should consider the development of a taxonomy to ensure consistent reporting and description of the characteristics of scalability across interventions. Similar taxonomies already exist for the implementation science and behaviour change fields (39, 61). For example, the Expert Recommendations for Implementing Change (ERIC) taxonomy was developed to address the inconsistent language and poor descriptions of implementation strategies employed within previous literature (39). The ERIC taxonomy consists of a refined compilation of terms and definitions systematically developed following input from a range of implementation science and clinical practice experts (39). Developing a similar taxonomy for scalability has the ability to improve the frequency and consistency of reporting of the characteristics of scalability of future interventions.

Further, development of validated tools to assess the scalability constructs appears warranted. A recent review by Charif et al. identified 11 tools which aimed to assess the scalability of health innovations (62). Across the 11 tools, 11 components (or domains) of scalability were identified (62). However, authors of the review concluded that the existing tools provide limited usefulness for assessing the scalability of health innovations (62). A lack of guidance on the intended application of the tools, including the context (e.g. public health versus clinical settings), in addition to inadequate development quality (i.e. non-validated), was identified as key limitations of the current evidence base (62). The ISAT was specifically developed to assess scalability dimensions in Australian health promotion programmes (41). The tool however, was designed to support practitioners and policy-makers in making systematic assessments of the suitability of public health interventions for scale-up, and has been appraised by end-users as a useful tool to assist with scale-up decisions (41). Nonetheless, the lack of validated measures that are appropriate to evaluate the characteristics of scalability broadly, or ECEC-based interventions specifically, curtails opportunities to develop the science of scale-up and should be a priority research area to move the field forward.

Maximising impact by considering attributes of an implementation strategy

While there has been limited research regarding the characteristics of interventions that facilitate population-wide implementation, far less research attention has focussed on the attributes of implementation strategies in supporting scale-up of public health interventions, including those in ECEC (63). In addition to examining strategies to improve the implementation of healthy eating policies and practices within ECEC centres, the systematic review within Chapter Five also examined

the cost, acceptability, adoption, reach, sustainability and appropriateness of the implementation support tested in the included trials. We believe that this is one of few reviews to synthesise this data on the implementation strategies, and the first to do so in the ECEC setting. Of the 18 studies that aimed to improve the implementation of healthy eating policies and practices, only five reported on acceptability and nine reported on penetration, whilst none reported on adoption, sustainability or appropriateness. No studies examined the cost to deliver implementation strategies - crucial information for policy makers and funders to determine if sufficient financial resource exists to execute the tested implementation strategies. Further, only two studies tested the impact of the intervention at scale (defined within the review as more than 50 centres), with mixed effects. As such, evidence from within the review provides little direction into the types of implementation strategies that should be selected in order to assist the delivery of ECEC-based implementation interventions at scale. The findings are consistent with an earlier review of the attributes of implementation strategies relevant to scale-up across a broad range of community settings including schools, workplaces and sporting clubs (64). The review of 40 implementation studies found that less than half reported on intervention adoption (33%), appropriateness (28%), acceptability (20%), cost (8%) and sustainability (5%) (64).

Given the limited evidence base regarding the scalability attributes of implementation strategies, there was a strong emphasis on scalability during the evaluation of the pilot implementation trial described within Chapters Three and Four. Adapting the ISAT tool developed by Milat et al. to focus on selected attributes of the implementation strategy rather than the intervention enabled the research team to evaluate the potential scalability of the implementation strategies (41). As described in Chapter Four Part B, the scalability assessment undertaken by the internal working group, consisting of research team members and experienced health promotion staff, indicated that the web-based implementation strategy was highly amenable to support scale-up. Evaluation of the implementation strategies reported in Chapter Four Part A found that they were relatively low cost for health promotion staff to deliver, and uptake was high (100%) for all implementation strategies embedded within the web-based program. Engagement with the web-based program was consistent with what was hypothesised by the research team. Lastly, almost all centres (91%) reported that using the web-based program was useful in helping centres to meet healthy eating practices and the implementation support strategies were highly acceptable (91-100%) to centre supervisors.

Although findings of the scalability assessment indicate that the implementation has attributes that are amenable to large scale application, future research is required to confirm this hypothesis. Indeed, the scale-up of the healthy eating practices described in Chapters Three and Four will be undertaken with the support of the implementation strategy tested by the Hunter New England local health district. The approach undertaken by the research team to assess the scalability of the implementation strategy was a pragmatic way of providing guidance to researchers and practitioners for the planning of future

scalable interventions. However the limitations of the scalability assessment, including the use of the ISAT as a research tool (described above), remain. Additionally, scalability was only assessed in one NSW local health district with a small number of health promotion practitioners and ECEC centres. Further research examining the generalisability of scalability assessments is therefore warranted.

Findings from this body of research suggest that web-based modalities have considerable potential as a strategy to support the implementation of healthy eating policies and practices by ECEC centres at scale. Although relatively novel, such approaches are beginning to be investigated in this setting (34, 35). For example, Ward et al. (2017) examined the impact of a pilot web-based program used to execute multiple implementation strategies, on the implementation of healthy eating policies and practices within 31 ECEC centres in the U.S (34). Although the improvements in centre nutrition environments reported by the trial were not statistically significant, centre supervisors indicated that the implementation strategies embedded within the web-based program were highly acceptable (34). Specifically, the automatically generated audit with feedback strategy was well received by supervisors as a method of identifying improvement areas, and the web-based development of a formal implementation blueprint was reported as positively impacting centre staff's ability to plan and accomplish goals (34). Given the encouraging findings, the researchers are conducting a fully-powered cluster-RCT to examine its impact (65). Similarly, web-based modalities to support the implementation of dietary guidelines by ECEC centre menu planners have been reported as a cost-effective approach to improving the foods consumed by children in care (35, 37, 66).

However, employing web-based approaches to support implementation can also bring challenges that are unique to traditional approaches. The use of web-based programs often require end-users to adopt new systems, with the impact of such interventions dependent on sufficient levels of engagement. This has been explored within the broader context of my PhD research program through a systematic review which found positive associations between digital health intervention engagement and nutrition behaviour (67). The barriers and enablers to the adoption of digital health interventions at scale to support the implementation of healthy eating practices within the ECEC setting have also been explored within the context of my PhD research program through a cross-sectional study with 407 Australian ECEC centres (Appendix 6.1) (68). Employing a purpose built measure based on the non-adoption, abandonment, scale-up, spread, and sustainability (NASSS) of health and care technologies framework by Greenhalgh et al. (68, 69), the study found a substantial portion of ECEC centres have high intentions to adopt a digital health intervention to support implementation (58.9%, n=229) (68). A number of barriers and enablers to adoption were evident, for example, the changes needed to centres' current practice (e.g. staff roles) was identified as a barrier to adoption, whilst centres' capacity to innovate (e.g. staff available to drive adoption), ease of adoption decision and identifying work and staff involved in implementation (e.g. existing staff to support adoption) were enablers to adoption (68). Similar factors may have been influential in the challenges of adoption and

uptake of the web-based program and implementation strategies in Chapters Three and Four. For example, the relatively low uptake of centre champion strategy may have been due to a lack of staff available to drive adoption of the web-based program, whilst variable levels engagement with the web-based program (although good overall) in some centres may be due to a reluctance or inability of those centres to make changes to current practice through adopting the program. However, there is a notable lack of qualitative data available to understand the barriers and facilitators to the adoption of web-based health promotion programmes within ECEC centres. Such data would help contextualise efforts to support the development and adoption of these programmes within ECEC centres and inform the selection of appropriate implementation strategies. Therefore, greater use of qualitative and mixed method research designs to investigate embedding strategies to maximise adoption and engagement with web-based modalities, potentially via targeting those components identified by Grady et al. as enabling adoption, is crucial given the increased reliance on such technologies to enhance impact at scale.

A novel approach to address potential barriers to the adoption of such web-based modalities is to embed these systems within existing technologies routinely used by ECEC centre staff. This has been explored within the context of my PhD research program through the development of a menu planning program to support the implementation of dietary guidelines by ECEC centre menu planners that was linked to existing ECEC management software mandated by the Australian Commonwealth Government (35, 70) (Appendix 6.2). An RCT evaluating the web-based program in 54 ECEC centres within NSW, Australia, found the web-based program was highly acceptable to centre staff, improved the foods consumed by children in care, and is cost-effective way of doing so (35, 37, 66). As such, the web-based program was funded by the Australian Commonwealth Government and is universally available to ECEC centres in this country. The integration of the web-based program developed in this thesis within such ECEC systems may enhance both its effect and potential scalability, and as such, should be explored in future research.

Enhanced involvement of parents within multi-component ECEC-based interventions

A recurrent theme emerging from within this body of research is the influence of parents on child dietary intake in care and ECEC centre implementation of evidence-based healthy eating practices. Findings from the cross-sectional study within Chapter Two demonstrated a statistically significant association between the availability of foods packed by parents and/or guardians within children's lunchboxes to consume in care and child dietary intake of such food items ($P < 0.01$), however no association between centres communicating with parents regarding lunchbox contents and child dietary intake of fruit and vegetable servings was observed (ES 0.00). Within Chapter Four Part A, findings of the pilot implementation trial demonstrated that implementation of the four of the five healthy eating practices improved at follow-up. However, centres supporting families to provide

healthier foods consistent with dietary guidelines (e.g. centre staff monitoring children's lunchboxes and distributing nutrition-focused messages to parents) decreased from 81.2% to 54.6%, which may impact the type of foods packed in children's lunchboxes.

Such findings suggest that strategies directly targeting parents should be developed and employed within future studies in order to support centre implementation of parent-targeted healthy eating practices and improve child dietary intake in care. This is consistent with evidence from recent reviews which examined the effectiveness of interventions aimed at improving child nutrition outcomes within the ECEC setting (43, 71). The umbrella review by Matweijkck et al. (2018) examined the characteristics of interventions promoting healthy eating for preschool aged children in ECEC settings (43). Interventions effective in improving child dietary intake were multi-component (i.e. targeted centre environmental-level and individual-level factors) and employed strategies targeting parents, with improvements in child dietary intake greater in studies with higher levels of parent involvement (43). Centre environmental-level factors included changes to centre nutrition policies, and educator mealtime practices, whilst individual-level factors included changes to the knowledge, skills and capacity of educators, children and parents. Multi-component interventions targeting centre environmental-level factors consistently reported improvements in fruit and vegetables offered to children, and fewer discretionary foods provided. Within these multi-component interventions, individual-level strategies which actively targeted parents included parent participation in interactive activities at the centre, completing homework tasks and attending education sessions or workshops (43). These strategies are largely in contrast to the passive strategies to involve parents employed within the pilot implementation trial in Chapter Three and Four, which predominately consisted of written materials disseminated to parents via ECEC centres. As such, it is possible that the inclusion of active strategies targeting parents within the pilot implementation trial may be needed to improve parent lunchbox packing behaviours (i.e. availability), thus child dietary intake (43).

Findings of the review by Matweijkck et al. were analogous to a recent systematic review by Nathan et al. (2020) which specifically examined the effectiveness of lunchbox interventions on improving the foods and beverages packed and consumed by children (71). The review included four studies (two RCTs, two non-randomised) conducted within the ECEC setting (71). Collectively, findings from both reviews and limitations from research conducted within this thesis indicate that active strategies targeting parents may be needed to improve the impact of future interventions on child dietary intake (43, 71). Further, embedding additional implementation strategies to increase ECEC centre communication with parents regarding lunchbox practices may also be warranted. The expansion of the web-based program to include modules directly targeting parents may also increase the potential impact of the intervention on parent lunchbox packing behaviours. In addition to embedding implementation strategies within interventions to target parents, formative research with

parents is required to adequately understand barriers to healthy lunchbox practices, as well as developing strategies to address such barriers that are appropriate for delivery in the ECEC context.

To our knowledge, only one RCT has assessed the impact of a website and app-based intervention on parent lunchbox packing behaviours within the ECEC setting. A cluster RCT by Pond et al. (2019) examined the impact of a nutrition intervention embedded within a mobile communication app on improving the foods packed within children's lunchboxes (72). The study used an existing centre-based mobile communication app to engage with parents and disseminate evidence-based nutrition messages relating to lunchbox packing behaviours to families (72). Push notifications delivered to parents via the app incorporated a combination of passive (e.g. nutrition-related factsheets) and active strategies (e.g. videos with activities) to target barriers to packing healthy foods within children's lunchboxes. Given the study findings are yet to be published, the effectiveness of employing this novel approach to involve parents within ECEC-based nutrition interventions in order to improve lunchbox packing behaviours and child dietary intake in care, is yet to be determined.

Beyond ECEC, a recent systematic evaluation of digital health promotion websites and apps for supporting parents to influence children's nutrition identified several effective school and home-based interventions (73). The review examining the effectiveness of digital platforms to improve nutrition in children identified eight studies and found that digital nutrition interventions targeting parents were typically effective in improving child nutrition outcomes (73). For example, of the seven studies that included fruit and vegetable intake as an outcome, five studies reported improvements in child intake (73). The systematic evaluation by Zarnowiecki et al. identified 11 studies that assessed parents preferred content, features and functionality of digital platforms to improve nutrition in children and parents (73). Parents reported a need for age-appropriate and practical information that support behaviour changes, in addition to functionalities such as the ability to set goals and receive feedback on progress, and have access to interactive features such as cooking videos and quizzes (73). Zarnowiecki et al. concluded that research employing digital platforms to target parent packing behaviours to improve child nutrition outcomes should go beyond solely using passive strategies to target parents, such as providing information about dietary changes, instead including information from trusted sources, interactivity and tailored feedback (73). As the web-based program employed within the pilot implementation trial in Chapters Three and Four incorporated the majority of the functionalities preferred by parents described above but instead targeted centre staff, future iterations and evaluation of the program where parents can directly access the information online is warranted. Future studies should examine the use of digital modalities, incorporating information from trusted sources, interactivity and tailored feedback, to provide scalable support to parents in order to improve the contents of children's lunchboxes, thus child dietary intake in care.

CONCLUSION

This thesis sought to describe the development, and investigate the potential impact of a web-based implementation intervention to improve ECEC centre environments and child dietary intake. The evidence presented within this thesis suggests that the web-based implementation intervention is a feasible, low-cost, highly acceptable and potentially effective approach to providing scalable support to ECEC centres to improve the implementation of evidence-based healthy eating practices. However, further research is needed to determine the amenability of the healthy eating practices for scale prior to large scale implementation. The body of research highlights the limited evidence to support the implementation of healthy eating practices at scale that exists in the current evidence base. As such, greater measurement tools and standardised reporting of the characteristics of scalability within future studies should be a priority research area to move the field forward. Whilst web-based modalities are a potentially effective and scalable approach to supporting implementation within the ECEC setting, deliberate strategies to maximise adoption, thus maximising impact on child dietary intake, need to be incorporated within future interventions. Additionally, modifications to the implementation intervention to consider scalability of the evidence-based nutrition programs and engagement with parents are needed in future iterations of the web-based program.

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APPENDICES

Office of Graduate Studies
Information Sheet
Thesis by Publication

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

A thesis may be submitted in the form of a series of published papers and the additional rules specific to this style of thesis are presented below. **It is important to note that the general rules for a University of Newcastle thesis are also applicable. Please ensure you also refer to** The Rules Governing Research Higher Degrees for the full scope of applicable rules.

Rule 39.1 A thesis by publication will include:

i. a full explanatory overview that links the separate papers and places them in the context of an established body of knowledge;
ii. a literature review;
iii. if detailed data and descriptions of methods are not otherwise given within the separate papers, they must be included in the body of the thesis or as appendices to the thesis;

Rule 39.2 For a thesis by publication:

i. the separate papers provided under sub-clause 39.1(i) must be published, in press or submitted to scholarly media only, i.e. refereed publications classified by current national standards and refereed conference papers, however at least 50% of these papers must have been published. Papers published up to three years prior to enrolment may be included provided they were published in scholarly media and do not represent more than 50% of the total papers;
ii. publications submitted by the candidate for another degree may only be referred to in the thesis literature review;
iii. the number of papers submitted should demonstrate that the body of work meets the requirements of the degree as outlined in the relevant schedule;
iv. the candidate must be the lead author in at least 50% of the papers written in the time of their formal Research Higher Degree candidature. Any published paper of which the candidate is a joint author may only be included in the thesis provided the work done by the candidate is clearly identified. The candidate must include in the thesis a written statement from each co-author attesting to the candidate's contribution to a joint publication included as part of the thesis. These statements must be endorsed by the Assistant Dean (Research Training).
v. the Assistant Dean (Research Training) may seek the approval of the Dean of Graduate Studies to include a paper that is outside the scope of these rules.

Office of Graduate Studies, East Wing, The Chancellery
Telephone: (02) 4921 6537 Fax: (02) 4921 6908 Email: research@newcastle.edu.au

Considerations

- Each discipline area will have different issues to consider in the decision to submit a thesis in the form of a series of published papers.
- It is essential that you discuss your options carefully with your supervisor(s). The thesis by publication must reflect a sustained and cohesive theme, an integrated whole that sits logically in the context of the available literature. Overall the material presented for examination needs to equate to that which would otherwise be presented in the traditional thesis format.
- The review process for some journals is significant resulting in lengthy waiting periods for papers to be accepted and this can delay thesis submission/completion. Time management and selection of journals/publishers is critical. Focusing on publication rather than research may lead to candidates being tempted to publish sections of their work prematurely and missing opportunities to fully capitalize on the significance of the work.
- Consider the thesis from the examiners' view point - if the publications do not have a clear cohesion and the contribution to knowledge is not clearly demonstrated, then the thesis may attract criticism and be rejected by examiners. The content of the thesis remains a matter of professional judgment for the supervisor(s) and candidate.
- Any published paper of which the candidate is a joint author may only be included in the thesis provided the work done by the candidate is clearly identified. The candidate must include in the thesis a written statement from each co-author attesting to the candidate's contribution to a joint publication included as part of the thesis. The statement/s need to be signed by the Faculty Assistant Dean (Research Training). A sample statement is provided below.
- We strongly advise that you arrange for the signatures from co-authors to be collected as soon as the paper is prepared or submitted for publication rather than trying to collect them at the time of thesis submission.
- There is no minimum or maximum requirement on the number of papers. Of equal, or perhaps more importance than quantity, is the quality of the journals. Please refer to your school or faculty for more specific guidance on the number and length of papers that would normally be expected in your discipline.

Alternative option

As discussed above, you need to consider if your publications will form a sufficient body of cohesive work to meet the requirements of thesis by publication. You may like to consider the other option of including publications within a standard thesis format, either in the body or as an appendix as supported in the rule below.

Rule 38.5. A thesis may:

i. Include publications arising as a consequence of the research undertaken for a thesis.
When the candidate includes a co-authored published paper or co-authored scholarly work, or a substantive component of a co-authored published paper or co-authored scholarly work in the body of the thesis, the candidate must include in the thesis a written statement attesting to their contribution to the joint publication. This statement must be signed by the supervisor. A statement is not required when publications are included as an appendix to the thesis.

Components and Layout

PLEASE NOTE: the layout and ordering of the contents is flexible and should be based on the judgement and experience of candidates and supervisors as well as discipline norms. Please use your own discretion and seek expert advice. The following is a suggested layout only.

1. **Title Page**

2. **Declarations**

   Originality
   I hereby certify that to the best of my knowledge and belief this thesis is my own work and contains no material previously published or written by another person except where due references and acknowledgements are made. It contains no material which has been previously submitted by me for the award of any other degree or diploma in any university or other tertiary institution.

   Thesis by Publication
   *I hereby certify that this thesis is in the form of a series of *papers. I have included as part of the thesis a written statement from each co-author, endorsed in writing by the Faculty Assistant Dean (Research Training), attesting to my contribution to any jointly authored papers. (*Refer to clause 39.2 of the Rules Governing Research Higher Degrees for acceptable papers).*

3. **Acknowledgements**

4. **List of publications included as part of the thesis**

   4.1 List all of the included published work with the full bibliographic citations in the order they appear in the thesis.

   4.2 Provide a statement to indicate that where necessary permission regarding copyright has been obtained from copyright owners. For example, the statement may say "I warrant that I have obtained, where necessary, permission from the copyright owners to use any third party copyright material reproduced in the thesis (e.g. questionnaires, artwork, unpublished letters), or to use any of my own published work (e.g. journal articles) in which the copyright is held by another party (e.g. publisher, co-author)."

5. **Table of Contents**

6. **Abstract**

   An abstract of approximately 300 words is required to describe the content of the thesis.

7. **Overview**

   A full explanatory overview is required to link the published papers to the research thesis. This may include sections for Literature Review (if not included separately), Research Design and Review/Discussion. Not all of these sections may be necessary. **Choose the format that underpins the academic argument so that the contents of the thesis are established as a substantial and significant body of work, but without unnecessary repetition.**

8. **Literature Review**

3

9. Statement of Contribution of Others

In the thesis, at the front of each paper, include a written statement from each co-author attesting to the candidate's contribution to a joint publication included as part of the thesis. The purpose of this statement is to summarise and clearly identify the nature and extent of the intellectual input by the candidate and any co-authors.

9.1 Sample co-author statement

By signing below I confirm that [Candidate Name] contributed [insert outline of contribution]) to the paper/publication entitled [insert reference details].

List:
Full Name of Co-Author/s, Date, Signature of Co-Authors

Full Name of Faculty Assistant Dean Research Training, Date, Signature

10. Papers/Chapters

Each paper/chapter should have an introduction to explain how it contributes to the overall body of knowledge. It is not necessary to reformat published papers in the thesis. Where appropriate publications can be included in full or in parts thereof.

11. Appendices

12. Bibliography

4

Health
Hunter New England
Local Health District

16 April 2019

Dr L Wolfenden
Population Health
Wallsend Campus

Dear Dr Wolfenden

Re: HNE Kids Healthy Eating and Physical Activity Program (06/07/26/4.04)

Thank you for submitting a request for an amendment to the above project. This amendment was reviewed by the Hunter New England Human Research Ethics Committee. This Human Research Ethics Committee is constituted and operates in accordance with the National Health and Medical Research Council's *National Statement on Ethical Conduct in Human Research, 2007 (updated 2018)* (National Statement) and the *CPMP/ICH Note for Guidance on Good Clinical Practice*. Further, this Committee has been certified under the National Health and Medical Research Council's *National Certification Scheme for the Ethical Review of Multi-Centre Human Research*.

I am pleased to advise that the Hunter New England Human Research Ethics Committee has determined the variation meets the requirements of the National Statement and has granted ethical approval for the following amendment requests:

Document	Version	Date
Parent Information Statement	1	29 March 2019
Parent Consent Form	1	29 March 2019
Nominated Supervisor information Statement	1	29 March 2019
Nominated Supervisor consent form	1	29 March 2019
Baseline Nominated Supervisors CATI	2	11 April 2019
Follow Up Nominated Supervisors CATI	2	11 April 2019
Information collected from Nominated Supervisors during recruitment	1	29 March 2019
EPAO data collection form	1	29 March 2019
Lunchbox data collection form	1	29 March 2019
Follow up service champion CATI	2	11 April 2019
Intervention fidelity record	1	29 March 2019

- To provide ECEC services with support to improve child dietary intake in care via the implementation of healthy eating policies and practices;
- To conduct a computer assisted telephone interview (CATI) with Nominated Supervisors at baseline and approximately 6 months follow up;

Hunter New England Research Ethics & Governance Office
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http://www.hnehealth.nsw.gov.au/ethics/Pages/Research-Ethics-and-Governance-Unit.aspx

- To conduct a computer assisted telephone interview (CATI) with service champions at approximately 6 months follow up;
- To undertake site visits to assess children's food intake in care at baseline and approximately 6 months follow up;
- To undertake observations of services' healthy eating policies and practices;
- To obtain analytics data from the web-based program;
- For the addition of Ms Courtney Barnes as student researcher

Approval has been granted for this study to take place at the following site:

- **Hunter New England Local Health District**

The National Statement, which the Committee is obliged to adhere to, include the requirement that the committee monitors the research protocols it has approved. **Ethics Approval will be for 5 years and subject to the following conditions:**

- A report on the progress of the above protocol is to be submitted at 12 monthly intervals. A proforma for the annual report will be sent at the beginning of the month of the anniversary of approval. Your review date is **November 2019.**
- All variations or amendments to this protocol must be forwarded to and approved by the Hunter New England Human Research Ethics Committee prior to their implementation.
- A final report must be submitted at the completion of the above protocol, that is, after data analysis has been completed and a final report compiled.
- Adhere to the safety reporting requirements of the NHMRC Safety Monitoring and Reporting Guidance for Therapeutic Goods Trials (November 2016) available at https://www.nhmrc.gov.au/_files_nhmrc/file/publications/16469_nhmrc_-_ahec_position_statement-web.pdf
- If for some reason the above protocol does not commence (for example it does not receive funding); is suspended or discontinued, please inform Dr Nicole Gerrand as soon as possible.
- If the study has not been completed by **November 2019** a Renewal Application will be required.

The Hunter New England Human Research Ethics Committee also has delegated authority to approve the commencement of this research on behalf of the Hunter New England Local Health District. This research may therefore commence.

Should you have any queries about your project please contact Dr Nicole Gerrand as per the contact details at the bottom of the page. The Hunter New England Human Research Ethics Committee Terms of Reference, Standard Operating Procedures, membership and standard forms are available from the Hunter New England Local Health District website.

Please quote **06/07/26/4.04**in all correspondence.

The Hunter New England Human Research Ethics Committee wishes you every success in your research.

Yours faithfully

For: A/Professor A Vertigan
Acting Chair
Hunter New England Human Research Ethics Committee

Hunter New England Research Ethics & Governance Office
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RESEARCH INTEGRITY UNIT

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Registration of External HREC Approval

To Chief Investigator or Project Supervisor:	**Associate Professor Luke Wolfenden**
Cc Co-investigators / Research Students:	**Doctor Serene Yoong** **Doctor Rebecca Wyse** **Doctor Tara Clinton-Mcharg** **Ms Rachel Sutherland** **Miss Kirsty Seward** **Professor John Wiggers** **Ms Nicole Nathan** **Doctor Lorraine Paras** **Mrs Lisa Janssen** **Mrs Nicole Pond** **Ms Taya Wedesweiler** **Mrs Renee Reynolds** **Ms Kirsty Hope** **Miss Courtney Barnes**
Re Protocol:	**HNE kids healthy eating and physical activity program: School and childcare surveys**
Date:	**08-May-2019**
Reference No:	**H-2008-0343**
External HREC Reference No:	**06/07/26/4.04**

Thank you for your **Variation** submission to the Research Integrity Unit (RIU) seeking to register an External HREC Approval in relation to the above protocol.

Background: The Good for Kids. Good for Life. program aims to support Early Childhood Education and Care (ECEC) service's in the Hunter New England Local Health District to implement policies and practices that prevent childhood obesity. The program is currently delivered as part of the NSW Healthy Children's Initiative (HCI) (Munch & Move), and forms part of a state-wide strategy addressing the NSW Premiers priority of reducing childhood obesity. The program involves development and delivery of local level programs to support the implementation of healthy eating policies and practices by ECEC services. This variation is proposed to enable us to evaluate the effectiveness of a new support strategy.
We seek approval for the following:
(1.) Provide Early Childhood Education and Care (ECEC) services with support to improve child dietary intake in care via the implementation of healthy eating policies and practices.
Similar to previous approaches, potentially eligible services within Hunter New England will be mailed a Nominated Supervisor Information Statement and Nominated Supervisor Consent Form. Approximately one week later, a team member will call the service to assess eligibility and invite participation in the study. Service demographics characteristics will also be obtained from consenters and non-consenters at this time to assess consent bias. Recruitment will continue until 22 services consent to participate in the trial. Upon providing consent and undertaking baseline data collection, services will be randomised to receive either the intervention or allocated to receive support after 6 months. The intervention will include support to services to implement healthy eating practices including: a web-based self-assessment including feedback and online resources program; face-to-face training; procurement of executive support; identification of a service champion; and telephone support.

(2.) Conduct a computer assisted telephone interview (CATI) with childcare service Nominated Supervisors at baseline and approximately 6 months follow up

Service Nominated Supervisors will be asked to complete a baseline CATI assessing staff experience and qualifications (including number of years in current role; total years within the Early Childhood Education and Care setting; highest level of education achieved) and contextual information about the service's current healthy eating and lunchbox practices.Questions regarding intervention acceptability, appropriateness, feasibility and fidelity will be asked at 6 months follow up to the intervention group only. The CATI will take approximately 10-15 minutes. In addition, Nominated Supervisors and service champions within the intervention arm only will be asked to complete a record of fidelity during the intervention support calls.

(3.) Conduct a computer assisted telephone interview (CATI) with service champions at approximately 6 months follow up
Service champions within intervention services only will be asked to complete a CATI at 6 months follow up only assessing staff experience and qualifications (including number of years in current role; total years within the Early Childhood Education and Care setting; highest level of education achieved), information about the service's healthy eating and lunchbox practices and intervention acceptability, appropriateness, feasibility and fidelity. The CATI will take approximately 10-15 minutes.

(4.) Undertake site visits to assess children's food intake in care at baseline and approximately 6 months follow up.
The research team will schedule a two day site visit to participating services to observe children's food intake. Parent consent for assessment of child dietary intake via lunchbox audit will be sought for both baseline and follow up. Services will be asked to distribute Parent Information Statements and Consent Forms at least two weeks prior to the nominated site visit days via their usual communication methods, including hard copies and email. To maximise consent rates, team members will also attend participating services at drop off and pick up times one week prior to the arranged site visit days to disseminate Parent Information Statements and seek consent. Parents will also be asked to provide basic demographic information for their child and themselves on the Parent Consent Form.

(5.) Undertake observations of services' healthy eating policies and practices
On one day of the site visit an observation of service policies and practices related to child healthy eating will be conducted. An adapted version of an existing validated tool, the Environment and Policy Assessment Observation instrument (EPAO) will be used. Research staff will observe educator's practices over three meal times (morning tea, lunch and afternoon tea) and ask the Nominated Supervisor some brief questions on service healthy eating policies (5 minutes).

(6.) Obtain analytics data from the web-based program
We are seeking approval from the service Nominated Supervisor to allow the research team to collect data regarding service use of the web-based program (for example, service time spent using program, responses to self-assessment items, completed action plans). Permission to access the data will be sought from Nominated Supervisors and has been included in the Nominated Supervisor Information Statement and Consent Form.

Your submission was considered under an **Administrative Review** by the Ethics Administrator.

I am pleased to advise that the decision on your submission is **External HREC Approval Noted** effective **08-May-2019**.

As the approval of an External HREC has been noted, this registration is valid for the approval period determined by that HREC.

Your reference number is **H-2008-0343**.

PLEASE NOTE:
As the RIU has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's RIU, via RIMS.

Linkage of ethics approval to a new Grant

Registered External HREC approvals cannot be assigned to a new grant or award (ie those that were not identified in the initial registration submission) without confirmation from the RIU.

Best wishes for a successful project.

Mr Alan Hales
Manager, Research Compliance, Integrity and Policy

For communications and enquiries:
Human Research Ethics Administration

Research & Innovation Services
Research Integrity Unit
The University of Newcastle
Callaghan NSW 2308
T +61 2 492 17894
Human-Ethics@newcastle.edu.au

RIMS website - https://RIMS.newcastle.edu.au/login.asp

Linked University of Newcastle administered funding:

Funding body	Funding project title	First named investigator	Grant Ref
ARC (Australian Research Council)/Linkage Projects(**)	Moving from policy to practice: A randomised trial of an implementation intervention to facilitate the adoption of a statewide healthy canteen policy	Wolfenden, Luke	G1201168
Hunter New England Population Health/Linkage Projects Partner Funding(**)	Moving from policy to practice: A randomised trial of an implementation intervention to facilitate the adoption of a statewide healthy canteen policy	Wolfenden, Luke	G1300710
Hunter New England Population Health/Scholarship(**)	A randomized trial of an implementation intervention to facilitate the adoption of a state-wide healthy canteen policy	Wolfenden, Luke	G1400725
Hunter New England Local Health District/Project Grant(**)	A randomised trial of an implantation intervention to facilitate the adoption of a state-wide health canteen policy	Wyse, Rebecca	G1400906
Hunter New England Population Health	Salary support Top Up - Sze Yoong: A randomised controlled trial of an intervention to improve implementation of nutrition guidelines in childcare services	Yoong, Serene	G1500778
NHMRC (National Health & Medical Research Council)/Translating Research into Practice (TRIP) Fellowships(**)	Use of an online canteen ordering system to implement healthy canteen policies in NSW primary schools	Wyse, Rebecca	G1500620
NHMRC (National Health & Medical Research Council)/Translating Research into Practice (TRIP) Fellowships(**)	Increasing the implementation of a mandatory primary school physical activity policy	Nathan, Nicole	G1600651
National Heart Foundation of Australia/Future Leader Fellowship(**)	Improving the translation of community cardiovascular disease prevention research	Wolfenden, Luke	G1600587
ARC (Australian Research Council)/Discovery Early Career Researcher Award (DECRA)(**)	Theory-based implementation of nutrition guidelines into childcare settings	Yoong, Serene	G1600359
Hunter New England Local Health District/Scholarship(**)	An online consumer intervention in primary school canteens	Wolfenden, Luke	G1500605
Hunter New England Population Health/Scholarship(**)	Scheduling frequent opportunities for outdoor play - a simple approach to increasing physical activity in childcare	Yoong, Serene	G1600481
Hunter New England Local Health District/Scholarship(**)	Healthy eating intervention for disadvantaged schools	Wolfenden, Luke	G1500701
Teachers Mutual Bank/Research Project(**)	Teachers Health Program in Schools	Wolfenden, Luke	G1600904
NHMRC (National Health & Medical Research Council)/Career Development Fellowships(**)	Addressing foundational impediments to the translation of chronic disease prevention interventions in community settings	Wolfenden, Luke	G1600414
Health Administration Corporation/Research Grant(**)	Research to gather baseline data regarding operations and provision of healthy food and drinks of licensed school canteens	Wolfenden, Luke	G1600903
NHMRC (National Health & Medical Research Council)/Partnership Projects(**)	A randomised trial of an intervention to facilitate the implementation of a state-wide school physical activity policy	Wolfenden, Luke	G1600792
Hunter Medical Research Institute/Project Grant(**)	A randomised controlled trial to assess the impact of a uniform intervention on girl's physical activity at school	Nathan, Nicole	G1701511
Hunter New England Population Health/Research Project(**)	SWAP-IT Community Research Trial and Dissemination	Wolfenden, Luke	G1800866

Funding body	Funding project title	First named investigator	Grant Ref
nib Foundation/Multi-Year Partnerships(**)	A technology based solution to support parents to improve their child's diet 'Swap What's Packed in the lunchbox: 'SWAP-It'	Wolfenden, Luke	G1700907
Teachers Health Foundation/Research Funding(**)	Addressing the health risk behaviours of the education workforce: A program to enhance the wellbeing of primary school teachers	Nathan, Nicole	G1800853
Hunter Medical Research Institute/Research Excellence Award(**)	HMRI Award for Early Career Research	Yoong, Serene	G1801493
Hunter New England Population Health/Research Project(**)	Enhancing Teacher's Health	Nathan, Nicole	G1800924

Hunter New England Population Health

Direct Contact Details
Phone: (02) 4924 6477 Fax: (02) 4924 6490
Locked Bag 10, Wallsend NSW 2287
Email: PHEnquiries@hnehealth.nsw.gov.au
www.hnehealth.nsw.gov.au

NSW GOVERNMENT Health Hunter New England Local Health District

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Parent Information Statement for the Research Study:
Childcare Electronic Assessment Tool and Support (EATS)
Document Version 1; dated 29/03/2019

Research Team: A/Prof Luke Wolfenden, Dr Serene Yoong, Dr Alice Grady, Dr Nicole Nathan and Ms Courtney Barnes from Hunter New England Population Health and the University of Newcastle;

You are invited to take part in the research study identified above, which aims to identify ways to improve child dietary intake in care by helping childcare services improve the implementation of healthy eating policies and practices.

Why is the research being done?
The research team are looking at ways to work with childcare services to help them meet healthy eating policies and practices. These practices include providing a healthy eating environment, staff nutrition training and professional development, service nutrition policies and service communication to families regarding healthy eating and foods packed within lunchboxes. The aim of this research is to determine if a web-based program together with face-to-face and telephone support, can improve child dietary intake in care and support services to implement healthy eating policies and practices. The findings of the study will inform the development of support offered to childcare services.

Where is the research being done?
The research is being conducted in childcare services across the Hunter New England Local Health District (HNELHD). This study is being undertaken by the University of Newcastle and Hunter New England Population Health. The study is being supported by a research grant from the Hunter Children's Research Foundation.

Who can participate?
Children attending participating childcare services within the HNELHD will be invited to participate.

What choice do you have to participate?
Participation in this study is entirely your choice. Only those people who give their informed consent will be included in the study. If you decide that your child is not to participate, or you wish to end your child's participation in the study, your child's placement at the service will not be affected, and you and your child will not be disadvantaged in the future in any way. If you exit from the study, we will be able to delete any information you or your child have provided.

What will you be asked to do?
As part of the study, the research team will be visiting your childcare service on two selected days during September 2019 and again during April 2020. They will approach you during drop-off and pick-up time to provide information about the study and invite you and your child to participate in the study. If you provide consent for your child to participate, approximately 2-4 weeks later, members of the research team will be conducting observations and measurements of lunchbox contents. This will take place on two occasions across the day, including prior to the children's first meal time, and after their last meal. Photographs will be taken of lunchboxes and contents weighed before and after meals in order to record foods packed and consumed by children. Strict food handling and safety procedures will be adhered to.

The research team member will not make any direct contact with your child while observing them. All research team members will have appropriate child protection clearance and all research activities will occur at the childcare service in the presence of your child's usual childcare service staff. Observations and measurements of lunchbox contents undertaken at baseline and again in six months' time. If your child is still attending the childcare service, your consent will cover both time points.

What are the risks and benefits of participating?
There are no anticipated risks or benefits to your child associated with participating.

How will your privacy be protected?
Any information provided will be treated as strictly confidential. Your identity and any information you provide, will not be revealed to anyone other than the researchers working on the study. All data will be stored securely in a locked cabinet or password protected file. All data will be destroyed seven years after the study has ended.

How will we ensure the wellbeing of the children?
All research staff will have appropriate child protection clearance and all research activities will occur at the childcare service in the presence of your child's usual childcare service staff. If research staff or childcare educators notice that participation in the study is concerning your child, a childcare educator will speak with them privately and may decide to withdraw them from the study.

How will the information collected be used?
The data will be used to help find ways to support childcare services encourage children to eat healthily. The data may be presented at scientific conferences, be published within scientific journals, form part of student's theses, or be provided to the NSW Ministry of Health. Non-identifiable data may be shared with other parties to encourage scientific scrutiny, and to contribute to further research and public knowledge, or as required by law.

What do you need to do to participate?
Please read this Information Statement and be sure you understand it before you agree to take part. If there is anything you do not understand, or if you have questions, please speak to the research assistant on the day. If you would like to participate, please complete the attached consent form and return it to the researcher or your childcare service.

Further information
If you would like further information please contact Dr Alice Grady on 02 49246310 or alice.grady@health.nsw.gov.au

Thank you for considering this invitation.

A/Prof Luke Wolfenden
Manager – Healthy Children's Initiative
Hunter New England Population Health
NHMRC Career Development Fellow
University of Newcastle

Complaints about this research
This research has been approved by the Hunter New England Human Research Ethics Committee of Hunter New England Local Health District, Reference 06/07/26/4.04

Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to Dr Nicole Gerrand, Manager, Research Ethics and Governance Unit, Hunter New England Human Research Ethics Committee, Hunter New England Local Health District, Locked Bag 1, New Lambton NSW 2305, telephone (02) 49214950, email Hnehrec@hnehealth.nsw.gov.au

Office use only: Consent form no.

Hunter New England Population Health

Direct Contact Details
Phone: (02) 4924 6477 Fax: (02) 4924 6490
Locked Bag 10, Wallsend NSW 2287
Email: PHEnquiries@hnehealth.nsw.gov.au

NSW GOVERNMENT | Health Hunter New England Local Health District

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Childcare Electronic Assessment Tool and Support (EATS) - PARENT CONSENT FORM
Version 2, dated 24/07/2019

I have read and understand that the study will be conducted as described in the Information Statement, a copy of which I have kept.

I have been made aware of the data collection activities involved in the study at baseline and six months' time, including any known or expected inconvenience, risk, or discomfort.

I understand that I/my child can withdraw at any time without providing a reason.

I understand that my personal information will remain confidential to the researchers.

I have had the opportunity to have questions answered to my satisfaction.

I hereby give my consent for researchers to **observe and weigh my child's lunchbox contents at childcare at baseline and at follow up** YES ☐ NO ☐

As part of future research to improve child health, I consent to being contacted via telephone or email to participate in other studies related to improving children's health. *This is not consent to participate in future studies, but consent to researchers contacting you. Your permission to participate in each study will be sought at the time of contact.* YES ☐ NO ☐

Parent/Guardian Name: _____

Parent/Guardian Signature: _____ Date: _____

Contact phone no: _____

Email address: _____

Postcode: _____

Your child's name: First name: _____ Last name: _____

Child's date of Birth (DD/MM/YYYY) _____

Child's sex assigned at birth (i.e on birth certificate) _____

Childcare centre name: _____

Days your child attends this childcare centre (*please* ☑ all that apply) ☐ Mon ☐ Tues ☐ Wed ☐ Thurs ☐ Fri

What is your relationship to this child? _____

Is your child from an Aboriginal and/or Torres Strait Islander background? (*please* ☑ all that apply) ☐ Aboriginal ☐ Torres Strait Islander ☐ Both ☐ Neither ☐ Prefer not to say

What is the highest level of qualification that you have completed? ☐ School certificate ☐ TAFE certificate ☐ Diploma ☐ University ☐ Other: _____

EPAO

Service ID:

Date of observation: ☐☐ / ☐☐ / ☐☐☐☐ Observer ID: _____

Observation Start time: ☐ ☐ : ☐ ☐ Observation Stop time: ☐ ☐ : ☐ ☐

SECTION A: MORNING MEAL TODAY		
A1.	What time did the morning meal **start**?	☐ ☐ : ☐ ☐
A2.	What time did the morning meal **end**? *[when the last child finished eating]*	☐ ☐ : ☐ ☐
A3.	How long did the morning meal last?	_____ minutes

A4. Which of the following practices most closely describes **how food was served** to children **during this meal**? *[Select one.]*	
O	Children served themselves most/all foods and decided what size portions to take.
O	Children served themselves most foods, but the provider decided what size portions children may take.
O	The provider served most foods, but children decided what size portions they wanted.
O	The provider served most foods and decided what size portions to give to the children.
O	Food arrives at classroom already portioned on each child's plate.
O	Children brought food from home.

A5. Was the TV (or a screen) on during this meal today?	
O	Yes, TV on, but in another room where it can only be heard from eating area.
O	Yes, TV on and visible from eating area.
O	TV in eating area, but not on during meal.
O	Classroom does not have a TV or a screen that can be seen OR heard from eating area.

X1: Location / physical environment of meals/involvement:			
		No	Yes
A.	The provider used child size appropriate tableware (e.g. smaller plates and cups, additional cutlery if not provided from home)	O	O
B.	The provider made fruits and vegetables easier to eat (e.g. assisted with opening lids/packaging of foods, offered slices, peeled oranges)	O	O
C.	Unhealthy snack foods (can be foods but also include packaging and imagery such as posters, advertisements etc.) are visible to children	O	O
D.	A variety of healthy foods (including imagery such as *Munch & Move* healthy eating posters, books etc.) are visible to children	O	O
E.	A moment was taken to settled before eating	O	O

EPAO Service ID:

		No	Yes
F.	The provider encouraged the children to sit around the table during meals	O	O
G.	The provider talked on the phone, texted, or was on the computer during meals	O	O
H.	Educators observed children's lunchboxes to ensure food items within the lunchbox were consistent with Australian Dietary Guidelines (e.g. educators used the Australian Dietary Guidelines, Caring for Children recommendations, Good for Kids, Munch & Move Healthy Lunchboxes Fact Sheet)	O	O

A6. During morning tea in this centre, did the provider eat any of the following foods in front of the children? *[Mark all that apply.]*

- ☐ The provider ate **fast food**.
- ☐ The provider ate a **salty snack (chips)**.
- ☐ The provider ate a **sweet snack (donuts, pastries, cookies, lollies)**.
- ☐ The provider ate **fruits**.
- ☐ The provider ate **vegetables**.
- ☐ The provider drank a **soft drink or other sweetened beverage**.
- ☐ The provider ate **the same foods** as the children.

A7. Did the following interactions between the provider and the children occur?

NOTE: If yes is selected, record ALL comments made by the provider regarding food in the text box below.

		No	Yes
A.	The provider **talked** with the children about the healthy foods they were eating.	O	O
B.	The provider **enthusiastically role modelled** eating healthy foods.	O	O
C.	The provider **encouraged** (not forced or coerced) children to try the foods on their plates.	O	O
D.	The provider **praised** a child for trying new or less preferred foods.	O	O
E.	The provider **praised** a child for eating **unhealthy foods**.	O	O
F.	The provider sat with the children during morning tea.	O	O
G.	The provider ate with the children during morning tea.	O	O
H.	The provider used an **authoritative feeding style**. **Definition:** Authoritative feeding styles strikes a balance between encouraging children to eat healthy foods and allowing children to make their own food choices. Providers use reason and education, rather than bribes or threats.	O	O
I.	The provider led/encouraged pleasant conversations during meals.	O	O
J.	The provider let the children choose between two healthy food options.	O	O

EPAO Service ID:

Record all comments made by the provider regarding food here:

A8. Did the provider support or hinder children's self-regulation?
NOTE: If yes is selected for items A, C, F, G, H, (marked with *) record all comments made by the provider regarding food in the text box below.

		No	Yes
A.	The provider **pressured** a child to **eat more than they seemed to want.**	O	O *
B.	When a child ate less than half of a meal or snack, the provider removed the plate/lunchbox **without asking** the child if he/she was full.	O	O
C.	When a child ate less than half of a meal or snack, the provider **asked a child if he/she was full before removing the plate/lunchbox.**	O	O *
D.	The provider required the child sit at the table until he/she cleaned their plate/finished all food.	O	O
E.	The provider spoon fed a child to get them to eat.	O	O
F.	The provider insisted that a child eat a food.	O	O *
G.	The provider rushed a child or children to eat.	O	O *
H.	The provider praised children for cleaning their plates, examples, "Very good! You have a happy (clean) plate".	O	O *

Record all comments made by the provider regarding food here:

EPAO Service ID:

A9. Did the provider use food as a reward or bribe? **NOTE: If yes is selected, record all comments made by the provider regarding food in the text box below.**			
		No	**Yes**
A.	The provider promised something **other than food** for eating ("If you eat your beans, we can play ball outside.").	O	O
B.	The provider used **food** as a reward or bribe for eating a specific food ("You can't have dessert until you eat your beans.").	O	O
C.	The provider used **food** as a reward or withheld food as a punishment for behaviour ("If you clean up your blocks, you can have a bigger helping of food.").	O	O
D.	The provider used food to calm an upset child.	O	O
E.	The provider negotiated with children to eat healthy foods (e.g. What about trying one bite and if you don't like it, you don't have to finish it).	O	O
F.	The provider reasoned with the children to eat healthy foods (e.g. Drinking milk makes your bones strong).	O	O
G.	The provider ignores or shows indifference to a child or children.	O	O
Record all comments made by the provider regarding food here:			

EPAO Service ID:

SECTION B: Activities Before Lunch - Teacher-Led Lessons and Activities:		
B1. When **inside** before lunch today how many minutes did children participate in each of the following **nutrition-related lessons and activities**? (*This can include activities done during indoor play time and circle time.*)		
	Activity	**Time**	**Description**
☐	A planned nutrition lesson	**Start** ☐☐:☐☐ **Stop:** ☐☐:☐☐	☐ Part of another lesson ☐ Part of centre time ☐ Part of circle time ☐ Part of free play ***Description:***
☐	Healthy eating activity (not including mealtime) as part of another planned lesson	**Start** ☐☐:☐☐ **Stop:** ☐☐:☐☐	☐ Part of another lesson ☐ Part of centre time ☐ Part of circle time ☐ Part of free play ***Description:***
☐	Cooking activity	**Start** ☐☐:☐☐ **Stop:** ☐☐:☐☐	☐ Part of another lesson ☐ Part of centre time ☐ Part of circle time ☐ Part of free play ***Description:***
☐	Other nutrition-related activity	**Start** ☐☐:☐☐ **Stop:** ☐☐:☐☐	☐ Part of another lesson ☐ Part of centre time ☐ Part of circle time ☐ Part of free play ***Description:***

EPAO

Service ID:

B2. What other provider behaviours did you notice?			
		No	Yes
A.	The provider read a **book** to the children today that included a **positive message about healthy eating**	O	O
B.	The provider used food to help calm a child who was upset.	O	O
C.	The provider used **food** as a reward or withheld food as a punishment for behaviour ("If you clean up your blocks, you can have a bigger helping of food.").	O	O
D.	The provider spoke with children about the importance of healthy eating.	O	O
E.	The provider offered food to children outside of mealtimes (If yes, record what was served and the quantity below).	O	O
Additional notes:			

EPAO

Service ID:

SECTION C: LUNCH MEAL TODAY		
C1.	What time did the lunch meal start?	☐☐:☐☐
C2.	What time did the lunch meal end? *[when the last child finished eating]*	☐☐:☐☐
C3.	How long did the lunch meal last?	_____ minutes

C4. Which of the following practices most closely describes how food was served to children during this meal? *[Select one.]*	
O	Children served themselves most/all foods and decided what size portions to take.
O	Children served themselves most foods, but the provider decided what size portions children may take.
O	The provider served most foods, but children decided what size portions they wanted.
O	The provider served most foods and decided what size portions to give to the children.
O	Food arrives at classroom already portioned on each child's plate.
O	Children brought food from home.

C5. Was the TV (or a screen) on during this meal today?	
O	Yes, TV on, but in another room where it can only be heard from eating area.
O	Yes, TV on and visible from eating area.
O	TV in eating area, but not on during meal.
O	Classroom does not have a TV or a screen that can be seen OR heard from eating area.

X2: Location / physical environment of meals/involvement:			
		No	Yes
A.	The provider used child size appropriate tableware (e.g. smaller plates and cups, additional cutlery if not provided from home).	O	O
B.	The provider made fruits and vegetables easier to eat (e.g. assisted with opening lids/packaging of foods, offered slices, peeled oranges).	O	O
C.	Unhealthy snack foods (can be foods but also include packaging and imagery such as posters, advertisements etc.) are visible to children.	O	O
D.	A variety of healthy foods (including imagery such as *Munch & Move* healthy eating posters, books etc.) are visible to children.	O	O
E.	A moment was taken to settle before eating.	O	O
F.	The provider encouraged the children to sit around the table during meals.	O	O
G.	The provider talked on the phone, texted, or was on the computer during meals.	O	O

EPAO

Service ID:

C6. During lunch in this centre, did the provider eat any of the following foods in front of the children? *[Mark all that apply.]*
☐ The provider ate **fast food**.
☐ The provider ate a **salty snack (chips)**.
☐ The provider ate a **sweet snack (donuts, pastries, cookies, lollies)**.
☐ The provider ate **fruits or vegetables**.
☐ The provider drank a **soft drink or other sweetened beverage**.
☐ The provider ate **the same foods** as the children.

C7. Did the following interactions between the provider and the children occur?

NOTE: If yes is selected, record ALL comments made by the provider regarding food in the text box below.

		No	Yes
A.	The provider **talked** with the children about the foods they were eating.	○	○
B.	The provider **enthusiastically role modelled** eating healthy foods.	○	○
C.	The provider **encouraged** (not forced or coerced) children to try the foods on their plates.	○	○
D.	The provider **praised** a child for trying new or less preferred foods.	○	○
E.	The provider **praised** a child for eating **unhealthy foods**.	○	○
F.	The provider sat with the children during lunch.	○	○
G.	The provider ate with the children during lunch.	○	○
H.	The provider used an **authoritative feeding style**. **Definition:** Authoritative feeding styles strikes a balance between encouraging children to eat healthy foods and allowing children to make their own food choices. Providers use reason and education, rather than bribes or threats.	○	○
I.	The provider led/encouraged pleasant conversations during meals.	○	○
J.	The provider let the children choose between two healthy food options.	○	○

Record all comments made by the provider regarding food here:

EPAO Service ID:

C8. Did the provider support or hinder children's self-regulation?

NOTE: If yes is selected for items A, C, F, G, H, (marked with *) record all comments made by the provider regarding food in the text box below.

		No	Yes
A.	The provider **pressured** a child to **eat more than they seemed to want.**	O	O *
B.	When a child ate less than half of a meal or snack, the provider removed the plate/lunchbox **without asking** the child if he/she was full.	O	O
C.	When a child ate less than half of a meal or snack, the provider **asked a child if he/she was full before removing the plate/lunchbox.**	O	O *
D.	The provider required the child sit at the table until he/she cleaned their plate/finished all food.	O	O
E.	The provider spoon fed a child to get them to eat.	O	O
F.	The provider insisted that a child eat a food.	O	O *
G.	The provider rushed a child or children to eat.	O	O *
H.	The provider praised children for cleaning their plates, examples, "Very good! You have a happy (clean) plate".	O	O *

Record all comments made by the provider regarding food here:

EPAO Service ID:

C9. Did the provider use food as a reward or bribe?

NOTE: If yes is selected, record all comments made by the provider regarding food in the text box below.

		No	Yes
A.	The provider promised something **other than food** for eating ("If you eat your beans, we can play ball outside.").	O	O
B.	The provider used **food** as a reward or bribe for eating a specific food ("You can't have dessert until you eat your beans.").	O	O
C.	The provider used **food** as a reward or withheld food as a punishment for behaviour ("If you clean up your blocks, you can have a bigger helping of food.").	O	O
D.	The provider used food to calm an upset child.	O	O
E.	The provider negotiated with children to eat healthy foods (e.g. what about trying one bite and if you don't like it, you don't have to finish it).	O	O
F.	The provider reasoned with the children to eat healthy foods (e.g. drinking milk makes your bones strong).	O	O
G.	The provider ignores or shows indifference to a child or children.	O	O

Record all comments made by the provider regarding food here:

EPAO Service ID:

SECTION D: NAP/REST TIME TODAY		
D1.	What time did the nap time start?	☐☐ : ☐☐
D2.	What time did nap time end? [when the last child finished sleeping]	☐☐ : ☐☐
D3.	How long did nap time last?	_____ minutes

D4. For each event listed, check the box that describes what was observed during nap time.

During nap time in this classroom, did the provider eat any of the following foods in front of the children?

		No	Yes
A.	... the provider ate fast food.	○	○
B.	... the provider ate a salty snack (e.g., chips).	○	○
C.	... the provider ate a sweet snack (e.g., donuts, pastries, cookies, lollies).	○	○
D.	... the provider ate fruits in front of the children.	○	○
E.	... the provider ate vegetables in front of the children.	○	○
F.	... the provider drank a soft drink or other sweetened beverage.	○	○

EPAO

Service ID:

SECTION E: AFTERNOON SNACK TODAY		
E1.	What time did the afternoon meal start?	☐☐ : ☐☐
E2.	What time did the afternoon meal end? *[when the last child finished eating]*	☐☐ : ☐☐
E3.	How long did the afternoon meal last?	_____ minutes

E4. Which of the following practices most closely describes how food was served to children during this meal? *[Select one.]*	
O	Children served themselves most/all foods and decided what size portions to take.
O	Children served themselves most foods, but the provider decided what size portions children may take.
O	The provider served most foods, but children decided what size portions they wanted.
O	The provider served most foods and decided what size portions to give to the children.
O	Food arrives at classroom already portioned on each child's plate.
O	Children brought food from home.

E5. Was the TV (or a screen) on during this meal today?	
O	Yes, TV on, but in another room where it can only be heard from eating area.
O	Yes, TV on and visible from eating area.
O	TV in eating area, but not on during meal.
O	Classroom does not have a TV or a screen that can be seen OR heard from eating area.

X3: Location / physical environment of meals/involvement:			
		No	Yes
A.	The provider used child size appropriate tableware (e.g. smaller plates and cups, additional cutlery if not provided from home).	O	O
B.	The provider made fruits and vegetables easier to eat (e.g. assisted with opening lids/packaging of foods, offered slices, peeled oranges).	O	O
C.	Unhealthy snack foods (can be foods but also include packaging and imagery such as posters, advertisements etc.) are visible to children.	O	O
D.	A variety of healthy foods (including imagery such as *Munch & Move* healthy eating posters, books etc.) are visible to children.	O	O
E.	A moment was taken to settle before eating.	O	O
F.	The provider encouraged the children to sit around the table during meals.	O	O
G.	The provider talked on the phone, texted, or was on the computer during meals.	O	O

EPAO Service ID:

E6. During afternoon tea in this centre, did the provider eat any of the following foods in front of the children? *[Mark all that apply.]*
☐ The provider ate **fast food**.
☐ The provider ate a **salty snack (chips)**.
☐ The provider ate a **sweet snack (donuts, pastries, cookies, lollies)**.
☐ The provider ate **fruits**.
☐ The provider ate **vegetables**.
☐ The provider drank a **soft drink or other sweetened beverage**.
☐ The provider ate **the same foods** as the children.

E7. Did the following interactions between the provider and the children occur?
NOTE: If yes is selected, record ALL comments made by the provider regarding food in the text box below.

		No	Yes
A.	The provider **talked** with the children about the foods they were eating.	O	O
B.	The provider **enthusiastically role modelled** eating healthy foods.	O	O
C.	The provider **encouraged** (not forced or coerced) children to try the foods on their plates.	O	O
D.	The provider **praised** a child for trying new or less preferred foods.	O	O
E.	The provider **praised** a child for eating **unhealthy foods**.	O	O
F.	The provider sat with the children during afternoon tea.	O	O
G.	The provider ate with the children during afternoon tea.	O	O
H.	The provider used an **authoritative feeding style**. **Definition:** Authoritative feeding styles strikes a balance between encouraging children to eat healthy foods and allowing children to make their own food choices. Providers use reason and education, rather than bribes or threats.	O	O
I.	The provider led/encouraged pleasant conversations during meals.	O	O
J.	The provider let the children choose between two healthy food options.	O	O

Record all comments made by the provider regarding food here:

EPAO Service ID:

E8. Did the provider support or hinder children's self-regulation?

NOTE: If yes is selected for items A, C, F, G, H, (marked with *) record all comments made by the provider regarding food in the text box below.

		No	Yes
A.	The provider pressured a child to eat more than they seemed to want.	O	O *
B.	When a child ate less than half of a meal or snack, the provider removed the plate/lunchbox without asking the child if he/she was full.	O	O
C.	When a child ate less than half of a meal or snack, the provider asked a child if he/she was full before removing the plate/lunchbox.	O	O *
D.	The provider required the child sit at the table until he/she cleaned their plate/finished all food.	O	O
E.	The provider spoon fed a child to get them to eat.	O	O
F.	The provider insisted that a child eat a food.	O	O *
G.	The provider rushed a child or children to eat.	O	O *
H.	The provider praised children for cleaning their plates, examples, "Very good! You have a happy (clean) plate".	O	O *

Record all comments made by provider regarding food here:

EPAO Service ID:

E9. Did the provider use food as a reward or bribe?

NOTE: If yes is selected, record all comments made by the provider regarding food in the text box below.

		No	Yes
A.	The provider promised something **other than food** for eating ("If you eat your beans, we can play ball outside.").	O	O
B.	The provider used **food** as a reward or bribe for eating a specific food ("You can't have dessert until you eat your beans.").	O	O
C.	The provider used **food** as a reward or withheld food as a punishment for behaviour ("If you clean up your blocks, you can have a bigger helping of food.").	O	O
D.	The provider used food to calm an upset child.	O	O
E.	The provider negotiated with children to eat healthy foods (e.g. What about trying one bite and if you don't like it, you don't have to finish it).	O	O
F.	The provider reasoned with the children to eat healthy foods (e.g. Drinking milk makes your bones strong).	O	O
G.	The provider ignores or shows indifference to a child or children.	O	O

Record all comments made by the provider regarding food here:

EPAO Service ID:

SECTION F: Activities After Nap - Teacher-Led Lessons and Activities:			
B1. When **inside** after nap today how many minutes did children participate in each of the following **nutrition-related lessons and activities**? (*This can include activities done during indoor play time and circle time.)*			
	Activity	**Time**	**Description**
☐	A planned nutrition lesson	**Start** ☐☐:☐☐ **Stop:** ☐☐:☐☐	☐ Part of another lesson ☐ Part of centre time ☐ Part of circle time ☐ Part of free play ***Description:***
☐	Healthy eating activity (not including mealtime) as part of another planned lesson	**Start** ☐☐:☐☐ **Stop:** ☐☐:☐☐	☐ Part of another lesson ☐ Part of centre time ☐ Part of circle time ☐ Part of free play ***Description:***
☐	Cooking activity	**Start** ☐☐:☐☐ **Stop:** ☐☐:☐☐	☐ Part of another lesson ☐ Part of centre time ☐ Part of circle time ☐ Part of free play ***Description:***
☐	Other nutrition-related activity	**Start** ☐☐:☐☐ **Stop:** ☐☐:☐☐	☐ Part of another lesson ☐ Part of centre time ☐ Part of circle time ☐ Part of free play ***Description:***

EPAO Service ID:

B42. What other provider behaviours did you notice?			
		No	Yes
A.	The provider read a **book** to the children today that included **a positive message about healthy eating.**	○	○
B.	The provider used food to help calm a child who was upset.	○	○
C.	The provider used **food** as a reward or withheld food as a punishment for behaviour ("If you clean up your blocks, you can have a bigger helping of food.").	○	○
D.	The provider spoke with children about the importance of healthy eating.	○	○
E.	The provider offered food to children outside of mealtimes (If yes, record what was served and the quantity below).	○	○

Additional notes:

EPAO Service ID:

SECTION H: Equipment, Environment and Space	
H1. Which of the following items does the play kitchen contain? *(Mark all that apply)*	
☐ They don't have a play kitchen (*Proceed to H2)*	☐ Fruit
☐ Milk	☐ Vegetables
☐ Soft drink	☐ Canned goods
☐ Juice	☐ Salty snacks
☐ Hamburgers/hotdogs	☐ Dessert items or sweet snacks (cookies, cakes, ice cream, etc.)
☐ Lean protein (chicken, beans, eggs)	
☐ Fried or high fat meats	☐ Commercial fast food items (French fries, items with logos, etc.)
☐ Dairy besides milk	
☐ Refined bread/grain products (ice, pasta, bread, etc.)	☐ Pizza
☐ Wholegrain bread/grain products	☐ Other: _____

H2. Where is the drinking water for children located **indoors**? (Mark all that apply)		
☐ Faucet / tap		
☐ Drinking fountain		
☐ Pitcher of water cooler		
☐ Individual bottles		
H2a. Is access to water ever restricted **indoors**?	○ No	○ Yes

H3. Where is the drinking water for children located **outdoors**? (Mark all that apply)		
☐ Faucet / tap		
☐ Drinking fountain		
☐ Pitcher of water cooler		
☐ Individual bottles		
H3a. Is access to water ever restricted **outdoors**?	○ No	○ Yes

H4. How many of the following does the classroom have?					Number
A. Books that encourage children to eat foods that are good for them.					_____
B. Books that encourage children to eat less healthy foods					_____
C. Total # books	○ 0-30	○ 31-60	○ 61-90	○ 91+	
D. Posters and pictures that encourage children to eat healthy foods.					_____
E. Posters and pictures that encourage children to eat less healthy food.					_____
F. Total # posters and pictures	○ 0-30	○ 31-60	○ 61-90	○ 91+	

EPAO Service ID:

H5. Is there a garden available at the centre for children to plant/grow items?	
○ No *(proceed to H6)*	
○ Yes (proceed to H5a)	
H5a. If yes, what is in the garden? (mark all that apply)	
☐ Garden not currently active	☐ Fruits
☐ Flowers	☐ Vegetables
☐ Herbs	
H5b. If yes for fruits or vegetables, is there enough	
○ For tasting only	
○ To be served as part of meals or snacks	

H6. Across the centre, soft drink and vending machines are located...
○ In the entrance or front of building
○ In building areas, but not entrances
○ Out of sight of children, building entrances and families
○ There are no vending machines on site

EPAO

Service ID:

EPAO - Document Review:

SECTION A: Training & Education

1. **Does the centre have any documentation that they have offered nutrition education to parents in the form of parent workshops or meetings in the past year?**
   - ○ No
   - ○ Yes — **1a. Document received:** ○ Yes ○ No documents received from service

2. **Does the centre have any documentation that they have offered nutrition information to parents in the form of handouts, newsletter articles, bulletin board topics, postings on the centre's website, or email in the past year?**
   - ○ No
   - ○ Yes — **2a. Document received:** ○ Yes ○ No documents received from service

   2b. Which topics were covered in the parent communication that were reviewed?

	Workshops or meetings	Emails, handouts, etc
a) Food and beverage recommendations for children	☐	☐
b) Serving sizes for children	☐	☐
c) Importance of variety in the child diet	☐	☐
d) Creating healthy mealtime environments	☐	☐
e) Using positive feeding practices	☐	☐
f) The program's policies on child nutrition	☐	☐
g) Other, specify: _____	☐	☐

3. **According to the documents on file, have at least 50% of educators received training in nutrition for young children (e.g., continuing education workshop or TAFE class) or training on a specific nutrition curriculum (e.g., *Munch & Move* Webinar series)?**
   - ○ No
   - ○ Yes, more than 12 months ago
   - ○ Yes, within the past 12 months

   3a. If yes, what was the name of the organisation delivering the training and the title of the training?

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3b. If yes, what type of nutrition information was covered? ***(Mark all that apply)***

- ☐ Australian Dietary Guidelines
- ☐ Food safety
- ☐ General nutrition
- ☐ Cooking with children
- ☐ Healthy snack ideas
- ☐ Gardening with children
- ☐ Munch & Move program
- ☐ Caring for Children recommendations
- ☐ Food and beverage recommendations for children
- ☐ Serving sizes for children
- ☐ Importance of variety in the child diet
- ☐ Creating healthy mealtime environments
- ☐ Using positive feeding practices
- ☐ Communicating with families about child nutrition
- ☐ The program's policies on child nutrition
- ☐ Other, specify: _____

SECTION B: Policy

1. Do children bring food from home? ***(Ask provider/owner)***

- ○ No
- ○ Yes

1a. If yes, are there written guidelines (e.g., list outlining foods, or a statement in the parent handbook) about what can or cannot be brought from home?

- ○ No
- ○ Yes **aa. Document received:** ○ Yes ○ No documents received from service

1b. If yes, what foods does the guideline address? ***(Mark all that apply)***

- ☐ Fruits and vegetables
- ☐ Breads and Cereals
- ☐ Discretionary food items
- ☐ Lollies or desserts
- ☐ Sugar-sweetened beverages
- ☐ Other, specify: _____

1c. According to written documents, are less healthy food items removed from the meals or snacks brought from home?

- ○ No
- ○ Yes

2. Does the centre have any documentation that they provide feedback to families when lunchbox food items are not consistent with the Australian Dietary Guidelines at least 4 times per year?

- ○ No
- ○ Yes **1a. Document received:** ○ Yes ○ No documents received from service

EPAO

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For each statement below, indicate whether or not there is a written policy covering that topic and if so, how close it was to the best practice.

3. Is there a nutrition policy that includes a statement about...

	Topic is not mentioned	Topic is mentioned	Topic is fully covered
Creating a healthy meal and snack environment, including			
a. Eating meals family style meals (where children are allowed to choose most/all foods themselves)	O	O	O
b. Having adults enthusiastically role model eating healthy foods	O	O	O
c. Having adults NOT eat unhealthy foods (such as chips, sweets, or fast food) or drinking unhealthy beverages (such as soft drink or other sugar-sweetened beverages) in front of children	O	O	O
d. Praising children for trying new or less preferred foods	O	O	O
e. Checking with a child about their hunger/fullness before serving seconds or removing an unfinished plate of food	O	O	O
f. Encouraging children to eat healthy foods without bribes or threats.	O	O	O
g. Not watching TV or videos during meals and snacks	O	O	O
h. Educators making positive comments about the healthy ('everyday' foods) consumed by children at meal and snack times			
Other practices, including			
i. Avoiding the use of food to calm a child when he/she is upset or as a bribe to get a child to behave	O	O	O
j. Providing a planned nutrition education activity for children 2 or more times per week	O	O	O
k. Using meal times to talk with children about food and provide informal nutrition education	O	O	O
l. Offering families education on child nutrition (e.g. brochures, flyers, links to websites, or in-person) once or more times per year	O	O	O
m. Providing guidelines to parents about food brought in for holidays and celebrations that encourage healthy foods or non-food items (e.g. stickers & party hats) and discourage unhealthy foods	O	O	O
n. Prohibiting the selling of unhealthy foods (e.g. cookies, donuts, or lollies) for fundraising	O	O	O
o. At least 50% of educators accessing professional development about child nutrition	O	O	O
p. Strategies are in place, including providing guidelines to parents, to ensure that food brought from home is consistent with Australian Dietary Guidelines.	O	O	O
q. Monitoring and reporting of achievement in healthy eating objectives at least annually	O	O	O
r. Materials promoting healthy eating (e.g. Munch & Move posters) are visible in the service	O	O	O
s. Educators avoid using preferred foods to encourage children to eat new or less preferred foods	O	O	O

EPAO

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3a. Was a copy of the written nutrition policy received from the service?

o No
o Yes, documents were received from the service

SECTION C: Monitoring and reporting on healthy eating objectives

1. Does the centre have any documentation that they monitor achievement in healthy eating objectives?

○ No

○ Yes **1a. Document received:** ○ Yes
○ No documents received from service

2. Does the centre have any documentation that they report (either internally or externally) on it's achievement with healthy eating objectives at least annually as part of continual quality improvement (e.g. quality improvement plan, centre reports)?

○ No

○ Yes **1a. Document received:** ○ Yes
○ No documents received from service

Service ID: Date: Field Officers:

Child ID: Page ___ of ___

Lunchbox Data Collection Form

Field Officers_____ **Room(s):** _____

Child ID

Meals Eaten:

Morning tea ☐

Lunch ☐

Afternoon tea ☐

Tick when complete:

Lunchbox Photo- pre ☐

Lunchbox weighing form- pre ☐

Lunchbox Photo- post ☐

Lunchbox weighing form- post ☐

Reference Weight (clay) result:

Same as reference weight ☐

Over reference weight ☐ (specify amount)

Under reference weight ☐ (specify amount)

Tablet Code: Tablet pin:

Comments (if not completed) e.g., child left early:

Service ID: Date: Field Officers:

Child ID: Page ___ of ___

Please make a note on the page if multiple forms are used for contents of one lunchbox (e.g. if data for one lunchbox can't be recorded on one form.)
For sandwiches, please record and use the checklist for description. Record foods that need to be weighed as "mixed" post consumption in Table 3.

Table 1 Checklist for sandwiches/ wraps/ crispbreads with fillings etc

Sandwich description If some or all fillings cannot be identified, record details and select 'Unable to determine' (E.g. meat and salad sandwich)	**Describe pre consumption container or wrapping included in the weight** (NA if none)	**Pre weight (0.000 kg)**	**Describe post consumption container or wrapping included in the weight** (NA if none)	**Post weight (0.000 kg)**	**Comments**

Description (use for first sandwich recorded only). For multiple sandwiches/ filled crispbreads etc, record the additional item and contents in TABLE 1A.

A. Type of bread/ roll/ wrap:

- Bread (standard) ☐
- Roll (round) ☐
- Wrap (circle: small / large) ☐
- English muffin ☐
- Crispbread/ Rice cake ☐
  (Specify type e.g. rice/corn cake, vitaweat etc.):
  _____
- Other (specify): ☐
  _____
- Unable to determine ☐

C. Spreads:

- Butter/ margarine: ☐
- Vegemite: ☐
- Honey: ☐
- Jam: ☐
- Cream cheese: ☐
- Mayonnaise: ☐
- Other (specify): ☐
  _____
- None ☐
- Unable to determine ☐

D. Salad fillings:

- Lettuce ☐
- Cucumber ☐
- Tomato ☐
- Carrot ☐
- Coleslaw ☐
- Other (specify): ☐
  _____
- None ☐
- Unable to determine ☐

E. Protein fillings:

- Ham: ☐
- Devon ☐
- Cheese ☐
- Chicken deli meat, breast ☐
- Chicken deli meat, square ☐
- Chicken, BBQ/ roast ☐
- Tuna ☐
- Salmon ☐
- Egg ☐
- Baked beans ☐
- Rissole ☐
- Sausage ☐
- Other (specify) ☐
  _____
- None ☐
- Unable to determine ☐

B. Type of grain:

- White ☐
- Wholemeal ☐
- Multigrain ☐
- Other (specify): ☐
  _____
- Unable to determine ☐

Service ID: Date: Field Officers:

Child ID: Page ___ of ___

Table 1A Checklist for **ADDITIONAL** sandwiches/ wraps/ crispbreads with fillings etc

Sandwich description If some or all fillings cannot be identified, record details and select 'Unable to determine' (E.g. meat and salad sandwich)	**Describe pre consumption container or wrapping included in the weight** (NA if none)	**Pre weight (0.000 kg)**	**Describe post consumption container or wrapping included in the weight** (NA if none)	**Post weight (0.000 kg)**	**Comments**

Description use for ADDITIONAL sandwich recorded only.

A. Type of bread/ roll/ wrap:

- Bread (standard) ☐
- Roll (round) ☐
- Wrap (circle: small / large) ☐
- English muffin ☐
- Crispbread/ Rice cake ☐
  (Specify type e.g. rice/corn cake, vitaweat etc.):
  _____
- Other (specify): ☐
  _____
- Unable to determine ☐

C. Spreads:

- Butter/ margarine: ☐
- Vegemite: ☐
- Honey: ☐
- Jam: ☐
- Cream cheese: ☐
- Mayonnaise: ☐
- Other (specify): ☐
  _____
- None ☐
- Unable to determine ☐

D. Salad fillings:

- Lettuce ☐
- Cucumber ☐
- Tomato ☐
- Carrot ☐
- Coleslaw ☐
- Other (specify): ☐
  _____
- None ☐
- Unable to determine ☐

E. Protein fillings:

- Ham: ☐
- Devon ☐
- Cheese ☐
- Chicken deli meat, breast ☐
- Chicken deli meat, square ☐
- Chicken, BBQ/ roast ☐
- Tuna ☐
- Salmon ☐
- Egg ☐
- Baked beans ☐
- Rissole ☐
- Sausage ☐
- Other (specify) ☐
  _____
- None ☐
- Unable to determine ☐

B. Type of grain:

- White ☐
- Wholemeal ☐
- Multigrain ☐
- Other (specify): ☐
  _____
- Unable to determine ☐

Service ID: Date: Field Officers:

Child ID: Page ___ of ___

Table 2 Food / Drink items in lunchbox (NOT sandwiches/ wraps/ crispbreads with fillings)

Describe Food / Drink Item Note any non-edible portions e.g. watermelon with skin, grapes with stalks. Describe brands and flavours of packaged foods. Describe ingredients visible in mixed foods e.g. fried rice Describe foods that are difficult to identify in photo adequately e.g. banana and sultana muffin.	**Describe pre-consumption container or wrapping included in the weight** (NA if none)	**Pre weight** **(0.000 kg)**	**Describe post consumption container or wrapping included in the weight** (NA if none)	**Post weight (0.000 kg)** OR (NA if single foods have now become mixed)	**Comments** (Examples: provide further detail of container/ wrapping, yoghurt weighed without lid; provide rough proportions of mixed dishes e.g. 1 cup fried rice with 1 tbs each of carrot, peas, corn and ham)

Service ID: Date: Field Officers:

Child ID: Page ___ of ___

Table 2 (continued)

Describe Food / Drink Item Note any non-edible portions e.g. watermelon with skin, grapes with stalks. Describe brands and flavours of packaged foods. Describe ingredients visible in mixed foods e.g. fried rice Describe foods that are difficult to identify in photo adequately e.g. banana and sultana muffin.	**Describe pre-consumption container or wrapping included in the weight** (NA if none)	**Pre weight** **(0.000 kg)**	**Describe post consumption container or wrapping included in the weight** (NA if none)	**Post weight (0.000 kg)** OR (NA if single foods have now become mixed)	**Comments** (Examples: provide further detail of container/ wrapping, yoghurt weighed without lid; provide rough proportions of mixed dishes e.g. 1 cup fried rice with 1 tbs each of carrot, peas, corn and ham)

Service ID: Date: Field Officers:

Child ID: Page ___ of ___

Table 3: Questions or unclassified food items requiring further discussion

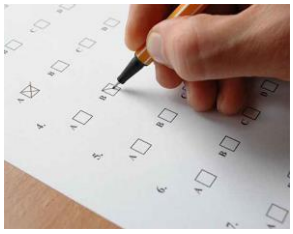
Describe Food / Drink Item	Describe pre-consumption container or wrapping included in the weight (NA if none)	Pre weight (0.000 kg)	Describe post consumption container or wrapping included in the weight (NA if none)	Post weight (0.000 kg) OR (NA if single foods have now become mixed)	Comments and/or Questions

Childcare EATS

Data Collection Protocol

Site Visit Protocol for Research Assistants

September 2019



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Contents

1. Important Contacts

Who	Contact details	Availability	Reasons
Taya Wedesweiler Project Officer	**W:** 02 49246327 **M:** 0419427971 **E:** taya.wedesweiler@health.nsw.gov.au Office: 0059B (ground floor, Booth building)	Mon – Fri (8:00am – 4:30pm)	- Unable to attend site visit - Running late to centre - Issues with data collection kits/equipment - Missing documentation - Picking up/dropping off data collection kits AND HNE cars - Issues regarding the consent process or children with allergies
Courtney Barnes Project Officer/ PhD student	**W:** 02 49246678 **M:** 0419035765 **E:** courtney.barnes@health.nsw.gov.au Office: 0034B (ground floor, Booth building)	Mon – Fri (7:30am – 4:30pm)	- Issues with procedures on site if Taya is not available
Alice Grady Post Doc Research Fellow	**W:** 02 4924 6310 **M**: 0421 972 257 **E**: Alice.Grady@health.nsw.gov.au Office: 0042B (ground floor, Booth building)	Mon – Fri (9.00am-3.30pm)	- Issues with procedures on site if Courtney and Taya are not available
Dot Baker Receptionist/ Admin	**W:** 02 4924 6499 **E**: Dorothy.Baker@health.nsw.gov.au	Mon – Fri (8:00am-5pm)	- Car bookings
Liz Harwood Admin	**W:** 02 49246022 **E**: Elizabeth.Harwood@health.nsw.gov.au	Mon – Fri (8:30am-5pm)	- For all HR and pay enquiries
EXTERNAL			
Emergency	**P:** 000	24/7	- Any emergency
NRMA	**P:** 131111	24/7	- Breakdown, flat tyre, flat battery
Wallsend Health Campus Security	**P:** 0409 923683 (Advise security if working after 6pm)	24/7	- If needing to access Booth Building outside of work hours - Collecting car kits outside work hours

2. Childcare Electronic Assessment Tool and Support (Childcare EATS) Study

The Childcare EATS study aims to support ECEC centres in improving their implementation of healthy eating policies and practices which influence child diet in care. The intervention includes the provision of a web-based program (known as Childcare EATS) as well as face to face and ongoing support to assist centres to implement these practices. To assess the effectiveness of the intervention, lunchboxes will be audited and the ECEC centre environment will be observed at baseline and follow-up (six months) to determine the following:

Primary outcome:

- Mean number of fruit and vegetables serves consumed during care

Secondary outcomes:

- Mean sat fat (g), sugar (g) and sodium (mg) consumed from all food and drinks during care
- Mean serves of fruit and vegetables packed within lunchboxes
- ECEC centre implementation of healthy eating policies and practices (e.g. providing a positive healthy eating environment, intentional learning experiences etc.)

Methodology

Study design and sample

This trial will employ a cluster randomised controlled trial with 22 ECEC centres located within the Hunter New England (HNE) region of NSW, Australia.

Study sample

A sample of eligible long day care centres within a 100km radius of Newcastle were randomly selected and approached to participate in the trial. Centres will be randomly allocated to a web-based intervention with additional support, delivered over a six month period, or eleven centres will be allocated to a control group.

To assess changes in mean number of fruit and vegetables serves consumed during care, lunchbox observations will be conducted on 440 consenting children.

Ethics

The study has received approval by the Hunter New England Area Human Research Ethics Committee (approval No. 06/07/26/4.04) and University of Newcastle Human Research Ethics Committee (reference No. H-2008-0343).

3. Preparation for the site visits

3.1 When will data collection take place?

Baseline data collection will take place from late August – October 2019. Follow-data collection will take place from April – May 2020. Data collection at both time points will be conducted over a two day period per ECEC centre.

3.2 Staffing

Taya Wedesweiler will be responsible for overall co-ordination of arrangements for data collection, and will develop a data collection travel itinerary and will forward it to data collection staff. Taya will also provide the team with the appropriate documents for each visit including copies of all tools, and all equipment needed.

Two to three research assistants (RAs) will attend each ECEC centre and will be responsible for the collection of data.

3.3 Prior to the site visits, the following will be completed by Hunter New England Population Health

- Confirmation of centre and parent consent, dates and times for the scheduled site visit with centre Nominated Supervisors
- Rostering of research assistants for each site visit shift
- Provision of research assistant names, contact details and WWCC details to the centre
- Hunter New England Population Health cars and accommodation bookings (if required)

3.4 Role of the Hunter New England Health (HNEH) research assistants

Although the procedures for each centre will be organised slightly differently, the staff roles will include the following:

- Conducting parent recruitment
- Explaining the days data collection procedures to the Nominated Supervisor and appropriate Educators
- Setting up equipment (e.g. the lunchbox audit station)
- Recording which consenting children are present and absent on the day of the site visit
- Conducting the Lunchbox Audit (records, photos and weights)
- Carrying out the Environment Policy Assessment and Observations (EPAO) on Educators from the designated room and completing the EPAO document review section with the centre Nominated Supervisor
- Returning all data to the Project Officer (Courtney)
- Packaging and interim storage of data

3.5 Role of the ECEC centre

- Participation by centre, Educators, parents and children is voluntary. Parents or Educators may act on children's behalf to withdraw them at any time from the study. Centres who have agreed to participate may have nominated an Educator(s) to assist on the day.
- Information sheets (known as information statements) outlining the study, data collection and the requirements of the centre have been sent to the Nominated Supervisor and parents.

- The Nominated Supervisor or an Educator designated to assist will inform you of a suitable place to complete the lunchbox audits, orient you to the room and Educators to be observed as part of the EPAO.

3.6 On the days of site visits

Please bring the following items with you to EVERY site visit:

- Photo ID badge: Staff ID badges and any visitors IDs provided by the centre should be worn at all times.
- Working With Children check clearance number
- Lunch (please exclude nuts and eggs)
- Long hair should be tied back and any cuts need to be bandaged: RA's should have their hair tied back in the event that they may be required to assist in the lunchbox review component of data collection
- Charged mobile phone (only to be used in emergencies)
- A hat and sunscreen to wear when outdoors
- Appropriate clothing: Ensure you are wearing your Good For Kids shirt or Close the Gap shirt. For those research assistants without a shirt, these will be provided to you at the mandatory training. RA's should wear the allocated Good for Kids shirt, appropriate-length shorts/pants and closed in and comfortable shoes

3.7 Before you leave Population Health

- Your shift will commence when you present at Population Health reception. (Wait in the top car park for the remainder of the RA team to arrive). Your team will usually consist of 2-3 Research Assistants.
- Collect the data collection kit. If you are collecting the data collection kit before 8:00am, the data collection kit and car keys will be waiting at the security office in the Population Health car park. You will be advised of these arrangements by Taya when confirming your shift details for the site visit. The name of the RAs and the ECEC centre will be clearly written on the data collection kit.
- NB: Not all RA staff will be required to meet at the Population Health campus. Some staff are able to commence their shift at the centre based on personal circumstance (i.e. proximity of home to centre); the exact time to meet at the centre will be negotiated individually. In these situations, you will be paid for the time onsite at the centre.

Each Data Collection Kit contains:

Centre Data			
1	Map and directions		
Equipment			
1	Scales	1	Box of gloves
1	Electrical cord for scales	3	Plastic buckets
1	Reference weight (block of clay)	3	Plastic takeaway containers
1	Tablet (in box with charging cord)	1	Antiseptic hand gel
1	Chopping board	1	Glad wrap
1	Alcohol surface wipes	3	Hair nets
1	Plastic bag/ sheets in blue plastic dispenser	1	Chux
Stationary			
1	Permanent marker	1	Notepad paper
3	Clipboards	1	Post it notes – (for covering children's names on lunchboxes in photos)
4	Pens – 2 black, 1 red		
1	Roll of garbage bags	4	Sheets of label stickers

50	Brown paper bags	1	Stapler
Documentation and data collection forms			
1	Consent Form for Nominated Supervisors	4	EPAO data collection forms
1	Information statement for Nominated Supervisors	XX	Lunchbox Observation data collection forms
30	Information Statements for Parents	4	Site Visit Protocol
30	Consent Forms for Parents	1	Data collection kit end of visit checklist
1	List of children with consent prior to the site visit	2	Document wallets (pre and post consumption)
1	Scale / ruler template (for reference photo)		

3.8 Confidentiality

All data collected should be treated in a confidential manner. Do not leave notes, names, IDs, or forms unattended. If you are not using consent or data collection forms they should be kept in the plastic tub. Do not discuss the intervention with the centre staff or children. Data will be linked in the computer to ECEC centre ID only, not name, and upon completion of the study all paperwork linking name to ID will be destroyed. Upon completion of the observation, both EPAO forms and all documents required to be collected are to be placed in an envelope and returned immediately to the research team.

3.9 Minimising child interaction

All RA's must minimise conversation and contact with all children. The children will be aware of the RA's presence and will be informed that a visitor is at the centre during the day to observe staff behaviours and interactions with children during meal times. The children will undoubtedly be curious at first and will try to interact with the RA's. Discourage interaction by avoiding eye contact and minimizing conversation in a curt but pleasant manner. RA's should not interject themselves into the interactions between children or between children and staff.

4. Procedure for Site Visits

4.1 Travel to Centre

Cars will be pre-booked for you to travel to the centre (refer to appendix IV). You will need to arrive 15 minutes before the ECEC centre opens.

4.2 Entering the centre

- Firstly, sign in and introduce yourself to the Nominated Supervisor (NS) and any other staff members.
- If the NS is not there at opening time, speak to another staff member to get information on how to sign in, and where to go to get to the selected room.
- When the NS arrives, briefly remind them of what you'll be doing throughout the day.
    - Recruiting parents as they arrive at the centre.
    - Explain that on the first day, 2 RAs will be designated to Lunchbox audits and one additional RA will complete Environment and Policy Assessment and Observations (i.e. EPAO). On day two, 2 RAs will complete lunchbox audits.
    - Reiterate that all leftovers must be kept in the lunchbox today and not thrown out.
    - RAs are to ask for the most recent list of child food allergies – the Nominated Supervisor would have been informed of this requirement prior to the visit.
    - Ask for any completed parent consent forms that the centre has collected.
- Ask the Nominated Supervisor if they are comfortable with us storing the data collection kit at the centre overnight (at the end of day one of data collection) in a secure place.

4.3 Setting up for lunchbox audits

- The two RAs designated to lunchbox audits should ask to be shown where you can set up the food scales and photography station. Centres will asked beforehand to think about an appropriate space to weigh and photograph lunchboxes. Ideally the space will be:

    - A private place, ideally away from direct view of most children, and from parents dropping off and picking up children. This can be in a partitioned or screened section or in a private corner of a larger room if desired.
    - Somewhere the food photography board and scales can be set up on a table – the table needs to be ergonomically appropriate (i.e. of suitable height)
    - A bin appropriate for the disposal of gloves and any materials used throughout procedure (e.g. photograph template)
    - A bin for lunch waste disposal (may or may not be the same bin). Note: Discuss with the Nominated Supervisor about usual centre waste disposal process (e.g. recycling, used for compost, to feed animals, etc) and adhere to this once post-consumption weighing has been completed
    - Close to lunchbox storage (i.e. for time efficiency and to avoid having to transport having to go up and downstairs with lunchboxes).
    - You may have 2 weighing stations if numbers of lunchboxes to be audited are larger (one RA for each weighing station).

- Refer to the list of child food allergies and compare it to the list of children on your consent list. Children with allergies that <u>have not</u> already been noted on our consent list CANNOT have their lunchbox audited unless you speak with a Population Health Dietitian (Courtney) and the Nominated Supervisor for advice regarding possible clearance.

- RAs are to request that Educators inform them if a consenting child is leaving prior to lunch or afternoon tea, as lunchbox weights can potentially be taken for morning tea only or morning tea/lunch only. (Note: the majority of centres will not have an afternoon tea break)
- After audit station has been set up, undertake food safety hygiene requirements and commence lunch photos and weights as consenting children arrive. At the end of the process, ask Educators to assist with marking off consenting children who are absent.
- Follow detailed Lunchbox audit procedure on page 11

4.4 Parent recruitment

Prior to the scheduled site visit, centres will be asked to distribute parent information statements and consent forms for children to participate in the study. Additionally, a member of the research team will visit the centre 1-2 weeks prior to recruit parents at drop off time who have not yet returned a consent form. Parent recruitment will also occur on the day of the site visits as parents are dropping off their children to the centre. The exact times will vary by centre however this will typically be from 7.30am - 9.30am.

NOTE: It is essential that data collection staff familiarise themselves with the parent information statement and consent form (see spares pack) and be prepared to answer any questions that may arise. We are aiming to recruit as many children into the study as possible. The parent recruitment procedure to be followed is as follows:

1. Speak with the Nominated Supervisor and educators about recruiting parents in the morning upon child arrival.
2. Collect any consent forms that have already been completed prior to the site visit from the Nominated Supervisor/other staff member.
3. Provide educators with an overview of the study and why this information is important (see information statement and consent form in appendix I and II).
4. Confirm the most appropriate place to approach parents to introduce the study (e.g. in the foyer, in one of the rooms, where children are signed in and out etc.).
5. Ask if educators could please remind parents about the study and direct them to data collection staff for the provision of information statements and consent forms.
6. Set up to recruit parents in place indicated by educators.
7. Provide parents with a brief introduction to the study and explanation of what information will be collected (see example recruitment script in appendix III).
8. If parent expresses interest in consenting, check child eligibility: children must be between the ages of 2 and 5 years; and not have a dietary restriction that requires specialised tailoring of their diet (e.g. allergies, intellectual or physical disability).
9. If the parent/caregiver declines to take part in the research, kindly thank them for their time.
10. Check all consent forms have been completed and are legible.

4.5 Conduct lunchbox measurements and observation

To be completed on both days of data collection. Refer to section 5 for a detailed protocol for conducting lunchbox observation and measurement.

4.6 Conduct EPAO observation

To be completed on day one of data collection. Refer to section 6 for a detailed protocol for completed the EPAO observation.

4.7 Complete site visit checklist

The site visit checklist is located in the data collection kit. Please make sure the centre and child ID is on EVERY document and page required.

4.8 Pack up all data collection resources

Pack up all data collection equipment, collate, check and sign recording forms. At the end of the first day of data collection, RA's can leave the data collection kit (in a tidy manner) in the secure place previously specified by the Nominated Supervisor. If a secure place has not been identified, or the Nominated Supervisor did not provide consent for the kit to be left at the centre, RA's are to return the kit to Population Health.

4.9 Return completed Centre Visit Packs and equipment to HNEPH

During business hours: return the car pouch to Dot in reception and return all other items to Taya Wedesweiler (Room 0059B)

After hours: return all items to security office, attach note "Taya Wedesweiler" to pick up <DATE>, contact ph. Ext46327 and let Taya know via text 0419427971 (before you leave security) to pick up items the next day.

5. Data Collection: Lunchbox Audit Photographing and Weighing Protocol

Measure	Tool	Target group	Role of RA
Lunchbox contents and consumption	Lunchbox photos using tablet Food weights with scales Data collection form	All consenting aged 2-5 years	Take pre and post photos and weights Complete data collection form for each lunchbox

5.1 Purpose

Comparison of pre- and post-lunchbox photos and weights to measure mean serves of fruit and vegetables consumed by children from their lunchboxes, mean serves of fruit and vegetables packed within the lunchboxes, and mean saturated fat, sugar and sodium from all foods and drinks consumed.

5.2 Training

Two trained RAs will take photos of lunchbox contents and undertake weighing of food and drink items packed in lunchboxes prior to the first mealtime and after consumption of the last meal.

RAs are to complete lunchbox audit training, including familiarisation with safe food handling practices (either from Food Authority standards as shown below, or individual centre policy/guidelines) prior to attending their first site visit.

- http://www.foodauthority.nsw.gov.au/_Documents/industry/children_services_fsp_template.pdf
- http://www.foodauthority.nsw.gov.au/_Documents/retailfactsheets/personal_hygiene_checklist.pdf
- http://www.foodauthority.nsw.gov.au/_Documents/retailfactsheets/hand_washing.pdf

5.3 Quality assurance

Quality assurance is needed to ensure that all observational data is collected in a standardised and reliable manner. All completed forms will be reviewed for errors, inconsistencies and issues.
RAs will be contacted following this checking process and informed of any issues. Solutions will be determined as necessary and decisions will be communicated with RAs to ensure consistency.

5.4 Lunchbox Audit Materials

Equipment			
1	Scales	1	Box of gloves
1	Electrical cord for scales	3	Plastic buckets
1	Reference weight (block of clay)	3	Plastic takeaway containers
1	Tablet (in box with charging cord)	1	Antiseptic hand gel
1	Chopping board	1	Glad wrap
1	Alcohol surface wipes	1	Washing up detergent
1	Plastic bag/ sheets in blue plastic dispenser	1	Chux

1	Hair nets	1	Tea towel
Stationary			
1	Permanent marker	1	Notepad
3	Clipboards	1	Post it notes – (for covering children's names on lunchboxes in photos)
4	Pens – 3 black, 1 red		
Documentation			
1	Lunchbox photographing and weighing support protocols (below in this document)	1	List of consenting children, including info on those with known pre-existing allergies/ intolerances

5.5 General instructions

1. Prior to the centre visit, a list of consenting children will be provided to the Nominated Supervisor and they will be asked to indicate any food allergies or special dietary requirements these children may have. These children will be screened for suitability for inclusion prior to your site visit.

2. At the visit, the list of consenting children is to be provided to the Nominated Supervisor and it should be requested again to be checked against any **new** reports of food allergy or other special dietary requirements reported. RAs are to phone in to the data collection supervisor and check suitability of inclusion if ANY previously unreported allergy or dietary related condition has been reported for a consenting child. In the situation that the supervisor cannot be consulted, the child should be excluded as a precaution. Absentees and early leavers should also be recorded after checking with the Nominated Supervisor or educator.

3. Educators from the designated data collection room are to be familiarised with the data collection procedures occurring that day. It is important to reinforce with educators that NO FOOD or DRINKS (with the exception of water) ARE TO BE DISPOSED of during the day, including empty packets, fruit skins, crusts etc.

4. If the centre has a procedure to monitor lunchboxes including removal of discretionary foods from lunchboxes, RAs are to ensure that food items are to still be included for weighing and photographing.

5. Educators will be asked to instruct children to keep all food scraps/ packages in the lunchbox after each meal. All food scraps/packages is to be collected in paper bags which will be placed in each child's lunchbox by RAs prior to mealtime. In the scenario that the educator deems the meal leftovers cannot be left in the lunchbox (e.g. too messy/ smelly), they are to inform the RA who will keep the leftovers in a plastic container labelled with the child's ID number, until the final weighing session.

6. If the centre has a usual process for disposing of leftovers (e.g. compost bin etc.), RAs are to ensure that leftovers are disposed of as requested by the centre after the final weighing.

7. Lunchbox photos and weighing of food and drink items to commence as soon as consenting children arrive at centre. This is to allow for ample time to complete prior to morning tea. Record data on one lunchbox data collection form per child.
8. Prior to consumption, RAs will collect lunchboxes (with the help of Educator/s to identify and locate lunchboxes of consenting children) and commence photographing and weighing. Lunchbox photos and weighing of food and drink items should take no longer than ~5 minutes total per lunchbox.

9. After consumption, RAs will repeat the process for both weighing and photographing lunchboxes.

5.6 Process for taking photos of lunchboxes prior to consumption

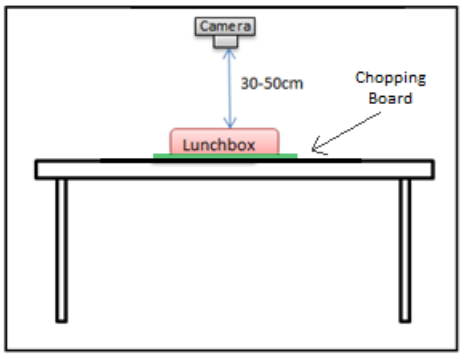
1. Ensure safe Food Handling Practises at all times. Prior to handling lunchboxes, RAs must thoroughly wash hands, hair should be contained in a hair net, and disposable gloves should be worn. A new pair of gloves are required for **each lunchbox** in order to avoid any cross contamination.

2. Up to 3 photos will be taken of each lunchbox during the day. Ensure the following prior to taking the photo:
   1. Place the chopping board on a clean flat surface.
   2. Wipe down the chopping board with an alcohol wipe and allow to dry
   3. Place the A3 paper on the board and attach child code sticker in the top right corner
   4. Put on gloves
   5. Place the opened lunchbox on the paper form.
   6. If children's name labels are visible on containers in photos please cover. Sticky notes are provided for this purpose.

3. Take a reference photo of the lunchbox as it is packed. This to reference the correct re-packing of food and drinks, if required, after the weighing process. This may not be necessary if not many/ any foods need to be removed from the lunchbox.

4. Prior to taking the pre-consumption photo, ensure the following:
   - All lids are taken off containers/lunchbox compartments open
   - All packaged food and drink items are visible (must be able to identify brand names and flavour)
   - Where food items are wrapped in aluminium foil or plastic that may be difficult to see through, carefully unwrap for the photo. Unwrap as little as possible to view contents (details can be recorded in data sheet rather than the photo especially if unwrapping may cause the food to fall apart). Keep the food placed on the foil/plastic for photo.
   - Where food items are hardly visible in the photo, take a close up photo if required and note it down in the data collection form.
   - Food and drink items may be moved around if necessary, or placed just outside the lunchbox, however bear in mind time constraints. Unwrapped food removed from lunchbox should be placed on a plastic slap sheet.
   - Do not take photos of water bottles. Only milk, juice and other calorific drinks.
   - Extra detail may be required and noted on lunchbox weighing data collection form e.g. record food/drink item if it will be hard to identify from photo.
   - Using the Samsung tablet, take one photo of each child's lunchbox
   - To take the photo, hold the camera at 90 degrees, 30-50cm above the lunchbox AND/OR ensure the lunchbox, including all items (including any calorific drinks), fills the viewfinder of the camera. (See Appendix V for examples)
   - Ensure the Child ID, and ruler are clearly visible in the photo.
   - DO NOT USE FLASH

- Using the review function on the camera, ensure that all items are clearly visible in the photo, including an unobstructed view of the ID, and that the photo is in focus (e.g. all brands/writing legible). If the photo is inadequate, delete the photo and retake
- Repeat above step until all items are clear and in focus. Tick the 'Lunchbox Photo' check box on the consent form



5. The A3 paper form can be kept for reuse at post consumption photography in the post consumption folder. Replacement forms will be available if required. If required, wipe over board with an alcohol wipe ready for the next lunchbox photo and allow to dry, discard gloves and replace with new and commence photography of next lunchbox.
6. Once all consenting children's lunchboxes have been photographed, wipe over all equipment and pack up station.

5.7 Process for weighing of food and drink items prior to consumption

1. Set up scales on a clean flat surface close to the lunchbox photography station. Turn the scales on by pressing on/off button. Ensure bubble in the "level" window is centred. Scales should "zero". Test calibration by using the reference weight provided and record any discrepancy.

2. When weighing foods, allow adequate time for weight to "stable" before recording weight. Consult manual for additional information.

3. Prior to handling lunchboxes, RAs must thoroughly wash hands, hair should be contained in a hair net, and disposable gloves should be worn. A new pair of gloves are required for each lunchbox in order to avoid any cross contamination.

4. Place a plastic sheet over the scales. **Do not tare**- the plastic sheet will be accounted for on analysis. Start weighing all food and drink items from lunchbox to the nearest gram (g).
5. All relevant food and drink items need to be weighed individually in their container or wrapping, including sandwiches, immediately after photography. Containers and wrapping that can't be seen through will have already been opened during photography. Do not separate children's sandwiches/crispbreads to see fillings- only determine from a "side view" of the items, you will be able to record detail on lunchbox data collection form

6. Record on lunchbox data collection form. See "How to Complete Data Lunchbox Collection Form" for more detail. Once complete, tick off lunchbox weighing-pre on checklist on front page of lunchbox data collection form.

7. Dispose of the plastic sheet after each lunchbox, or after an item weighed may have affected the plastic sheet (wet, ripped, left a residue). Wipe down scales with an alcohol wipe after each lunchbox.

8. Return all lids, re-wrap of foods and re-pack lunchbox, using the initial photo as a reference if necessary. Return the lunchbox immediately to refrigerated storage. Remove gloves and replace for next lunchbox.

9. Remind educators to keep all food scraps and packaging in children's lunchboxes for post weighing of lunchboxes.

5.8 Food waste that cannot be kept in the lunchbox

Educators should be informed that if they feel they cannot keep food waste in lunchbox (messy/smelly foods, food that fell on the floor and can no longer be eaten), they can request a plastic container from the RAs to put the food waste info. The plastic container needs to be labelled with a child code sticker and can be kept with the RAs.

A note should be made on the child's data collection form of the reason why the food was not in lunchbox (especially if it could not be eaten as it was dropped) and that the container needs to be retrieved prior to final weighing and photography. This food waste should be included in final weighing and photography.

5.9 Process for photographing food and drinks post consumption

1. Prior to handling lunchboxes, RAs must thoroughly wash hands, hair should be contained in a hair net, and disposable gloves should be worn. RAs can commence weighing lunchboxes as soon as the first child finishes their meal.

2. If possible, educators are to inform RAs of children leaving prior to the last meal and RAs can request that the photography and weighing of lunchbox contents still be undertaken, taking note that the child left before the final meal on the Data Lunchbox collection form.

3. Repeat process as for pre-consumption photo. All lids are taken off containers/lunchbox compartments open. All packaged food and drink items are visible. Foods may be unwrapped as they will not be returned to the child, however take care to note on the form that no wrapping was included in the weight. You may take this opportunity to clarify sandwich fillings.
4. Food and drink items may be moved around if necessary, or placed just outside the lunchbox, however bear in mind time constraints. Remember to photograph any food that was stored in plastic takeaway containers (i.e. could not remain in the lunchbox).

5. Do not take photos of water bottles. Only milk, juice and other calorific drinks.

6. Extra detail may be required and noted on lunchbox weighing data collection form e.g. record food/drink item if it will be hard to identify from photo.

7. See instructions for how to complete the data collection form if foods have got mixed up whilst eating or if a “new food” is in the lunchbox that wasn’t there at the pre consumption photo.

5.10 Process for weighing of food and drink items post consumption

1. Prior to handling lunchboxes, RAs must thoroughly wash hands, hair should be contained in a hair net, and disposable gloves should be worn.

2. Repeat same procedure as pre consumption for after consumption.

3. Whenever possible, weigh empty containers and record the weight of the container

4. Record on lunchbox data collection form. See “How to Complete Data Lunchbox Collection Form” for more detail. Once complete, tick off lunchbox weighing-post on checklist on front page of lunchbox data collection form.

5. Remember to check for leftovers that needed to be removed from children’s lunchboxes (stored in labelled takeaway plastic containers).

6. After weighing is complete, RAs are to return lunchboxes to their designated area and dispose of foods scraps and packaging according to centre instructions.

7. Clean equipment and pack up.

6. Data collection: Environmental and Policy Assessment and Observation (EPAO) protocol

Measure	Tool	Target group	Role of RA
EPAO observation	EPAO form (includes Nominated Supervisor interview questions)	Educators present in the nominated "room" (observed) and Nominated Supervisor (interview).	Explain process of observations and interview One or two RAs to complete tool during the day and complete interview section at a time arranged with the Nominated Supervisor

6.1 Purpose

The purpose of the Environmental and Policy Assessment and Observation (EPAO) is to objectively and effectively describe the nutrition policies, practices and environment of ECEC centres.

6.2 Training

Each RA will undergo training, which will include:

- An overview of general ECEC centre nutrition and meal time procedures
- An overview of general field observation techniques
- A review of the EPAO instrument and guidelines for specific questions/sections
- A lesson on interview techniques and procedures
- Instruction and demonstration of record keeping and form completion
- A trial EPAO centre visit at a centre not involved in the trial will take place prior to baseline data collection involving an experienced Project Officer and at least one RA

6.3 Quality assurance

Quality assurance is needed to ensure that all observation data are collected in a standardised and reliable manner.

6.4 Sample to be observed

Only one 2-5 year old room will be observed during meal times (between 9am-3pm). In the case where there is more than one 2-5 year old room, the room with the most consenting children will be observed. The name of this room will be listed on the site visit cover sheet.

6.5 Materials needed

Materials			
1	Pen	1	EPAO support protocol
1	EPAO form		Documentation to be collected from centre (e.g. written nutrition policy) as per EPAO data collection form

6.6 Prior to centre visit (completed by Project Officer)

1. The EPAO centre visit will be prearranged with the centre, including a time scheduled for the 'Nominated Supervisor interview and document review' and the specific room identified (i.e. ideally, room with the highest number of child consent)

2. Information to be collected on centre's daily program, specifically meal procedures i.e. start/end times, and Educators allocated to the nominated room over the course of the day (i.e. morning/afternoon shift)

3. Nominated Supervisors will be asked to communicate with staff in regards to the EPAO centre visit and what it involves

4. Document requests (i.e. nutrition policy, lunchbox guidelines) will be made prior to centre visit for RA/ field data collection staff to pick-up on the day of centre visit

6.7 General guidelines

- Prior to the EPAO observation, the EPAO document should be thoroughly reviewed by the RA's to become familiar with the key constructs – there are likely to be situations where multiple constructs will be observed at once, so familiarity with the tool is key.
- The EPAO will be completed on the same day as the Lunchbox reviews, so there will be 3 RA's present on site for day one of data collection. As there will be potential changes to usual centre procedure and to ensure maximal efficiency, it is essential that an RA from the lunchbox review 'team' and the RA conducting the EPAO meet with the NS (or nominated staff member) upon arrival to confirm proceedings for the day including the timing for the 'Nominated Supervisor interview and document review'.
- The EPAO is to be completed solely based on what is observed, not what staff communicate are "usual" occurrences. While some questions may require confirmation or clarification from staff, most are able to be observed during the observation period.

6.8 Instructions

1. When there are two RAs conducting the EPAO, they are to complete their EPAO forms independently.

2. RAs will be informed prior to the centre visit of the room they will be observing. On the day of observations, they will need to liaise with the Nominated Supervisor to identify who the Educators are for the designated room.
3. RA's are to complete the top section of the form (e.g. date of observation) upon arriving at the centre. The observation start time should correspond with the arrival of the first child.

4. RA's will be required to sketch a diagram of the layout of the room/locations being observed and indicate where they were positioned at key times for observations during the day (it is important to capture this information so it can be replicated or notes made regarding deviations).

5. Where possible, the RAs are to observe the entire room. However, in the event that the children and Educators consume meals in different areas (i.e. some may sit outside, some inside), RAs are to follow the nominated Educator who is with the highest number of children. It is important that this is clearly noted on the EPAO form.

6. RAs are to include brief notes on Educator movements throughout meal time (predominantly stationary, roving, etc.)

7. If the originally observed Educators aren't present during one of/any of the meal times (i.e. they are replaced to have a break/own meals separately/end of shift), observe replacement Educators/staff and record their behaviours, making a note of the staff changeover.

8. RAs are to always take detailed notes and discuss complicated situations with the research team, who will decide upon appropriate classification. There will be regular communication with RAs to clarify any issues that arise to ensure consistency between observers and reliability of data.

6.9 EPAO Items and description

Section A, C and E: This items are repeated for Morning Tea (Section A), Lunch (Section C) and Afternoon Tea (Section E)

#	Item	Description / required response
1	What time did the meal start?	Record the meal start time (i.e. when the first child starts eating)
2	What time did the meal end? [when the last child finished eating]	Record the meal finish time (i.e. when the last child stops eating)
3	How long did the meal last?	This questions aims to capture the duration of the meal time. Subtract Start Time from Finish Time and record the answer in minutes
4	Which of the following practices most closely describes how food was served to children during this meal? [Select one.]	
	Children served themselves most/all foods and decided what size portions to take.	Children are seated around a table with bowls of food on the table. Children are able to portion out food onto their own plates; they are able to decide if and how much of a food they would like. This is commonly called a "family style" meal.
	Children served themselves most foods, but the provider decided what size portions children may take.	Children are seated around a table with bowls of food on the table; staff determine how much the children must serve themselves.
	The provider served most foods, but children decided what size portions they wanted.	Food is brought to the classroom in bulk and served by staff; however, children decide on portion size. For example, staff walk around the room with a container of food and ask each child if they would like some and how much they would like.
	The provider served most foods and decided what size portions to give to the children.	Food is brought to the classroom in bulk and staff decide amount to serve to the children. For example, staff pre-plate all the food before the children are called to a meal.
	Food arrives at classroom already portioned on each child's plate.	Food is brought to the classroom already portioned on trays or plates.

	Children brought food from home.	E.g. lunchboxes packed from home.
5	Was the TV (or a screen) on during this meal today?	Take note if television viewing occurs during any meal time.
X1	Location / physical environment of meals/involvement:	
A.	The provider used child size appropriate tableware (e.g. smaller plates and cups, additional cutlery if not provided from home)	Take note if any staff provided children with cutlery to consume food and drink items, and the size of these. This does not include cutlery brought from home.
B.	The provider made fruits and vegetables easier to eat (e.g. assisted with opening lids/packaging of foods, offered slices, peeled oranges)	This can include: peeling or cutting fruit, opening yoghurt lids or other food packaging. Pay close attention to how food was provided from home to ensure only educator behaviours are captured.
C.	Unhealthy snack foods (can be foods but also include packaging and imagery such as posters, advertisements etc.) are visible to children	This can include: posters, magazines, empty wrappers/packaging, cans of soft drink/sweetened beverages etc. Any type that may promote consumption of unhealthy foods that is visible within the centre.
D.	A variety of healthy foods (including imagery such as Munch & Move healthy eating posters, books etc.) are visible to children	Imagery may include brochures, posters, books, pamphlets. Any type that promotes healthy eating and nutrition that is visible within the centre.
E.	A moment was taken to settle before eating	Please be aware that this is to be observed as soon as the first child commences meal time.
F.	The provider encouraged the children to sit around the table during meals	Take note if the educator encourages children to sit around the table at meal time. This may include verbal encouragement, or non-verbal gestures (e.g. pointing at the table, guiding children to the table)
G.	The provider talked on the phone, texted, or was on the computer during meals	Take note if the educator is using their phone, computer/laptop or other electronic device during meal times.
H.	Educators observed children's lunchboxes to ensure food items within the lunchbox were consistent with Australian Dietary Guidelines	Take note if any educator observes any children's lunchboxes to monitor lunchbox contents, and whether this is done for consistency with Australian Dietary Guidelines.
6	During morning tea in this centre, did the provider eat any of the following foods in front of the children? [Mark all that apply.]	
	The provider ate fast food.	This includes any food brought in from an outside fast food venue, whether in packaging or not.
	The provider ate a salty snack (chips).	This includes chips, corn chips, Doritos, Combos, tortilla chips, cheese puffs, etc. This doesn't include nuts or pretzels.
	The provider ate a sweet snack (donuts, pastries, cookies, lollies).	This includes donut, Danishes, pastries finger buns, cookies, candy bars, lollies, etc.
	The provider ate fruits.	This includes anything the provider brought themselves or what was served for the meal/snack.
	The provider ate vegetables.	This includes anything the provider brought themselves or what was served for the meal/snack.
	The provider drank a soft drink or other sweetened beverage.	This includes diet or regular soda, fruit punches, lemonade, etc.
	The provider ate the same foods as the children.	They ate the lunch served to children at the centre
7*	Did the following interactions between the provider and the children occur?	
A.	The provider talked with the children about the healthy foods they were eating.	This includes any informal discussion about the served food. For example, they might talk about what the food is made of, where it comes from, what

		color/shape/texture it is, or why it is healthy/unhealthy.
B.	The provider enthusiastically role modelled eating healthy foods.	This occurs when the provider eats a healthy food and indicates, through their words or actions, that they really like that food. For example, if a provider ate a bite of carrots and said "Wow! These carrots are so delicious!"
C.	The provider encouraged (not forced or coerced) children to try the foods on their plates.	We are looking for positive/gentle encouragement here. We are not counting when children HAVE to try a bite of something or when they are forced or coerced in any way. (Ex. "Try a bite of your peas and you can have another slice of bread")
D.	The provider praised a child for trying new or less preferred foods.	This includes any verbal praise for eating that not specific to a particular food. For example, if a provider said "Molly, good job eating your breakfast."
E.	The provider praised a child for eating unhealthy foods.	This includes any verbal praise for eating unhealthy foods, such as fried foods, sweet or salty snacks, etc.
F.	The provider sat with the children during morning tea.	The provider (s) sat with the children at the table and participate in the meal. They may or may not eat the served food.
G.	The provider ate with the children during morning tea.	The provider(s) ate food with the children during the meal time.
H.	The provider used an authoritative feeding style.	Definition: Authoritative feeding styles strikes a balance between encouraging children to eat healthy foods and allowing children to make their own food choices. Providers use reason and education, rather than bribes or threats. For example, if a child didn't seem to be eating his food, the provider might say "Charlie, why don't you eat some of your chicken? It's good for you! It'll make your muscles grow strong!" but it was clear that there was no coercion involved (i.e. the child could decide whether or not he actually wanted to eat the chicken), this would count as authoritative feeding.
I.	The provider led/encouraged pleasant conversations during meals.	The provider facilitated positive conversation during meal time. This does not include formal conversation regarding nutrition, but may include discussion on how the child's day is going, daily activities at the centre etc.
J.	The provider let the children choose between two healthy food options.	Take note if the provider has a discussion with children regarding healthy options within their lunchboxes and encourages them to choose between two healthy food options.
8*	Did the provider support or hinder children's self-regulation?	
A.	The provider pressured a child to eat more than they seemed to want.	This would include comments such as "finish your peas," "drink all your milk before you get up," "clean your plate." This would not include encouraging comments designed to get a child to try a food. This may be very similar to the question above, so pay close attention. If a child has specifically stated that they are finished or are full and the provider asks them to "take one more bite" etc. then it counts here.

B.	When a child ate less than half of a meal or snack, the provider removed the plate/lunchbox without asking the child if he/she was full.	With this question and the one below, pay attention if a child in the class eats less than half of their meal or snack and then whether or not the provider asked the child if he/she was finished before removing the plate
C.	When a child ate less than half of a meal or snack, the provider asked a child if he/she was full before removing the plate/lunchbox.	
D.	The provider required the child sit at the table until he/she cleaned their plate/finished all food.	This happens when the provider tells a child that he/she cannot get up from the table until they are finished eating all of the food on their plate, regardless of how full the child is
E.	The provider spoon fed a child to get them to eat.	Note if the provider(s) holds the children's food and spoon feeds them in order to get children to eat. This does not include the provider helping the children unwrap food items.
F.	The provider insisted that a child eat a food.	Note if the provider makes comment to a child insisting that they eat a particular food item. Note, insisting to eat a food is different that a provider encouraging children to try a new food.
G.	The provider rushed a child or children to eat.	Note if the provider makes comments to the child to pressure them to eat their meal at a faster rate. For example "Quick, finish that sandwich, your friends are waiting to play".
H.	The provider praised children for cleaning their plates, examples, "Very good! You have a happy (clean) plate".	Note if the provider(s) makes any positive comments directly to the child when they consume all foods packed within the lunchbox.
9*	Did the provider use food as a reward or bribe?	
A.	The provider promised something other than food for eating ("If you eat your beans, we can play ball outside.").	These are all forms of coercion, which is giving the child something for eating. Please take note of things that are not food only for this questions (promised non-food for food)
B.	The provider used food as a reward or bribe for eating a specific food ("You can't have dessert until you eat your beans.").	For this question, take note of things that are not food only for this questions (promised food for food)
C.	The provider used food as a reward or withheld food as a punishment for behaviour ("If you clean up your blocks, you can have a bigger helping of food.").	For this question, take note of things that are not food only for this question (promised food for non-food)
D.	The provider used food to calm an upset child.	If the provider offers food to a child who is upset, in an effort to calm or soothe the child, please mark that here.
E.	The provider negotiated with children to eat healthy foods (e.g. What about trying one bite and if you don't like it, you don't have to finish it).	Note, negotiating is different to the provider using a food/non-food item as a reward or punishment for behaviour. Negotiating may include the provider asking a child to have a bite or taste of a food, but allowing children to not finish it (e.g. negotiates with the child to have a small amount).
F.	The provider reasoned with the children to eat healthy foods (e.g. Drinking milk makes your bones strong).	This may include the provider giving a reason or explanation to the child for why they should eat a certain food. For example, milk makes your bones strong, carrots are good for your eyes.
G.	The provider ignores or shows indifference to a child or children.	Note if the provider(s) do not acknowledge a child during meal time when approached. This may include

		turning away from the child, or pretending not to hear a child when asked a question or comment.

Section B and F: These items are repeated for Activities after Morning Tea (Section B) and activities After Nap (Section F)

#	Item	Description
1	When inside before lunch today how many minutes did children participate in each of the following nutrition-related lessons and activities? (This can include activities done during indoor play time and circle time.)	
	A planned nutrition lesson	This is a formal nutrition lesson that will most likely appear on the daily lesson plan that discusses healthy eating. It may include talk about the nutritional value of certain foods, talk about always and sometimes food, how certain foods affect your body, etc. It is not informal conversation during centre time or meal time or solely reading a book
	Healthy eating activity (not including mealtime) as part of another planned lesson	This is defined as a regular lesson that incorporates healthy eating. For example a lesson about a foreign country and then trying a healthy food from that country or a lesson on the 5 senses and then discussing the look, feel, smell and taste of a particular fruit.
	Cooking activity	Record any cooking activity, healthy or not, and then list what was made.
	Other nutrition-related activity	Anything that does match categories above
2	What other provider behaviours did you notice?	
A.	The provider read a book to the children today that included a positive message about healthy eating	The provider read a book to the children that included a message about healthy eating.
B.	The provider used food to help calm a child who was upset.	The provider used food to help calm a child who was upset.
C.	The provider used food as a reward or withheld food as a punishment for behaviour ("If you clean up your blocks, you can have a bigger helping of food.").	The provider used food as a reward or withheld food as a punishment for behaviour. E.g. "If you clean up your blocks, you can have a bigger helping of food."
D.	The provider spoke with children about the importance of healthy eating.	The provider spoke with children about the importance of healthy eating.
E.	The provider offered food to children outside of mealtimes (If yes, record what was served and the quantity below).	Take note of any food offered to children outside of the meal time. Including food type and quantity, and any discussion between child and provider.

Section D: Nap/Rest time today

#	Item	Description
D1	What time did the nap time start?	Record nap start time (i.e. when the first child starts napping)
D2	What time did nap time end? [when the last child finished sleeping]	Record the nap finish time (i.e. when the last child stops napping)
D3	How long did nap time last?	This questions aims to capture the duration of the afternoon meal time.

		Subtract Start Time from Finish Time and record the answer in minutes
D4	For each event listed, check the box that describes what was observed during nap time. During nap time in this classroom, did the provider eat any of the following foods in front of the children?	This question aims to capture the type of foods (if any) Educators consumed for the meal period. Tick the 'yes' box for all food types consumed by the Educator Tick the 'no' box for all food types not consumed by the educator

Section H: Equipment, Environment and Space

#	Item	Description
H1	Which of the following items does the play kitchen contain? (Mark all that apply)	Some time while inside, take an inventory of the play kitchen items, being sure to not distract the classroom's activities while looking through the items.
H2	Where is the drinking water for children located indoors? (Mark all that apply)	Both indoors and outdoors, mark where water is located, whether from a faucet, drinking fountain, pitcher, or individual bottles, and whether water is ever restricted. It is likely that water being restricted will only be able to be determined if a provider refuses to serve a child water. It likely won't be something that you can determine otherwise.
H2a	Is access to water ever restricted **indoors**?	
H3	Where is the drinking water for children located outdoors? (Mark all that apply)	
H3a	Is access to water ever restricted **outdoors**?	
H4	How many of the following does the classroom have?	
A.	Books that encourage children to eat foods that are good for them.	While indoors, look at the books, posters, and pictures. Count the number of each that encourage children to eat healthy foods, unhealthy foods, be physically active, or watch TV shows/movies as well as the total number of books and posters/pictures. If a poster/picture spread is made up of several posters clustered together, only count that as one poster.
B.	Books that encourage children to eat less healthy foods	
C.	Total # books	
D.	Posters and pictures that encourage children to eat healthy foods.	
E.	Posters and pictures that encourage children to eat less healthy food.	
F.	Total # posters and pictures	
H5	Is there a garden available at the centre for children to plant/grow items?	While outdoors, be sure to look for a **garden** for the children in the classroom being observed. If there is a garden, note what is growing in it and about how much fruits or vegetables there are.
H5a	If yes, what is in the garden? (mark all that apply)	
H5b	If yes for fruits or vegetables, is there enough	
H6	Across the centre, soft drink and vending machines are located…	While observing the centre, record where the vending machines are located (if any are present at the centre).

EPAO Document review items:

Section A: Training and education

#	Item	Description
1	Does the centre have any documentation that they have offered nutrition education to parents in the form of parent workshops or meetings in the past year?	Review all parent **workshop/meeting** agendas, lesson plans, presentation documents, etc. Mark which topics are covered in these materials.

2	Does the centre have any documentation that they have offered nutrition information to parents in the form of handouts, newsletter articles, bulletin board topics, postings on the centre's website, or email in the past year?	Review all parent **informational** materials – *newsletters, handouts, parent bulletin board, etc*. Mark which topics are covered in these materials.
2b	Which topics were covered in the parent communication that were reviewed?	
3	According to the documents on file, have at least 50% of educators received training in nutrition for young children (e.g., continuing education workshop or TAFE class) or training on a specific nutrition curriculum (e.g., Munch & Move Webinar series)?	Review all educator professional development documents. Ask the Nominated Supervisor, or review to documentation (i.e. attendance lists) to determine if at least 50% of educators have received training in nutrition. Tick the relevant boxes to reflect the content that was covered in the professional development.
3a	If yes, what was the name of the organisation delivering the training and the title of the training?	
3b	If yes, what type of nutrition information was covered? (Mark all that apply)	

Section B: Policy

#	Item	Description
1	Do children bring food from home? (Ask provider/owner)	Yes/No response
1a	If yes, are there written guidelines (e.g., list outlining foods, or a statement in the parent handbook) about what can or cannot be brought from home?	Based on the parent/staff handbook, determine if there is a policy for food to *ever* be brought from home and describe the policy. If food is regularly brought from home, determine if there is a policy or other written document/guideline about what can/cannot be brought and if food items are supplemented by the centre. Determine if there is documentation to demonstrate that the centre communicates with families at least 4 times per year if lunchboxes are not consistent with the Australian Dietary Guidelines.
1b	If yes, what foods does the guideline address? (Mark all that apply)	
1c	According to written documents, are less healthy food items removed from the meals or snacks brought from home?	
2	Does the centre have any documentation that they provide feedback to families when lunchbox food items are not consistent with the Australian Dietary Guidelines at least 4 times per year?	
3	Is there a nutrition policy that includes a statement about:	Observe the written nutrition policy. For each element within the policy, tick the relevant box on the EPAO that matches the stated element.
3a	Was a copy of the written nutrition policy received from the centre?	If the centre does have a policy and/or guidelines, RA to get a copy and record collection. If policy/guidelines do exist but a hardcopy is not available, RAs to provide Good for Kids email address and/or fax number to collect electronically and request that any relevant documents be provided within the week. Record that this method is being used on the EPAO form. A Project Officer will follow this up if documents not provided within the time frame.

Section C: Monitoring and reporting on healthy eating objectives

#	Item	Description
1	Does the centre have any documentation that they monitor achievement in healthy eating objectives?	Review all documentation to support centre monitoring and/reporting of achievement in healthy eating objectives (e.g. quality improvement plans, reports)
2	Does the centre have any documentation that they report (either internally or externally) on its achievement with healthy eating objectives at least annually as part of continual quality improvement (e.g. quality improvement plan, centre reports)?	

Dear Professor Wolfenden

2019/ETH12353: HNE Kids Healthy Eating and Physical Activity Program

The Amendment has been reviewed by the Executive Officer as delegated by the Hunter New England Human Research Ethics Committee and has been approved at the following:

- To amend the follow-up data collection time period and content
- Six month follow-up data collection was originally planned to commence May 2020 and will now be conducted as a nine months follow-up, from August - September 2020
- Conduct semi-structured interviews with service nominated supervisors and service champions within the intervention arm

The following documentation is included in this approval:

- Semi-structured interview information statement (Version 1 dated 3 August 2020)
- Semi-structured Interview consent form (Version 1 dated 3 August 2020)
- Semi structured interview questions (Version 1 dated 3 August 2020)
- Follow Up Nominated Supervisors CATI (Version 2 dated 3 August 2020)
- Follow up service champion CATI (Version 3 dated 11 August 2020)

It is noted that the Hunter New England Human Research Ethics Committee is constituted in accordance with the National Statement on Human Conduct in Research, 2007 (NHMRC). This decision will be ratified at the next meeting of the Committee to be held on 16 September 2020.

This email constitutes ethical and scientific approval only.

Approval has been granted for this study to take place at the following site/s:

- Hunter New England Population Health

Please Note: This is your approval, you will no longer receive a formal letter.

Please contact us if you would like to discuss any aspects of this process further, at HNELHD-HREC@health.nsw.gov.au.

Kind regards

Debbie Madden
Ethics Administration Officer
Research Office
Hunter New England Local Health District
Ph: 02 49855929
Email: Debbie.madden@health.nsw.gov.au

RESEARCH INTEGRITY UNIT

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Registration of External HREC Approval

To Chief Investigator or Project Supervisor:	**Associate Professor Luke Wolfenden**
Cc Co-investigators / Research Students:	**Miss Jacklyn Jackson** **Doctor Alice Grady** **Doctor Serene Yoong** **Doctor Rebecca Wyse** **Doctor Tara Clinton-McHarg** **Ms Rachel Sutherland** **Miss Kirsty Seward** **Professor John Wiggers** **Dr Nicole Nathan** **Mrs Nicole Pond** **Ms Taya Wedesweiler** **Mrs Renee Reynolds** **Ms Kirsty Hope** **Doctor Lorraine Paras** **Mr Michael Stepanovski** **Ms Melanie Lum** **Ms Ashleigh Dives** **Ms Maria Romiti** **Professor Stewart Trost** **Mrs Lisa Janssen** **Miss Courtney Barnes** **Ms Tessa Delaney**
Re Protocol:	**HNE kids healthy eating and physical activity program: School and childcare surveys**
Date:	**16-Sep-2020**
Reference No:	**H-2008-0343**
External HREC Reference No:	**06/07/26/4.04 2019/ETH12353**

Thank you for your **Variation** submission to the Research Integrity Unit (RIU) seeking to register an External HREC Approval in relation to the above protocol.

Your submission was considered under an **Administrative Review** by the Ethics Administrator.

I am pleased to advise that the decision on your submission is **External HREC Approval Noted** effective **16-Sep-2020**.

As the approval of an External HREC has been noted, this registration is valid for the approval period determined by that HREC.

Your reference number is **H-2008-0343**.

PLEASE NOTE:
As the RIU has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's RIU, via RIMS.

Linkage of ethics approval to a new Grant

Registered External HREC approvals cannot be assigned to a new grant or award (ie those that were not identified in the initial registration submission) without confirmation from the RIU.

Best wishes for a successful project.

Mr Alan Hales
Manager, Research Compliance, Integrity and Policy

For communications and enquiries:
Human Research Ethics Administration

Research & Innovation Services
Research Integrity Unit
The University of Newcastle
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T +61 2 492 17894
Human-Ethics@newcastle.edu.au

RIMS website - https://RIMS.newcastle.edu.au/login.asp

Linked University of Newcastle administered funding:

Funding body	Funding project title	First named investigator	Grant Ref
ARC (Australian Research Council)/Linkage Projects(**)	Moving from policy to practice: A randomised trial of an implementation intervention to facilitate the adoption of a statewide healthy canteen policy	Wolfenden, Luke	G1201168
Hunter New England Population Health/Linkage Projects Partner Funding(**)	Moving from policy to practice: A randomised trial of an implementation intervention to facilitate the adoption of a statewide healthy canteen policy	Wolfenden, Luke	G1300710
Hunter New England Population Health/Scholarship(**)	A randomized trial of an implementation intervention to facilitate the adoption of a state-wide healthy canteen policy	Wolfenden, Luke	G1400725
Hunter New England Local Health District/Project Grant(**)	A randomised trial of an implantation intervention to facilitate the adoption of a state-wide health canteen policy	Wyse, Rebecca	G1400906
Hunter New England Population Health	Salary support Top Up - Sze Yoong: A randomised controlled trial of an intervention to improve implementation of nutrition guidelines in childcare services	Yoong, Serene	G1500778

Funding body	Funding project title	First named investigator	Grant Ref
NHMRC (National Health & Medical Research Council)/Translating Research into Practice (TRIP) Fellowships(**)	Use of an online canteen ordering system to implement healthy canteen policies in NSW primary schools	Wyse, Rebecca	G1500620
NHMRC (National Health & Medical Research Council)/Translating Research into Practice (TRIP) Fellowships(**)	Increasing the implementation of a mandatory primary school physical activity policy	Nathan, Nicole	G1600651
National Heart Foundation of Australia/Future Leader Fellowship(**)	Improving the translation of community cardiovascular disease prevention research	Wolfenden, Luke	G1600587
ARC (Australian Research Council)/Discovery Early Career Researcher Award (DECRA)(**)	Theory-based implementation of nutrition guidelines into childcare settings	Yoong, Serene	G1600359
Hunter New England Local Health District/Scholarship(**)	An online consumer intervention in primary school canteens	Wolfenden, Luke	G1500605
Hunter New England Population Health/Scholarship(**)	Scheduling frequent opportunities for outdoor play - a simple approach to increasing physical activity in childcare	Yoong, Serene	G1600481
Hunter New England Local Health District/Scholarship(**)	Healthy eating intervention for disadvantaged schools	Wolfenden, Luke	G1500701
Teachers Mutual Bank/Research Project(**)	Teachers Health Program in Schools	Wolfenden, Luke	G1600904
NHMRC (National Health & Medical Research Council)/Career Development Fellowships(**)	Addressing foundational impediments to the translation of chronic disease prevention interventions in community settings	Wolfenden, Luke	G1600414
Health Administration Corporation/Research Grant(**)	Research to gather baseline data regarding operations and provision of healthy food and drinks of licensed school canteens	Wolfenden, Luke	G1600903
NHMRC (National Health & Medical Research Council)/Partnership Projects(**)	A randomised trial of an intervention to facilitate the implementation of a state-wide school physical activity policy	Wolfenden, Luke	G1600792
Hunter Medical Research Institute/HMRI Research Excellence Award(**)	Directors Award for Mid-Career Researcher	Wolfenden, Luke	G2000337
Hunter Medical Research Institute/Project Grant(**)	Pilot cluster randomised controlled trial assessing the potential impact of an online intervention to improve child dietary intake in childcare	Grady, Alice	G1801365
Department of Health/MRFF Rapid Applied Research Translation Grant(**)	Physical Activity	Nathan, Nicole	GS190039
Department of Health/MRFF Rapid Applied Research Translation Grant(**)	Child Obesity	Wolfenden, Luke	GS190040
NHMRC (National Health & Medical Research Council)/MRFF Investigator(**)	A big problem needs a big solution: Advancing the science of scaling up chronic disease prevention interventions	Sutherland, Rachel	G2000052
Hunter New England Local Health District/Research Funds(**)	Optimizing public health interventions in schools	Wolfenden, Luke	G1900823
NHMRC (National Health & Medical Research Council)/MRFF Investigator(**)	Sustaining the implementation of evidence-based chronic disease prevention programs in education	Nathan, Nicole	G2000053
NHMRC (National Health & Medical Research Council)/Partnership Projects(**)	A randomised trial of an intervention to sustain schools' implementation of a state-wide physical activity policy	Nathan, Nicole	G1900842
Hunter Medical Research Institute/Project Grant(**)	A randomised controlled trial to assess the impact of a uniform intervention on girl's physical activity at school	Nathan, Nicole	G1701511
Hunter New England Population Health/Research Project(**)	SWAP-IT Community Research Trial and Dissemination	Wolfenden, Luke	G1800866
nib Foundation/Multi-Year Partnerships(**)	A technology based solution to support parents to improve their child's diet 'Swap What's Packed in the lunchbox: 'SWAP-It'	Wolfenden, Luke	G1700907
Teachers Health Foundation/Research Funding(**)	Addressing the health risk behaviours of the education workforce: A program to enhance the wellbeing of primary school teachers	Nathan, Nicole	G1800853

Funding body	Funding project title	First named investigator	Grant Ref
Hunter Medical Research Institute/Research Excellence Award(**)	HMRI Award for Early Career Research	Yoong, Serene	G1801493
Hunter New England Population Health/Research Project(**)	Enhancing Teacher's Health	Nathan, Nicole	G1800924
NHMRC (National Health & Medical Research Council)/Centres of Research Excellence (CRE) - Centres of Population Health Research Excellence(**)	NHMRC Centre for Research Excellence in Implementation for Community Chronic Disease Prevention.	Wolfenden, Luke	G1701553
NHMRC (National Health & Medical Research Council)/Investigator Grant(**)	Transforming approaches to chronic disease prevention in community settings	Wolfenden, Luke	G1901360
University of Sydney/Shared(**)	Methods and metrics for moving from best practice prevention to implementation and scale up (ISU)	Wolfenden, Luke	G2000481

ANZCTR
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Trial Review

COVID-19 studies are our top priority. For all other trials, there is a 4-week delay in processing a trial submitted/resubmitted to the ANZCTR and additional delays for updates of registered trials. We appreciate your patience.

VIEW TRIAL AT REGISTRATION VIEW HISTORY

The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it has been endorsed by the ANZCTR. Before participating in a study, talk to your health care provider and refer to this information for consumers

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Trial registered on ANZCTR

Registration number	ACTRN12619001158156
Ethics application status	Approved
Date submitted	1/08/2019
Date registered	19/08/2019
Date last updated	19/08/2019
Date data sharing statement initially provided	19/08/2019
Type of registration	Prospectively registered

Titles & IDs

Public title	A web-based intervention to increase child intake of fruit and vegetables within childcare centres
Scientific title	A cluster randomised controlled trial of a web-based intervention to increase child intake of fruit and vegetables within childcare centres
Secondary ID [1]	None
Universal Trial Number (UTN)	
Trial acronym	
Linked study record	

Health condition

Health condition(s) or problem(s) studied:

Nutrition

Condition category	Condition code
Public Health	Health promotion/education
Diet and Nutrition	Obesity

Intervention/exposure

Study type	Interventional
Description of intervention(s) / exposure	The six month intervention will target nominated supervisors and staff within childcare centres and support their implementation of five healthy eating practices. Specifically, childcare centres will be asked to implement the following targeted healthy eating practices within the intervention period: 1. Supporting families to provide healthier foods consistent with dietary guidelines; 2. Provision of intentional learning experiences about healthy eating to children; 3. Use of feeding practices that support children's healthy

eating; 4. Staff participation in professional development in healthy eating; 5. Comprehensive written nutrition policy that outlines key healthy eating.

Childcare centres allocated to the intervention will receive support from health promotion officers (HPO) within the local health district with experience working with childcare centres. Support to implement the intervention (i.e. healthy eating practices) will include:
1. Audit and feedback: The web-based program includes a self-assessment of the implementation of targeted healthy eating practices. Following the completion of the self-assessment, the web-based program will immediately provide centres with feedback on practice performance.
2. Develop a formal implementation blueprint: Following the completion of the self-assessment, centres will then be encouraged to set goals and create an action plan within the web-based program to facilitate improvements in practice.
3. Distribution of educational materials: The web-based program will house relevant materials designed to assist centre implementation of healthy eating practices, and include: factsheets, email messages and newsletter snippets to facilitate communication with parents regarding children's lunchbox contents alignment with guidelines; educational materials to improve staff knowledge of providing a positive healthy eating environment; example activities to demonstrate intentional nutrition learning experiences within the centre; directions to online learning opportunities, including webinars and eLearning modules to support staff professional development in nutrition; and nutrition policy templates.
4. Identify and prepare a centre champion: Centres will be asked by the HPO to identify and prepare a staff member from the centre who will dedicate themselves to supporting, marketing and driving implementation of the intervention.
5. Educational outreach visit from a HPO: Centre staff (nominated supervisor and centre champion) will receive one face-to-face training session of approximately two hours by a HPO to support implementation of the healthy eating practices and introduce the web-based program at the beginning of the intervention period. This will be a practical, hands-on training session to ensure staff are comfortable using the web-based program, accessing supporting resources and are aware of the key practices targeted by the intervention.
6. Mandate change: Centre nominated supervisors will be asked by the HPO to show support for implementing targeted healthy eating practices and use of the web-based program via a memorandum of understanding, which will outline the responsibilities and expected commitment from both the childcare centre and HPO in working to improve the implementation of healthy eating practices to improve child dietary intake in care.
7. Provide ongoing consultation and local technical assistance: Childcare centre staff will be provided with approximately two telephone calls pending childcare centre needs by the HPOs who conducted the educational outreach visit. The HPOs providing the support will identify centre barriers to implementing the intervention and web-based program, and discuss strategies address these barriers. Email support will be provided by HPOs upon request by the centre. An additional training session delivered via online modalities will be offered to centres, pending childcare centre needs.

Adherence to the intervention will monitored via observations of centre implementation of healthy eating practices, google analytics regularly captured by the web-based program, and internal records detailing the provision of implementation strategies including selection of a centre champion, educational outreach visit, centre staff signatories on the memorandum of understanding, and provision of ongoing consultation and technical assistance, maintained by the research team.

Intervention code [1]	Prevention
Intervention code [2]	Behaviour
Comparator / control treatment	The control group will receive usual care during the intervention period. Usual care includes general support from a health promotion officer upon request to implement the state-wide obesity prevention program. Centres will be provided with access to the web-based program following the completion of the trial.
Control group	Active

Outcomes

Primary outcome [1]	Mean serves of fruit from all food and beverages consumed whilst in care. This will be assessed through the measurement of lunchbox foods and beverages across the day. Two trained research assistants will assess the lunchboxes of participating children. Measurement of lunchbox contents will be conducted on two occasions across the day. Prior to the children's first meal, a photo will be taken of the entire lunchbox contents. Research assistants will then weigh each food item included in the lunchbox. This process will be repeated after the children's last meal. Consumption will be calculated based on foods and beverages present at the first measurement minus foods remaining at the second measurement. Weighed food record data will be entered into a nutrient analysis software by a dietitian and categorised into food groups to calculate mean serves of fruit consumed in accordance with the serve sizes specified within the Australian Guide to Healthy Eating.
Timepoint [1]	Baseline and approximately 6 months follow up
Primary outcome [2]	Mean serves of vegetables from all food and beverages consumed whilst in care. This will be assessed through the measurement of lunchbox foods and beverages across the day. Two trained research assistants will assess the lunchboxes of participating children. Measurement of lunchbox contents will be conducted on two occasions across the day. Prior to the children's first meal, a photo will be taken of the entire lunchbox contents. Research assistants will then weigh each food item included in the lunchbox. This process will be repeated after the children's last meal. Consumption will be calculated based on foods and beverages present at the first measurement minus foods remaining at the second measurement. Weighed food record data will be entered into a nutrient analysis software by a dietitian and

	categorised into food groups to calculate mean serves of vegetables consumed in accordance with the serve sizes specified within the Australian Guide to Healthy Eating.
Timepoint [2]	Baseline and approximately 6 months follow up
Secondary outcome [1]	Mean serves of vegetables packed within lunchboxes assessed through the measurement of lunchbox foods and beverages across the day. Two trained research assistants will assess the lunchboxes of participating children. Prior to the children's first meal, a photo will be taken of the entire lunchbox contents. Research assistants will then weigh each food item included in the lunchbox. Weighed food record data will be entered into a nutrient analysis software by a dietitian and categorised into food groups to calculate mean serves vegetables packed within lunchboxes in accordance with the serve sizes specified within the Australian Guide to Healthy Eating.
Timepoint [1]	Baseline and approximately 6 months follow up
Secondary outcome [2]	Mean serves of fruit packed within lunchboxes assessed through the measurement of lunchbox foods and beverages across the day. Two trained research assistants will assess the lunchboxes of participating children. Prior to the children's first meal, a photo will be taken of the entire lunchbox contents. Research assistants will then weigh each food item included in the lunchbox. Weighed food record data will be entered into a nutrient analysis software by a dietitian and categorised into food groups to calculate mean serves of fruit packed within lunchboxes in accordance with the serve sizes specified within the Australian Guide to Healthy Eating.
Timepoint [2]	Baseline and approximately 6 months follow up
Secondary outcome [3]	Mean child dietary intake of sodium (mg) in care assessed through the measurement of lunchbox foods and beverages across the day. Two trained research assistants will assess the lunchboxes of participating children. Measurement of lunchbox contents will be conducted on two occasions across the day: prior to the children's first meal time and after the children's last meal time. Prior to the children's first meal, a photo will be taken of the entire lunchbox contents. Research assistants will then weigh each food item included in the lunchbox. This process will be repeated after the children's last meal. Consumption will be calculated based on foods and beverages present at the first measurement minus foods remaining at the second measurement. Weighed food record data will be entered into a nutrient analysis software by a dietitian. The nutrient output provided by weighed food record data will be used to assess child intake of sodium (mg).
Timepoint [3]	Baseline and approximately 6 months follow up
Secondary outcome [4]	Mean child dietary intake of added sugar (g) in care assessed through the measurement of lunchbox foods and beverages across the day. Two trained research assistants will assess the lunchboxes of participating children. Measurement of lunchbox contents will be conducted on two occasions across the day: prior to the children's first meal time and after the children's last meal time. Prior to the children's first meal, a photo will be taken of the entire lunchbox contents. Research assistants will then weigh each food item included in the lunchbox. This process will be repeated after the children's last meal. Consumption will be calculated based on foods and beverages present at the first measurement minus foods remaining at the second measurement. Weighed food record data will be entered into a nutrient analysis software by a dietitian. The nutrient output provided by weighed food record data will be used to assess child intake of added sugar (g).
Timepoint [4]	Baseline and approximately 6 months follow up
Secondary outcome [5]	Mean child dietary intake of saturated fat (g) in care assessed through the measurement of lunchbox foods and beverages across the day. Two trained research assistants will assess the lunchboxes of participating children. Measurement of lunchbox contents will be conducted on two occasions across the day: prior to the children's first meal time and after the children's last meal time. Prior to the children's first meal, a photo will be taken of the entire lunchbox contents. Research assistants will then weigh each food item included in the lunchbox. This process will be repeated after the children's last meal. Consumption will be calculated based on foods and beverages present at the first measurement minus foods remaining at the second measurement. Weighed food record data will be entered into a nutrient analysis software by a dietitian. The nutrient output provided by weighed food record data will be used to assess saturated fat (g).
Timepoint [5]	Baseline and approximately 6 months follow up
Secondary outcome [6]	Childcare centre implementation of the targeted healthy eating practices (intervention adherence) will be assessed with the Environmental and Policy Assessment and Observation (EPAO) tool. This tool has been previously validated and is considered to be the gold standard for environment observations in the childcare setting. Per EPAO protocol, a trained RA will undertake a one-day observation and review of childcare centre documentation.
Timepoint [6]	Baseline and approximately 6 months follow up
Secondary outcome [7]	Childcare centre uptake of implementation strategies, including use of the web-based program will be assessed through data provided via Google Analytics. These analytics include, but not limited to, total time logged into the program, completion of the self-assessment, most frequently used program features and the number of requests for assistance. Internal records detailing the provision of implementation strategies including the educational outreach visit, ongoing consultation and local technical assistance, memorandum of understanding and identification of a centre champion will be maintained by research team members.
Timepoint [7]	End of the intervention period (approximately 6 months follow up)
Secondary outcome [8]	Feasibility of the intervention for a fully-powered implementation trial will be assessed through childcare centre and parent recruitment, and consent rates for each component of data collection. Appropriateness of the intervention and implementation strategies will be evaluated through information collected during telephone interviews with centre supervisors and champions.

	End of the intervention period (approximately 6 months follow up)
Secondary outcome [9]	Factors associated with implementation of healthy eating practices will be assessed during a telephone interview with childcare supervisors using items from three of the five domains of the Consolidated Framework for Implementation Research (inner setting (compatibility with centre values and direction, level of priority); innovation characteristics (perceived complexity and cost); and outer setting (external influences such as policies, regulations and peer behaviour)).
Timepoint [9]	End of the intervention period (approximately 6 months follow up)
Secondary outcome [10]	Acceptability and scalability of implementation strategies and intervention will be assessed via a telephone interview conducted with supervisors and champions from centres allocated to the intervention group. This telephone interview will include items previously used by the research team to assess perceived intervention effectiveness, unintended consequences, reach and adoption, acceptability and feasibility and engagement with the web-based program.
Timepoint [10]	End of intervention period (approximately 6 months follow up)

Eligibility

Key inclusion criteria	Centre-based childcare services (long day care services and preschools) To be eligible, childcare centres must: (1) enrol >20 children per day; (2) have internet access at the centre; (3) not provide meals or snacks to children (i.e. parents or caregivers must be required to provide food packed in lunchboxes); (4) not be currently participating in any other intervention to improve child healthy eating and/or physical activity; and (5) not be fully compliant with healthy eating practices specified in the NSW state obesity prevention program. Children In order for children to be eligible to participate, they must: (1) have prior written consent from a parent or guardian; (2) be between the ages of 2 and 5 years.
Minimum age	2 Years
Maximum age	No limit
Gender	Both males and females
Can healthy volunteers participate?	Yes
Key exclusion criteria	Centre-based childcare services (long day care services and preschools) Mobile preschool, family day care centres, and centres that do not cater to children aged 2-5 years; cater exclusively for children requiring specialist care; or are run by the Department of Education and Communities Centre will be excluded due to differing operational characteristics. Children Children with dietary restrictions that require specialised tailoring of their diet (e.g. allergies, intellectual or physical disability).

Study design

Purpose of the study	Prevention
Allocation to intervention	Randomised controlled trial
Procedure for enrolling a subject and allocating the treatment (allocation concealment procedures)	Childcare centres A list of potentially eligible childcare centres located within the HNE region will be provided by the NSW Ministry of Health. A recruitment package will be progressively distributed to potentially eligible centres in random order. A research assistant will then telephone centres in random order to assess eligibility and request consent for study participation. The research assistant will schedule a two-day site visit to complete baseline data collection for consenting centres. Randomisation will be completed following baseline data collection by a statistician with no involvement in the trial. Children Centres will be asked to distribute parent information statements and consent forms via email, parent communication apps, and child pigeonholes. Prior to, and on the day of the scheduled site visits, two research assistants will be present at the childcare centre to request written consent from parents for child participation in the study.
Methods used to generate the sequence in which subjects will be randomised (sequence generation)	Childcare centres will be randomly allocated following a block randomisation procedure in a 1:1 ratio using a computerised random number function in Microsoft Excel 2013 by a trained statistician not otherwise involved in the trial. Randomisation will be stratified by centres with a high number of Aboriginal child enrolments (>10%) and socioeconomic status.
Masking / blinding	Blinded (masking used)
Who is / are masked / blinded?	The people assessing the outcomes The people analysing the results/data
Intervention assignment	Parallel

Phase	Not Applicable
Type of endpoint(s)	Efficacy
Statistical methods / analysis	Descriptive statistics will be used to describe childcare centre and child characteristics, the appropriateness, feasibility, acceptability and scalability of the intervention, and determinants of implementation. At the child level, mixed linear regression models will be run, where a group by time interaction will assess effectiveness of the intervention. All models will include a random effect for childcare centre to account for potential clustering effect, as well as fixed effects for prognostic variables (SES, gender). Scores of the EPAO will be adjusted for baseline, through linear regression analysis. Given a 10% childcare centre attrition rate at follow up, recruitment of approximately 440 children from 22 childcare centres (20 children per centre) will enable detection of a mean difference of 0.3 serves in the primary outcome, with an alpha of 0.05 and an estimated ICC of 0.1, with 80% power and a standard deviation of 0.6 serves. This number of participants will allow detection of a difference of approximately 1.9g saturated fat, 4.7g added sugar and 155 mg sodium.

Recruitment

Recruitment status	Not yet recruiting		
Date of first participant enrolment			
Anticipated	1/09/2019	**Actual**	
Date of last participant enrolment			
Anticipated		**Actual**	
Date of last data collection			
Anticipated		**Actual**	
Sample size			
Target	22	**Accrual to date**	**Final**
Recruitment in Australia			
Recruitment state(s)	NSW		

Funding & Sponsors

Funding source category [1]	Government body
Name [1]	Hunter New England Population Health
Address [1]	Longworth Avenue, Wallsend, NSW 2287
Country [1]	Australia
Funding source category [2]	Charities/Societies/Foundations
Name [2]	Hunter Children's Research Foundation (HCRF)
Address [2]	Lot 1 Kookaburra Circuit, New Lambton Heights, NSW 2305
Country [2]	Australia
Funding source category [3]	Other
Name [3]	Hunter Medical Research Institute (HMRI)
Address [3]	Lot 1 Kookaburra Circuit, New Lambton Heights, NSW 2305
Country [3]	Australia
Funding source category [4]	University
Name [4]	Priority Research Centre for Health Behaviour, University of Newcastle
Address [4]	University Drive, Callaghan, NSW 2308, Australia
Country [4]	Australia
Primary sponsor type	University
Name	University of Newcastle
Address	University Drive, Callaghan, NSW 2308, Australia
Country	Australia
Secondary sponsor category [1]	Government body
Name [1]	Hunter New England Population Health
Address [1]	Longworth Avenue, Wallsend, NSW 2287

Country [1]	Australia

Ethics approval

Ethics application status	Approved
Ethics committee name [1]	Hunter New England Human Research Ethics Committee
Ethics committee address [1]	Locked Bag No 1 HRMC NSW 2310
Ethics committee country [1]	Australia
Date submitted for ethics approval [1]	29/03/2019
Approval date [1]	16/04/2019
Ethics approval number [1]	06/07/26/4.04
Ethics committee name [2]	University of Newcastle Human Research Ethics Committee
Ethics committee address [2]	University Drive, Callaghan, NSW 2308, Australia
Ethics committee country [2]	Australia
Date submitted for ethics approval [2]	07/05/2019
Approval date [2]	08/05/2019
Ethics approval number [2]	H-2008-0343

Summary

Brief summary	Early childhood education and care (ECEC) is a promising setting for interventions targeting children's nutrition behaviours. Web-based modalities may be a promising way of delivering childcare-based interventions whilst overcoming some of the challenges of previous approaches. As such, the primary aim of this study is to examine the impact of a web-based intervention together with health promotion officer support targeting childcare centre healthy eating practices on improving child dietary intake of fruit and vegetable serves in childcare. The intervention will target staff within childcare centres and support their implementation of healthy eating practices.
Trial website	
Trial related presentations / publications	
Public notes	

Contacts

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Data sharing statement

Will individual participant data (IPD) for this trial be available (including data dictionaries)?	No
No/undecided IPD sharing reason/comment	No individual participant data for this trial will be available as ethics approval does not cover this. If a request for individual participant data is made and appropriate ethics approvals obtained, such data may be made available in the future.
What supporting documents are/will be available?	No other documents available

Summary results

No Results

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SPIRIT

STANDARD PROTOCOL ITEMS: RECOMMENDATIONS FOR INTERVENTIONAL TRIALS

SPIRIT 2013 Checklist: Recommended items to address in a clinical trial protocol and related documents*

Section/item	**Item No**	**Description**	**Addressed on page number**
Administrative information			
Title	1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	1
Trial registration	2a	Trial identifier and registry name. If not yet registered, name of intended registry	2,18
	2b	All items from the World Health Organization Trial Registration Data Set	2
Protocol version	3	Date and version identifier	1
Funding	4	Sources and types of financial, material, and other support	19, 20
Roles and responsibilities	5a	Names, affiliations, and roles of protocol contributors	1, 19, 20
	5b	Name and contact information for the trial sponsor	19
	5c	Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities	19, 20
	5d	Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint adjudication committee, data management team, and other individuals or groups overseeing the trial, if applicable (see Item 21a for data monitoring committee)	20
Introduction			

Background and rationale	6a	Description of research question and justification for undertaking the trial, including summary of relevant studies (published and unpublished) examining benefits and harms for each intervention	3-5
	6b	Explanation for choice of comparators	12
Objectives	7	Specific objectives or hypotheses	4-5
Trial design	8	Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group), allocation ratio, and framework (eg, superiority, equivalence, noninferiority, exploratory)	5
Methods: Participants, interventions, and outcomes			
Study setting	9	Description of study settings (eg, community clinic, academic hospital) and list of countries where data will be collected. Reference to where list of study sites can be obtained	5
Eligibility criteria	10	Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and individuals who will perform the interventions (eg, surgeons, psychotherapists)	5, 6
Interventions	11a	Interventions for each group with sufficient detail to allow replication, including how and when they will be administered	7, 8, 9
	11b	Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose change in response to harms, participant request, or improving/worsening disease)	19
	11c	Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence (eg, drug tablet return, laboratory tests)	12, 13
	11d	Relevant concomitant care and interventions that are permitted or prohibited during the trial	12
Outcomes	12	Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended	13-16
Participant timeline	13	Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see Figure)	Figure 1
Sample size	14	Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations	16
Recruitment	15	Strategies for achieving adequate participant enrolment to reach target sample size	5, 6

Methods: Assignment of interventions (for controlled trials)			
Allocation:			
Sequence generation	16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions	7
Allocation concealment mechanism	16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned	7
Implementation	16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions	7
Blinding (masking)	17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how	7
	17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial	7
Methods: Data collection, management, and analysis			
Data collection methods	18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol	13-16
	18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols	6, 13-16
Data management	19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol	13-16
Statistical methods	20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol	16, 17
	20b	Methods for any additional analyses (eg, subgroup and adjusted analyses)	16, 17

	20c	Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation)	16, 17
Methods: Monitoring			
Data monitoring	21a	Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed	N/A
	21b	Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial	N/A
Harms	22	Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct	19, 20
Auditing	23	Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor	N/A
Ethics and dissemination			
Research ethics approval	24	Plans for seeking research ethics committee/institutional review board (REC/IRB) approval	18
Protocol amendments	25	Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC/IRBs, trial participants, trial registries, journals, regulators)	N/A
Consent or assent	26a	Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32)	5, 6, 18
	26b	Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable	N/A
Confidentiality	27	How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial	6, 7
Declaration of interests	28	Financial and other competing interests for principal investigators for the overall trial and each study site	19
Access to data	29	Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators	N/A

Ancillary and post-trial care	30	Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation	N/A
Dissemination policy	31a	Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions	18
	31b	Authorship eligibility guidelines and any intended use of professional writers	N/A
	31c	Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code	N/A
Appendices			
Informed consent materials	32	Model consent form and other related documentation given to participants and authorised surrogates	N/A
Biological specimens	33	Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular analysis in the current trial and for future use in ancillary studies, if applicable	N/A

*It is strongly recommended that this checklist be read in conjunction with the SPIRIT 2013 Explanation & Elaboration for important clarification on the items. Amendments to the protocol should be tracked and dated.

	STUDY PERIOD				
	Enrolment	**Allocation**	**Post-allocation**		**Close-out**
TIMEPOINT	***-t_1***	**0**	***0***	***6 months***	***12 months***
ENROLMENT:					
Eligibility screen	X				
Informed consent	X				
Allocation		X			
INTERVENTIONS:					
[Intervention]			♦———	———♦	
ASSESSMENTS:					
[Child dietary intake of fruit and vegetable servings in care]	X			X	X
[Mean servings of fruit and vegetables packed within lunchboxes]	X			X	X
[Child dietary intake of sodium, saturated fat and added sugar in care]	X			X	X
[ECEC centre implementation of targeted healthy eating practices]	X			X	X
[ECEC centre uptake of implementation strategies]				X	
[Feasibility of intervention and appropriateness of implementation strategies]				X	
[Acceptability of implementation strategies and intervention]				X	
[Implementation context]				X	

Hunter New England Population Health

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NSW GOVERNMENT | Health Hunter New England Local Health District

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Nominated Supervisor Information Statement for the Research Study:
Childcare Electronic Assessment Tool and Support (EATS)
Document Version 2; dated 24/07/2019

Research Team: A/Prof Luke Wolfenden, Dr Serene Yoong, Dr Alice Grady, Dr Nicole Nathan and Ms Courtney Barnes from Hunter New England Population Health and the University of Newcastle

Introduction

You are invited to participate in the research study identified above, which will evaluate a web-based support program together with face to face and telephone support for child care services. The study has been designed to be used by childcare service staff to help improve the diets of young children via implementation of healthy eating policies and practices.

Why is the research being done?

The childcare setting provides a valuable opportunity for establishing and encouraging lifelong healthy eating habits for children. However, previous research suggests that childcare services can find it difficult to meet healthy eating policies and practices, including providing a healthy eating environment, staff training and professional development in nutrition, and communicating with families regarding healthy eating and foods provided within lunchboxes.

Previous research has found that key barriers to meeting these healthy eating practices identified by childcare services include insufficient supporting resources and a lack of time to assess and plan for implementation. The aim of this research study is to determine if a web-based program together with face to face and telephone support can assist services to implement healthy eating practices and improve child dietary intake in care.

Where is the research being done?

This study is being undertaken by the University of Newcastle and Hunter New England Population Health. The study is being supported by a research grant from the Hunter Children's Research Foundation, the Hunter Medical Research Institute and Hunter New England Population Health.

Who can participate in the research?

We are seeking long day care childcare services and pre-schools, where parents pack a lunchbox for their children (i.e. the service does not provide meals to children) and internet access is available to participate in this research.

Unfortunately the study is not suitable for your service if it: is a Department of Education and Communities Service; provides care for children with special needs only, is participating in other studies to improve child nutrition and/or physical activity, and is already implementing the recommended healthy eating policies and practices.

What choice do you or your service have?

Participation in this study is entirely voluntary. Your service does not have to take part in it. Whether or not you decide to participate, this decision will not disadvantage your service in any way. If you do take part, you may withdraw from the study at any time without giving a reason and you will have the option of withdrawing any data which identifies you or your service. If your service exits from the study, we will be able to delete any information you or your service has provided.

What would you be asked to do?

If you agree to participate, your service will be randomly allocated to the intervention or control group. Allocation to the intervention or control group will be done using a computer-generated random number list.

If you are allocated to the intervention group, we will arrange a convenient day and time to provide a face-to-face visit to discuss your involvement in the study. During this visit, a support team member will deliver a training session to help you familiarise yourself with the web-based program and discuss any technical questions. Your service will then have access to use the program over the next six months. You will also be asked to nominate a staff member to champion the uptake of the study, including the use of the web-based program within the service. The support team member will touch base with you and your service champion during the six months following training to see how you are going.

If you are allocated to the control group, you will be asked to continue with your usual healthy eating practices. At the end of the study period, you will be offered support to help your service implement healthy eating policies and practices.

If you agree to participate, we will also ask to collect the following information at two time points, baseline (before the study) approximately September 2019, and follow-up (six months later) approximately April 2020.

- Basic demographic information about your service and information about the usual service policies and practices related to healthy eating. Services within the intervention group will be asked additional questions regarding their perceptions of the web-based program and the support provided to your service. We will gather this information via two telephone interviews or online surveys conducted by a trained research assistant with you (the nominated supervisor). These interviews will take approximately 10-15 minutes to complete.
- If you are allocated to the intervention group, we will also ask to complete a telephone interview or online survey with the nominated service champion at follow-up. We will ask for basic demographic information, and perceptions of the web-based program and the support provided to your service. This survey will take approximately 10-15 minutes to complete.
- We will also ask if you would be willing for us to visit your service to collect information about the current implementation of healthy eating policies and practices within your service. If your service agrees to participate, we will arrange to visit your service on two consecutive days. The visit will involve 2 - 3 trained research assistants attending your service for the two whole days of operation. During the service visit:

  - Research assistants will request consent from parents for their child to participate in the study. This will involve conducting observations and measurements of children's lunchbox contents on two occasions across the day including prior to the children's first meal time, and after the children's last meal time. The contents of children's lunchboxes will be weighed and a photograph of the content of children's lunchboxes will be taken on both of these occasions to assess foods packed and consumed by children in childcare services. The weighing of lunchbox contents will be undertaken with strict attention to food handling and safety procedures. Research staff will visit your service to assist with the co-ordination of data collection, including distribution and collection of information and consent forms to parents. Such data will only be collected from children with signed parental consent and will occur at both baseline and at follow-up.

  - Information will be gathered by the research assistants, where they will observe the nutrition environment, and will request to see service documentation including current healthy eating policies. We will collect this information at two time points: at baseline and follow-up.
- If you are allocated to the intervention group, we will also access your service's usage data and information entered into the web-based program.

All research staff will have appropriate child protection clearance and all research activities will occur at the childcare service in the presence of your usual childcare service staff.

What are the risks and benefits of participating?

We don't anticipate any risk to your service from participation in this research study. While we intend that this study will provide valuable information about how we can best support childcare services to implement healthy eating practices to improve child diet, it may not be of any direct benefit to you or your service. There is a small risk to your service's privacy because some service identifying information is used in the record linkage process. This risk is minimised by separating the processes of record linkage and data analysis. The record linkage only contains general information such as service name and address. At the time of linkage, a unique personal identification number will replace your service information.

How will your privacy be protected?

All the information collected from you and your service will be treated confidentially, and only authorised members of the research team will have access to it. The study results may be presented at a conference or in a scientific publication, but it will not be possible to identify individuals or services in any publication or presentation arising from the research study.

Any information provided during the interviews and service visits will be stored in a secure facility. All information stored and/or transferred electronically will be done in a file which is password protected. The information collected will be safely stored for seven years. All safety measures have been put in place to ensure that the confidentiality of the participant's information is maintained, including the removal of identifying information, the use of unique study numbers and the adherence to strict guidelines regarding data transfer, storage and access.

How will the information collected be used?

Information collected for the study will be used to evaluate the effectiveness and usefulness of the web-based support program together with face-to-face and telephone support in improving child dietary intake in care, and helping childcare services to implement healthy eating policies and practices. The data may be presented at scientific conferences, be published within scientific journals or form part of student theses, or be provided to the NSW Ministry of Health. Non-identifiable data may also be shared with other parties to encourage scientific scrutiny, and to contribute to further research and public knowledge, or as required by law.

What do you need to do to participate?

A member of the research team will make telephone contact with you in approximately one week to request your participation. If you would like to participate, please indicate this to the team member during the telephone call. The team member will arrange for you to complete and return a consent form for your service, and will also let you know what the next steps will be for participating in the study, including procedures for collecting baseline information.

Further information

If you would like further information, please contact Alice Grady on (02) 49246310 or alice.grady@health.nsw.gov.au

Thank you for considering this invitation.

A/Prof Luke Wolfenden
Manager – Healthy Children's Initiative
Hunter New England Population Health
NHMRC Career Development Fellow
University of Newcastle

Complaints about this research

This research has been approved by the Hunter New England Human Research Ethics Committee of Hunter New England Local Health District, Reference 2019/ETH12353

Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to Dr Nicole Gerrand, Manager, Research Ethics and Governance Office, Hunter New England Human Research Ethics Committee, Hunter New England Local Health District, Locked Bag 1, HRMC NSW 2310, telephone (02) 49214950, email HNELHD-HREC@health.nsw.gov.au.

Hunter New England Population Health

Direct Contact Details
Phone: (02) 4924 6477 Fax: (02) 4924 6490
Locked Bag 10, Wallsend NSW 2287
Email: PHEnquiries@hnehealth.nsw.gov.au
8/9/2019

Health
Hunter New England
Local Health District

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

The Nominated Supervisor
Elermore Vale Public School Preschool
Jubilee Road
2287

Nominated Supervisor Consent Form for the Research Study:
Childcare Electronic Assessment Tool and Support (EATS)
Version 2, dated 24/07/2019

Please complete this form and return it to:
Taya Wedesweiler at taya.wedesweiler@health.nsw.gov.au
OR Taya Wedesweiler Locked Bag 10 Hunter New England Population Health Wallsend 2287;
OR return via fax (02) 4924 6490 (Attention: Taya Wedesweiler).

I have read and understand that the study will be conducted as described in the Information Statement, a copy of which I have retained.

I have been made aware of the procedures involved in participating in the study, including any known or expected inconvenience, risk, discomfort or potential side effect, and of their implications as far as they are currently known by the researchers.

I consent to the members of the research team visiting my service as detailed in the Information Statement.

I understand that my service can withdraw at any time without providing a reason and my service will not be disadvantaged by this decision.

I understand that my personal information will remain confidential to the researchers.

I have had the opportunity to have questions answered to my satisfaction.

I hereby give my consent for my service to participate in service visits.

I consent to the research team accessing usage data and information entered into the web-based program.

Name of childcare service _____

Name of Nominated Supervisor _____

Signature of Nominated Supervisor _____

*Date*_____

NOTE FOR ETHICS COMMITTEE:

- **The CATI and online survey questions will be scripted to incorporate/finalise appropriate skips prior to being administered**

Introduction

Intro	Hello, my name is ^_INTVR_^ and I'm calling from Hunter New England Local Health District. I'm calling to speak to [Nominated Supervisor Name] regarding a study your service has agreed to participate in to assist childcare services to improve child diet by implementing healthy eating policies and practices.	Go to Intro1

Intro1	Could I please speak to [Nominated Supervisor Name]?	
	1 Yes - Speaking to that person	Go to Intro2
	2 Yes – person called to the phone	Go to Intro2
	3 Not available /Call back later	Go to Call1
	.R Refused	Go to

Intro2	Hi [Nominated Supervisor Name]. I believe [team member name] has recently been in contact with you about participating in a study we are running called Childcare EATS. The study looks to see if a new web-based program together with support from health promotion officers, will help your childcare services to meet healthy eating policies and practices to improve child diet. I'm calling today about the first telephone survey that [team member name] mentioned we would be conducting with childcare supervisors as part of the study. The survey will take about 15 minutes to complete. Is now a good time for you, or would you like me to call back later?	
	1 Yes now	
	2 Yes, but need to call back later	
	3 No/Declines to participate	
	.R Refused	

Call1	Could you suggest the best time that we can call back? [Make arrangements for a call back and record on Log Sheet] *Also WRITE name of nominated supervisor on log sheet* Thank you very much for your time. Goodbye.

Confid1	Great, thanks for agreeing to take part. We would like to reassure you that your responses will be kept confidential, and that services will not be identified in any of the reports we produce. We'd like to start by asking you a few questions about your service.	Go toNS1

	No worries, thank you for your time today anyway. Bye.

Nominated Supervisor demographics

NS1	The following questions are about your service and your role at the service	NS2

NS2	What is your main role at the service? [INTERVIEWER NOTE: PROMPT Response options in need, **S**elect all that apply]	
	1 Nominated / Authorised Supervisor	Go to next
	2 Director	
	3 Educator	
	4 Cook	
	5 Room leader	
	6 Service owner	
	7 Other (please specify)	
	8 [DO NOT READ OUT] Don't know	
	.R [DO NOT READ OUT] Refused, Prefer not to say	

	How long have you worked *in this role* in total, either at this service, or at any other services? (INTERVIEWER NOTE: one option only)	
	1 Less than 1 year	Go to next
	2 1-5 years	
	3 5-10 years	
	4 More than 10 years	
	.R Refused	

	How long in total have you worked in the early childhood education and care setting, either *in this role* or any other roles e.g. an educator? (INTERVIEWER NOTE: one option only)	
	1 Less than 1 year	Go to next
	2 1-5 years	
	3 5-10 years	
	4 More than 10 years	
	.R Refused	

Age	What is your age?	
	<enter age>	Go to next
	(Code '777' prefer not to say')	
	(Code '999' if Refused)	

QUAL	What training and/or qualifications do you have? (INTERVIEWER NOTE: Read out options)	
	1 A University qualification	Go to HOURS
	2 A TAFE qualification	
	3 A course with a registered training organisation	
	4 'On the job' training	
	5 Commercial cooking qualification	
	6 Other qualifications or training, please specify [OQUAL]	
	7 None	
	8 Don't know	
	.R Refused	

HOURS	How many hours per week do you typically work in the service?	
	<enter numeric value>	Go to FREPL
	(Code '888' if don't know)	
	(Code '999' if Refused)	

Intro	The next set of questions will focus on your service's experience with the Munch & Move program. The Munch & Move program is a NSW Health initiative that was developed to help support Early Childhood Education	Go to next

	and Care services to implement healthy eating and physical activity best practice guidelines and recommendations. The following questions will allow us to determine what additional support may be required.	

CFCG1	Have you heard of the Munch & Move healthy eating policies and practices, such as monitoring children's lunchboxes and providing intentional healthy eating learning experiences?	
	1 Yes	(Go to CFCG2)
	2 No	(Go to review1)
	888 Don't know	(Go to review1)
	999 Refused	(Go to review1)

CFCS1	Has your service received any support to implement the Munch & Move healthy eating policies and practices in the last 12 months? [Interviewer note: For example, from your Local Health District]	
	1 Yes	(Go to GFCS1a)
	2 No	Go to next
	3 Don't know	
	.R Refused	

CFCS1a	What support has your service received? (NOTE: select all that apply) [INTERVIEWER NOTE: 'w'=with, 'info'=information, '&'=and]	
	1 Attended workshops	(Go to assist)
	2 eLearning modules or webinars	
	3 Face-to-face support	
	4 Telephone support	
	5 Email support	
	6 Printed resources or newsletters with info & tips	
	7 Web-based support program	
	8 Other (please specify)	
	9 Don't know	
	.R Refused	

Assist	Does anyone assist you with implementing heathy eating policies and practices? INTERVIEWER NOTE: Read out all options	
	1 Yes – service director or manager	Go to next
	2 Yes – educators who work at the service	
	3 Yes – parents	
	4 No – I'm fully responsible	
	5 Other, please specify	
	6 Don't know	
	R Refused	

Adverse / time spent:

Time1	How much time per month do you spend **reviewing** your service processes to see if they are meeting Munch & Move healthy eating practices? *Please provide your best estimate in minutes, or hours*	
	1 _____minutes _____ hrs	Go to next
	2 None	
	3 Don't know	

	.R Refused	

Time2	How much time per month do you spend **planning** service processes to meet Munch & Move healthy eating practices? *Please provide your best estimate in minutes, hours*	
	1 _____minutes _____ hrs	Go to next
	2 None	
	3 Don't know	
	.R Refused	
Time3	Is anyone else at your service responsible for reviewing your service processes to see if they are meeting Munch & Move healthy eating practices?	
	1 Yes - Nominated / Authorised Supervisor	Go to next
	2 Yes - Director	
	3 Yes - Educator	
	4 Yes - Cook	
	5 Yes - Room leader	
	6 Yes - Service owner	
	7 Other (please specify)	
	8 No	
	9 [DO NOT READ OUT] Don't know	
	.R [DO NOT READ OUT] Refused, Prefer not to say	

Time4	How much time per month do they spend **reviewing** your services processes to see if they are meeting Munch & Move healthy eating practices? *Please provide your best estimate in minutes, hours*	
	1 _____minutes _____ hrs	Go to next
	2 None	
	3 Don't know	
	.R Refused	

Time5	How much time per month do they spend **planning** service processes to meet Munch & Move healthy eating practices *Please provide your best estimate in minutes, hours*	
	1 _____minutes _____ hrs	Go to next
	2 None	
	3 Don't know	
	.R Refused	

Self-assessment questions:

Info screen	In the next set of questions, we will ask about how your service is currently going with meeting healthy eating policies and practices. The information gathered from these questions will help us determine what kind of additional support may be required to help services meet healthy eating policies and practices.

Lunch1	Do educators observe children's lunchboxes to monitor the packing of recommended / not recommended food items?	
	1, No, the service does not observe children's lunchboxes	Go to next
	2, Yes, the service observes children's lunchboxes	
	8 Don't know	
	R Refused	

Lunch2	What is the primary source of nutrition information educators use to determine which foods are/are not recommended to be packed in children's lunchboxes? (Select one)	
	1, Educators use their best judgement (i.e. no resources are used)	Go to next
	2, List of recommended/not recommended foods developed by the service (i.e. internal resource)	
	3, Externally developed resource (specific resources allowed: Australian Dietary Guidelines, Caring for Children recommendations, Good for Kids, Munch & Move Healthy Lunchboxes Fact Sheet)	
	4, Information available on the internet (e.g. Google search)	
	8 Don't know	
	R Refused	

Lunch3	How often does the service observe children's lunchboxes?	
	1, Once per week or less	Go to next
	2, 1-2 times per week	
	3, 3-4 times per week	
	4, Every day	
	8 Don't know	
	R Refused	

Feed1	Does your service provide feedback to families about whether lunchbox contents are consistent with the service nutrition policy/guidelines?	
	1, No	Go to next
	2, Yes	
	8 Don't know	
	R Refused	

Feed2	If the lunchbox is not consistent with the service nutrition policy/guidelines, how often do educators provide feedback to families?	
	1, Less than once per year	Go to next
	2, Once per year	
	3, Twice per year	
	4, Quarterly or more often	
	5, N/A (lunchbox is consistent)	
	8 Don't know	
	R Refused	

Feed3	Does your service provide parents with a specific resource or list outlining foods that are recommended or not recommended for packing in children's lunchboxes?	
	1, Yes	Go to next
	2, No	
	8 Don't know	
	R Refused	

Info1	Has your service provided information to families about healthy eating for children from a recognised health authority in the last six months (e.g. Munch & Move, Healthy Eating for Children brochure, resources from Local Health District)?	
	1, No	Go to next
	2, Yes	
	8 Don't know	
	R Refused	

Learn1	Does your service provide intentional healthy eating learning experiences to children? (e.g. lessons involving food, books, puzzles and story time, cooking and gardening activities, discussion about 'everyday' and 'sometimes' foods)	
	1, No	If yes, go to learn2
	2, Yes	
	8 Don't know	
	R Refused	

Learn2	How often does your service provide intentional healthy eating learning experiences to children?	
	1, Never	Go to next
	2, Monthly	
	3, Fortnightly	
	4, Once per week	
	5, At least two times per week	
	8 Don't know	
	R Refused	

Enviro1	Are any materials (e.g. posters, brochures, books, fact sheets) promoting healthy eating visible in your service?	
	1, Yes	If yes, go to enviro2
	2, No	
	8 Don't know	
	R Refused	

Enviro3	How often is the TV or other screen devices on during meal or snack times?	
	1, Every day	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Role1	How often do the service staff sit and eat with the children?	
	1, Every day	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Role2	How often do the service staff eat or drink unhealthy foods in front of the children?	
	1, Every day	Go to next

	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Role3	How often do the service staff consume fruit in front of the children?	
	1, Every day	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Role4	How often do the service staff consume vegetables in front of the children?	
	1, Every day	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Role5	How often do the service staff enthusiastically role model eating healthy foods? (include example here)	
	1, Every day at	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Behav1	How often do the service staff encourage children to try a new or less preferred food? (Note: encouragement does not mean coerce or forced to try new foods)	
	1, Every time a new or less preferred food is provided in the lunchbox	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Behav2	How often do service staff use children's preferred foods to encourage them to eat new or less-preferred foods?	
	1, Every time a new or less preferred food is provided in the lunchbox	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	

	R Refused	

Behav3	How often do service staff use food to calm upset children or encourage appropriate behaviour?	
	1, Every day	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Behav4	How often do the service staff use food as a reward or incentive?	
	1, Every day	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Behav5	How often do service staff require that children sit at the table until they finish the foods within their lunchbox?	
	1, Every day	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Comm1	How often do educators talk with children informally about healthy eating?	
	1, Everyday	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Comm2	How often do the service staff make positive comments about the healthy choices ('everyday' foods) provided within children's lunchboxes?	
	1, Every day	Go to next
	2, At least weekly	
	3, At least monthly	
	4, Less than monthly	
	5, Never	
	8 Don't know	
	R Refused	

Staff1	What percentage of primary contact educators in the service have accessed professional development in nutrition in the last six months (e.g. Munch & Move webinars, eLearning modules, staff development kit, or educational workshop)?

	1, Less than 50%	Go to Policy1
	2, 50%	
	3, More than 50%	
	8 Don't know	
	R Refused	

Policy1	Does your service have a written nutrition policy?	
	1, Yes	If yes, go to policy2
	2, No	
	8 Don't know	
	R Refused	

Policy2	Does your service written nutrition policy contain any of the following elements? (Select all that apply)	
	1, Strategies are in place to ensure that food and drinks provided by families in lunchboxes are consistent with the Australian Dietary Guidelines (e.g. using Munch & Move Healthy Lunchboxes fact sheet, Caring for Children, Good for Kids)	Go to next
	2, Strategies are in place to ensure food isn't used as a reward or incentive for children	
	3, Educators role model healthy food and drink choices at every meal and snack time	
	4, Educators reinforce healthy eating behaviours to children, including trying new and less preferred food items whenever that food is packed	
	5, Educators provide positive comments regarding healthy food items packed within children's lunchboxes at every meal and snack time	
	6, At least 50% of primary contact educators have accessed professional development in nutrition in the past six months	
	8, Information on healthy eating for children is provided to families at least once every six months	
	9, Intentional healthy eating learning experiences are delivered to children at least twice per week	
	10, Materials promoting healthy eating (e.g. *Munch & Move* posters) are visible in the service	
	11, TV or other screen devices are not on during meal and snack times	
	12, Educators avoid using preferred foods to encourage children to eat new or less preferred foods	
	13, None of the above	
	888 Don't know	
	R Refused	

Info screen	Now we've reached the end of the survey. Thank you for answering all of those questions, we really appreciate it. One of the research team members will be in touch with you soon to discuss the next steps for the study. Have a great day.

NOTE FOR ETHICS COMMITTEE:

- **The CATI questions will be scripted to incorporate/finalise appropriate skips prior to being administered**

Introduction

Intro	Hello, my name is ^_INTVR_^ and I'm calling from *Hunter New England Local Health District.* I'm calling to speak to the Supervisor of your service about the web-based support study that ^CENTNAME^ is participating in. Would ^NSNAME^ be available?	
	1 Yes – Speaking to that person	Go to Intro1d
	2 Yes – person called to the phone	Go to Intro1a
	3 No – person no longer at the service	Go to Name
	4 Not available /Call back later	Go to Intro2b
	5 **Not Childcare service** [check for changed name]	Go to service2
	.R Refused	Go to Intro2c

Name	Could you please tell me the name of the new Nominated Supervisor at your service? [INTERVIEWER NOTE: Record name]	
	1 Record name	Go to NINTRO1

Service2	I'm sorry, I have this number as ^CENTNAMF^? Has your childcare service ever been known by that name?	
	1 Yes	Go to Service5
	2 No	Go to Info2
	3 Not a childcare service	

Service5	Ok, What is the NEW name of your service? I'll just update our records with that information. [INTERVIEWER NOTE: Record centre name]	
	1 Record name	Go to NINTRO1

NINTRO1	Would [Nominated Supervisor Name] be available?	
	1 Yes – Speaking to that person	Go to INTRO1d
	2 Yes – person called to the phone	Go to INTRO1a
	3 Not available /Call back later	Go to Intro2b
	4 Refused	Go to Intro2c

Intro1a	Hello [Nominated Supervisor Name], my name is ^_INTVR_^ and I'm calling from *Hunter New England Local Health District.*	Go to Intro1d

Intro1d	We recently contacted you to let you know that we would be completing the follow-up survey for the web-based support study which your service is participating in. You will be asked some questions over the telephone about your service processes. The interview will take approximately 10-15 minutes. Is now a good time for you to complete the survey?

	1 Yes	Go to INFO
	2 Yes/Call back later	Go to Intro2b
	3 Requests email to be resent before continuing	Go to LETT
	4 Requests more information before continuing	**Intervention:** Go to INTINF **Control:** Go to CTLINF
	5 No/Declines to participate	Go to Intro2c
	.R Refused	Go to Intro2c

INTINF	In <month><year> your service agreed to participate in a study to improve child dietary intake in care via the implementation of healthy eating policies and practices. Your service was provided with access to the web-based program along with training and ongoing support from HNE health promotion officers to use the web-based program. We are now recontacting your service to complete the follow up telephone survey. Are you happy to continue with the survey now?	
	1 Yes will do now	Go to INFO
	2 Yes/Call back later	Go to Intro2b
	3 Requests email to be resent before continuing	Go to LETT
	4 No/Declines to participate	Go to Intro2c
	.R Refused	Go to Intro2c

CTLINF	In <month><year> your service agreed to participate in a study to improve child dietary intake in care via the implementation of healthy eating policies and practices. We are now recontacting your service to complete the follow up telephone survey. Are you happy to continue with the survey now?	
	1 Yes will do now	Go to INFO
	2 Yes/Call back later	Go to Intro2b
	3 Requests email to be resent before continuing	Go to LETT
	4 No/Declines to participate	Go to Intro2c
	.R Refused	Go to Intro2c

LETT	Sure, I can send you another copy. What is your best email address?	
	Email [record email address]	Go to NLETT

NLETT	I'll send that off as soon as possible. Would you be willing to continue the interview today, or would you prefer us to call you back once you've had a chance to read the email?	
	1 Continue survey	Go to INFO
	2 Arrange call back	Go to Intro2b

Intro2b	Could you suggest the best number and time that we can call back? [Make arrangements for a call back and record on Log Sheet] Thank you very much for your time. Goodbye.

Intro2c	OK, thank you for your time. [Do not ask, but record reason if given. If no reason given, record 'nil']

INFO	Great, thanks for taking the time. We would like to reassure you that your responses will be kept confidential, and that services will not be identified in any of the reports we produce. We'd like to start by asking you a few questions about your service.	Go to EL1a

Info2 [end survey]	No worries, thank you for your time today anyway. Bye.

[Intervention services only] Acceptability, appropriateness and feasibility of support strategies and engagement with web-based program:

FAAcc	Over the last nine months your service was provided with access to the web-based program, along with support from the team to use this program to meet healthy eating policies and practices. We are interested in your experience with using the web-based program and the support you received from HNE health promotion officers. There are no right or wrong answers so please just provide the response that first comes to mind. Please tell us if you Strongly Agree, Agree, Neither agree nor disagree, Disagree or Strongly Disagree with the following statements.

Appropriateness:

Approp1	The healthy eating policies and practices seem fitting.	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Approp2	The healthy eating policies and practices seems suitable.	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Approp3	The healthy eating policies and practices seem applicable.	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Approp4	The healthy eating policies and practices seem like a good match.	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

CFIR items:

Innov1	The healthy eating policies and practices are difficult to implement	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Innov2	Implementing the healthy eating policies and practices is costly for our service.	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Inner1	The healthy eating policies and practices are consistent with the philosophy of my service.	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Outer1	The healthy eating policies and practices are consistent with the National Quality Framework.	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Outer2	Most other services in my region would be supportive of the healthy eating policies and practices.	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Engagement with web-based program

The next questions will ask specifically about your perceptions of the web-based program you were provided access to.

Engage1	I think that I would like to use this web-based program frequently. Do you…[INTERVIEWERS: PROMPT responses as required]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Engage3	I thought this web-based program was easy to use. Do you…[INTERVIEWERS: PROMPT responses as required]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Engage4	I think that I would need assistance to be able to use this web-based program. Do you…[INTERVIEWERS: PROMPT responses as required]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Engage9	I felt very confident using this web-based program. Do you…[INTERVIEWERS: PROMPT responses as required]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	

	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Acceptability:

Accept1	Using the web-based program is an acceptable method for assessing if our service is meeting the healthy eating policies and practices. Do you…[INTERVIEWERS: PROMPT responses as required]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Accept2	The web-based program was useful in my service to help meet *the* healthy eating policies and practices. Do you …. [PROMPT response options in need]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused [Do not read out]	

Accept3	Using the web-based program improved my services performance in meeting *the* healthy eating policies and *practices.* Do you …. [PROMPT response options in need]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Accept4	The children benefited from our service's use of the web-based program. Do you …. [INTERVIEWERS: PROMPT responses as required]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	
Accept5	I would recommend the web-based program to other childcare services.	

	Do you …. [PROMPT response options in need]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Accept6	I intend to continue to use the web-based program to help our service meet the healthy eating policies and practices. Do you ….[PROMPT response options in need]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Intervention support strategies:

Suppintro	The following questions will help us to evaluate the usefulness of the support provided to your service to implement healthy eating policies and practices. For each question please say whether you found it very useful, useful, somewhat useful, not very useful or not at all useful.	

Supp1	I found the face-to-face training session useful.	
	1 Very useful	
	2 Useful	
	3 Somewhat useful	
	4 Not very useful	
	5 Not at all useful	
	6 Don't know	
	R Refused	

Supp2	I found the garnering of managerial support useful. PROMPT: Garnering of managerial support included discussing service responsibility and strategies to communicate support of the program to staff members.	
	1 Very useful	
	2 Useful	
	3 Somewhat useful	
	4 Not very useful	
	5 Not at all useful	
	6 Don't know	
	R Refused	

Supp3	I found the ongoing telephone support provided by the HNE health promotion officers useful.	
	1 Very useful	
	2 Useful	
	3 Somewhat useful	
	4 Not very useful	
	5 Not at all useful	
	6 Don't know	
	R Refused	

Supp4	I found nominating a service champion useful. PROMPT: Services were asked to nominate a service champion to support uptake of the program within the service.	Only asked of those service that identified a service champion
	1 Very useful	
	2 Useful	
	3 Somewhat useful	
	4 Not very useful	
	5 Not at all useful	
	6 Don't know	
	R Refused	

Impact of COVID-19 restrictions on usual childcare service processes:

COVIDintro	The next set of questions will focus on the potential impact of COVID-19 restrictions on usual processes at your service. Please tell us if you Strongly Agree, Agree, Neither agree nor disagree, Disagree or Strongly Disagree with the following statements.	

COVID1	COVID-19 had a negative impact on the services' ability to meet healthy eating policies and practices	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

COVID2	COVID-19 had a negative impact on my ability to use the Childcare EATs web-based program meet the healthy eating policies and practices*	
	1 Strongly agree	*Asked of intervention services only
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

COVID3	COVID-19 had a negative impact on parents' ability to pack healthy foods for their children to consume in care	
	1 Strongly agree	

	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

COVID3	COVID-19 had a negative impact on the children's consumption of healthy and unhealthy foods in care	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

	Do you have any other comments about the study? [INTERVIEWERS: Record comments or NO]	

FINISH	Thank you for answering all of those questions and for your participation in the study. Your contribution is much appreciated and will be valuable in helping us to determine the usefulness of the web-based program and support strategies in assisting childcare services to meet healthy eating policies and practices. Thanks for your time and have a lovely day.	

NOTE FOR ETHICS COMMITTEE:

- **The CATI questions will be scripted to incorporate/finalise appropriate skips prior to being administered**

Introduction

Intro	Hello, my name is ^_INTVR_^ and I'm calling from *Hunter New England Local Health District.* I'm calling to speak to [service champion] about *the* web-based support study that ^CENTNAME^ is participating in. Would ^service champion^ be available?	
	1 Yes – Speaking to that person	Go to Intro1d
	2 Yes – person called to the phone	Go to Intro1a
	3 No – person no longer at the service	Go to Name
	4 Not available /Call back later	Go to Intro2b
	.R Refused	Go to Intro2c

NINTRO1	Would [service champion] be available?	
	1 Yes – Speaking to that person	Go to INTRO1d
	2 Yes – person called to the phone	Go to INTRO1a
	3 Not available /Call back later	Go to Intro2b
	4 Refused	Go to Intro2c

Intro1a	Hello [service champion], my name is ^_INTVR_^ and I'm calling from *Hunter New England Local Health District.*	Go to Intro1d

Intro1d	We recently contacted you to let you know that we would be completing the follow up survey for the web-based support study which your service is participating in. You will be asked some questions over the telephone about your service processes. The interview will take approximately 10-15 minutes. Is now a good time for you to complete the survey?	
	1 Yes	Go to INFO
	2 Yes/Call back later	Go to Intro2b
	3 Requests email to be resent before continuing	Go to LETT
	4 Requests more information before continuing	**Intervention:** Go to INTINF
	5 No/Declines to participate	Go to Intro2c
	.R Refused	Go to Intro2c

INTINF	In <month><year> your service agreed to participate in a study to improve child dietary intake in care via the implementation of healthy eating policies and practices. Your service was provided with access to the web-based program along with training and ongoing support from HNE health promotion officers to use the program. We are now recontacting your service to complete the follow up telephone survey. Are you happy to continue with the survey now?	
	1 Yes will do now	Go to INFO
	2 Yes/Call back later	Go to Intro2b
	3 Requests email to be resent before continuing	Go to LETT

	4 No/Declines to participate	Go to Intro2c
	.R Refused	Go to Intro2c

LETT	Sure, I can send you another copy. What is your best email address?	
	Email [record email address]	Go to NLETT

NLETT	I'll send that off as soon as possible. Would you be willing to continue the interview today, or would you prefer us to call you back once you've had a chance to read the email?	
	1 Continue survey	Go to INFO
	2 Arrange call back	Go to Intro2b

Intro2b	Could you suggest the best number and time that we can call back? [Make arrangements for a call back and record on Log Sheet] Thank you very much for your time. Goodbye.

Intro2c	OK, thank you for your time. [Do not ask, but record reason if given. If no reason given, record 'nil']

INFO	Great, thanks for taking the time. We would like to reassure you that your responses will be kept confidential, and that services will not be identified in any of the reports we produce. We'd like to start by asking you a few questions about your service.	Go to EL1a

Info2 [end survey]	No worries, thank you for your time today anyway. Bye.

Service champion demographics

NS1	The following questions are about your service and your role at the service	NS2

NS2	What is your main role at the service? [INTERVIEWER NOTE: PROMPT Response options in need, **S**elect all that apply]	
	1 Nominated / Authorised Supervisor	
	2 Director	
	3 Educator	
	4 Cook	
	5 Room leader	
	6 Service owner	
	7 Other (please specify)	
	8 [DO NOT READ OUT] Don't know	
	.R [DO NOT READ OUT] Refused, Prefer not to say	

	How long have you worked *in this role* in total, either at this service, or at any other services? (INTERVIEWER NOTE: one option only)	
	1 Less than 1 year	
	2 1-5 years	
	3 5-10 years	
	4 More than 10 years	
	.R Refused	

	How long in total have you worked in the Early Childhood Education and Care setting, either *in this role* or any other roles e.g. an educator? (INTERVIEWER NOTE: one option only)	
	1 Less than 1 year	
	2 1-5 years	
	3 5-10 years	
	4 More than 10 years	
	.R Refused	

Age	What is your age?	
	<enter age>	
	(Code '777' prefer not to say')	
	(Code '999' if Refused)	

QUAL	What training and/or qualifications do you have? (INTERVIEWER NOTE: Read out options)	
	1 A University qualification	Go to HOURS
	2 A TAFE qualification	
	3 A course with a registered training organisation	
	4 'On the job' training	
	5 Commercial cooking qualification	
	6 Other qualifications or training, please specify [OQUAL]	
	7 None	
	8 Don't know	
	R Refused	

HOURS	How many hours per week do you typically work in the service?	
	<enter numeric value>	Go to FREPL
	(Code '888' if don't know)	
	(Code '999' if Refused)	

<u>Acceptability, appropriateness and feasibility of support strategies and engagement with web-based program:</u>

FAAcc	Over the last nine months your service was provided with access to the web-based program, along with support from the team to use this program to meet healthy eating policies and practices. We are interested in your experience with using the web-based program and the support you received from HNE health promotion officers. There are no right or wrong answers so please just provide the response that first comes to mind. Please tell us if you Strongly Agree, Agree, Neither agree nor disagree, Disagree or Strongly Disagree with the following statements.

Acceptability:

Accept1	Using the web-based program, is an acceptable method for assessing if our service is meeting healthy eating policies and practices. Do you…[INTERVIEWERS: PROMPT responses as required]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	

	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Accept2	The web-based program was useful in my service to help meet *the* healthy eating *policies and practices.* Do you …. [PROMPT response options in need]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused [Do not read out]	

Accept3	Using the web-based program improved my services performance in meeting *the* healthy eating *policies and practices.* Do you …. [PROMPT response options in need]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Accept4	The children benefited from our service's use of the web-based program. Do you …. [INTERVIEWERS: PROMPT responses as required]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Accept5	I would recommend the web-based program to other childcare services. Do you …. [PROMPT response options in need]	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Accept6	I intend to continue to use the web-based program to help our service meet the Munch & Move healthy eating practices. Do you ….[PROMPT response options in need]

	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

Intervention support strategies:

Suppintro	The following questions will help us to evaluate the usefulness of the support provided to your service to implement healthy eating policies and practices. For each question please say whether you found it very useful, useful, somewhat useful, not very useful or not at all useful.	

Supp1	I found the face-to-face training session useful.	
	1 Very useful	
	2 Useful	
	3 Somewhat useful	
	4 Not very useful	
	5 Not at all useful	
	6 Don't know	
	R Refused	

Supp2	I found the garnering of managerial support useful. PROMPT: Garnering of managerial support included discussing service responsibility and strategies to communicate support of the program to staff members.	
	1 Very useful	
	2 Useful	
	3 Somewhat useful	
	4 Not very useful	
	5 Not at all useful	
	6 Don't know	
	R Refused	

Supp3	I found the ongoing telephone support provided by the HNE health promotion officers useful.	
	1 Very useful	
	2 Useful	
	3 Somewhat useful	
	4 Not very useful	
	5 Not at all useful	
	6 Don't know	
	R Refused	

Impact of COVID-19 restrictions on usual childcare service processes:

COVIDintro	The next set of questions will focus on the potential impact of COVID-19 restrictions on usual processes at your service. Please tell us if you Strongly Agree, Agree, Neither agree nor disagree, Disagree or Strongly Disagree with the following statements.	

COVID1	COVID-19 had a negative impact on the services' ability to meet healthy eating policies and practices	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

COVID2	COVID-19 had a negative impact on my ability to use the Childcare EATs web-based program meet the healthy eating policies and practices*	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

COVID3	COVID-19 had a negative impact on parents' ability to pack healthy foods for their children to consume in care	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

COVID3	COVID-19 had a negative impact on the children's consumption of healthy and unhealthy foods in care	
	1 Strongly agree	
	2 Agree	
	3 Neither agree nor disagree	
	4 Disagree	
	5 Strongly disagree	
	6 [Do not read out] Don't know	
	R Refused	

FINISH	Thank you for answering all of those questions and for your participation in the study. Your contribution is much appreciated and will be valuable in helping us to determine the usefulness of the web-based program and support strategies in assisting childcare services to meet healthy eating policies and practices. Thanks for your time and have a lovely day.	

How-To Guide

Childcare EATS

HOME | ABOUT | SELF-ASSESSMENT | ACTION PLANNING | RESOURCES | SUPPORT

GOAL SETTING AND ACTION PLANNING

TIPS AND MATERIALS

ONLINE SUPPORT

Artwork: 'Heart of a child' by Lara Went Worimi artist

HOME | ABOUT | SELF-ASSESSMENT | ACTION PLANNING | RESOURCES | SUPPORT

Contents

Introduction to Childcare EATS:

Childcare Electronic Assessment Tool and Support (Childcare EATS) is a web-based tool to help early childhood education and care (ECEC) services meet healthy eating practices, and to improve child dietary intake in care.

By supporting ECEC services to meet healthy eating practices, the Childcare EATS program also helps services to align with the requirements of the National Quality Framework (NQF) and Early Years Learning Framework (EYLF).

The tool is based on Go-NAPSACC, a web-based program used by over 1,500 ECEC services in the United States to improve the health of young children through practices, policies, and environments that instil habits supporting lifelong health and well-being.

Childcare EATS has been developed by a team of health professionals with experience working in the ECEC setting in collaboration with ECEC service staff and the developers of Go-NAPSACC.

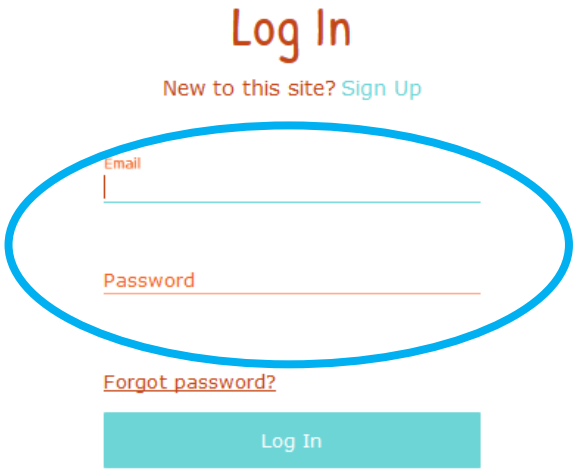
Logging in:

1. To access the Childcare EATS web-based program, follow this link: https://www.childcareeats.com

2. When accessing Childcare EATS for the first time, a pop-up may appear to ask if you wish to allow Cookies while using the web-based program. If this pop-up does appear, please click allow or enable. This will allow the Childcare EATS team to monitor usage of features within the web-based program.

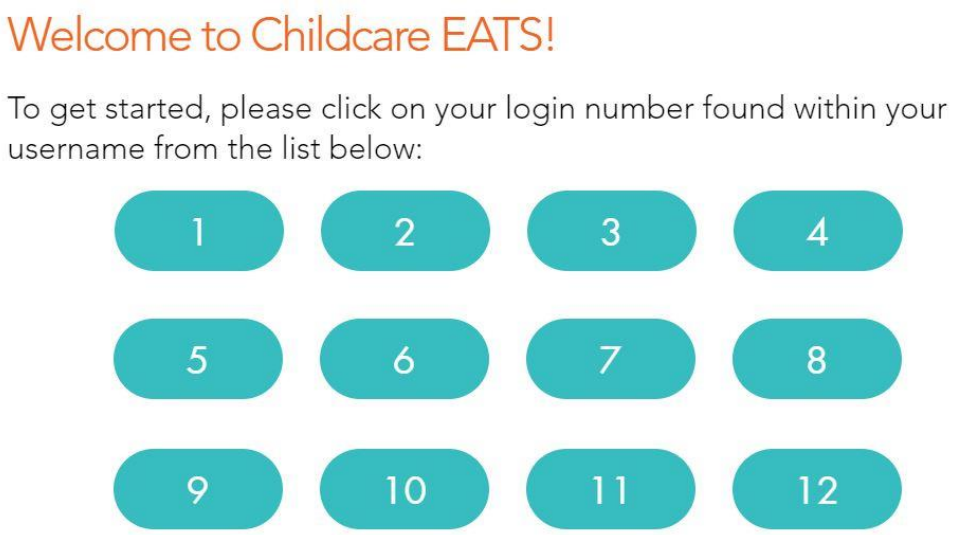
3. Click the login button on the top right hand corner.

4. The unique email username and password previously provided to you by your Health Promotion Officer will be needed to login to the program. The email username and password was provided to you by email and during the face-to-face training session.



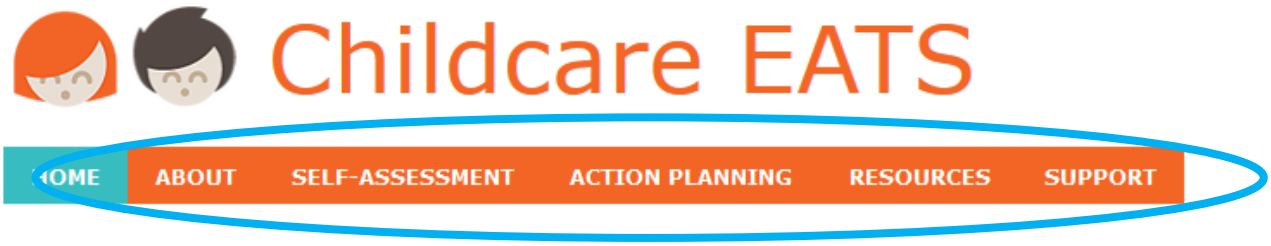
5. If you are unable to remember your service password, click 'forgot password' and follow the prompts to reset your password.

6. Once your service has logged in, you will be asked to select the number that corresponds with the number within your unique service username. For example, User12@childcareeats.com would select the number 12 icon.



Program features:

The Childcare EATS web-based program has five main features which can be accessed by clicking on any of the feature headings across the top of the page or in the footer at the bottom of the page.



The following pages of this user guide detail how to use each feature of the program.

About page:

This page describes the aim of the web-based program, which is to help childcare services meet a number of healthy eating practices.

This page also describes the recommended five step process to follow to when using the program

How does Childcare EATS work?

Childcare EATS helps services to meet healthy eating practices through a simple 5 step process:

Step 1: Check how your service is going with meeting healthy eating practices by completing the self-assessment quiz

Step 2: Based on results of the self-assessment quiz, develop goals and create an action plan to help your service meet healthy eating practices

Step 3: Check out the library of resources and select those that will help your service meet goals developed within the action plan

Step 4: Schedule time within the next team meeting to discuss the developed action plan, share ideas and strategies for reaching the goals

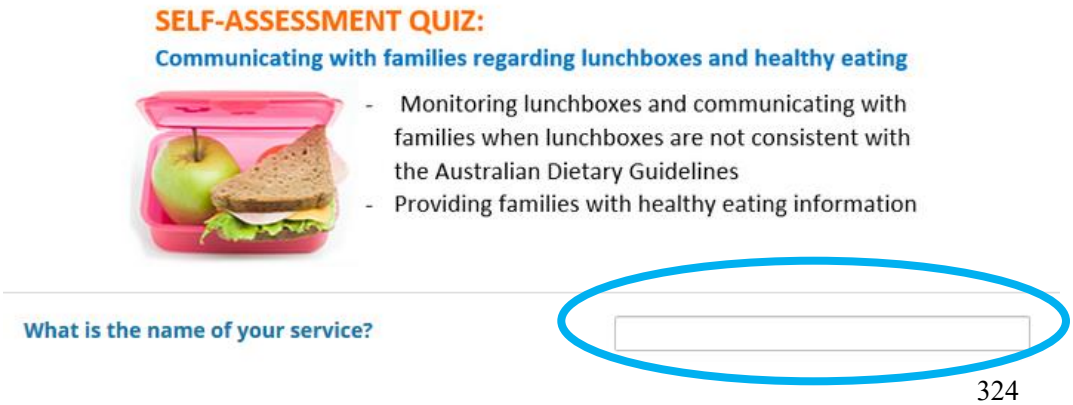
Step 5: Re-complete the self-assessment quiz to see what improvements your service has made in meeting the healthy eating practices

Self-assessment:

This page provides access to the self-assessment quizzes. Six targeted healthy eating practices have been categorised into three quizzes. After completing each quiz, your service will be provided with instant feedback on which practices your service is currently working towards, meeting or exceeding.

1. To complete a quiz, click on the heading in green or the icon next to the quiz you would like to complete.

2. Once your service has selected a quiz, an additional web page will open in which you can complete the self-assessment.
3. To begin the quiz, type in the name of your childcare service and click next page.



4. If the wrong option is accidently selected whilst completing the quiz, use the reset button to redo that particular question.

Do educators observe children's lunchboxes to monitor the packing of recommended / not recommended food items?

- No, the service does not observe children's lunchboxes
- Yes, the service observes children's lunchboxes

reset

5. Once your service has completed the selected quiz, feedback specific to each healthy eating practice assessed will appear. Use this feedback to decide which healthy eating practice your service would like to create an action plan for.

Have a look at the quiz results below to see which healthy eating practices your service is doing well, and other practices that could be improved.

Practices highlighted in orange indicate that your service is **working towards** the healthy eating practice	Practices highlighted in orange indicate that your service is **meeting** the healthy eating practice	Practices highlighted in orange indicate that your service is **exceeding** the healthy eating practice

6. Please save a copy of your self-assessment quiz responses and feedback after each quiz is completed. To do this, click next page at the bottom right corner of the screen.

7. Click submit down the right hand corner of the screen.

8. Select the download button to save your service quiz responses and feedback as a PDF document.

Download your survey response (PDF): Download

9. Once the PDF is downloaded, select close survey and return to the Childcare EATS web-based program.

Action planning:

Based on the results of the self-assessment quizzes, you and your service are encouraged to identify goals and create action plans for those healthy eating practices that could be improved. The action plans are broken into each of the six healthy eating practices.

To allow for enough time and resources to achieve your service goals, select a maximum of three practices to work on at any one time.

1. To begin an action plan, click on the heading or the icon next to the healthy eating practice your service would like to work on.

2. Once a practice is selected for the action plan, an additional web page will open in which your service can develop the action plan.

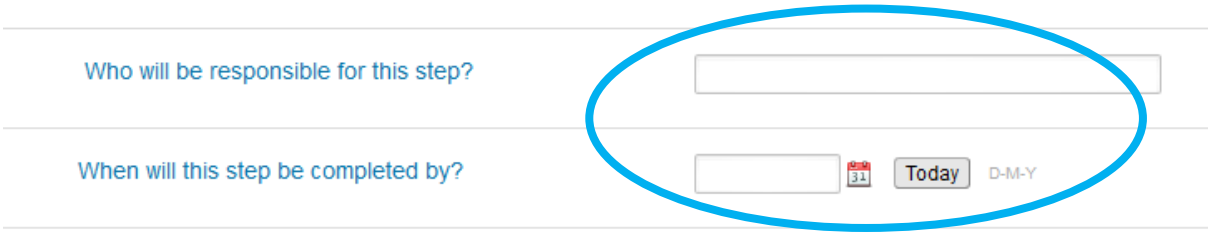
3. To begin the action plan, type in the name of your service.

4. Your service will then be asked to select your specific goals relevant to the healthy eating practice you are targeting.

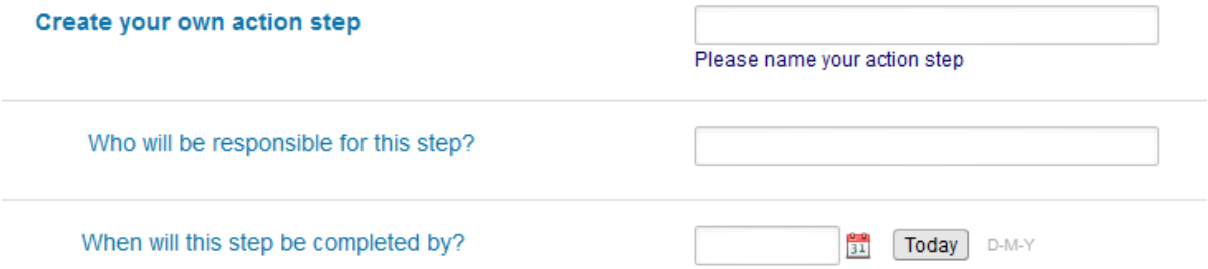
5. If the wrong goal is accidently selected whilst developing your service action plan, select the previous page button at the bottom of the page to select another goal.

6. Once a goal has been selected, your service will then be asked to select action steps that will assist your service to achieve the goal. A list of suggested action steps specific to each goal will be available to your service once a goal is selected. In addition to selecting the suggested action steps, your service also has the ability to create your own action steps. Once your actions steps are selected, click next page.

7. For each action step selected, please record the staff member responsible for completing each step and the timeframe for completion.



8. If your service selected to create an action step that is not listed, please record the details of the action step as well staff member responsible for completing each step and the timeframe for completion.



9. Please save a copy of the action plan after each action plan is developed. To do this, click next page at the bottom right corner of the screen.

10. Click submit down the right hand corner of the screen.

11. Select the download button to save your service action plan as a PDF document.

12. Once the PDF is downloaded, select close survey and return to the Childcare EATS web-based program.

Resources:

A library of resources is available to assist your service to achieve the goals developed within your action plan. Similar to the self-assessment quizzes, the resources are broken into three different categories.

1. To access a resource, click on the heading in green or the icon next to the category your service is working on.

Communicating with families about lunchboxes and healthy eating

- Monitoring children's lunchboxes and communicating with families when lunchboxes are not consistent with the Australian Dietary Guidelines
- Providing families with healthy eating information

Childcare service healthy eating environment

- Providing intentional learning experiences about healthy eating
- Creating a positive healthy eating environment for children through role modelling, reinforcing and implementing healthy eating practices

Staff training and service nutrition policies

- Developing a service written nutrition policy
- Educators accessing professional development in nutrition

2. A list of resources will be available for each healthy eating practice.

3. Click on the icon or heading of the resource you would like to open and/or download.

Support:

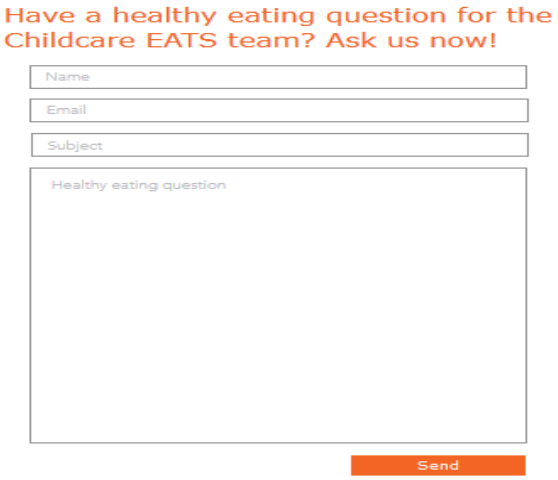
The support page of the Childcare EATS web-based program provides access to supporting resources.

1. **Frequently Asked Questions:** The Childcare EATS team have responses to commonly asked questions regarding the Childcare EATS program, general healthy eating practices for children and more. The FAQ page can be accessed by clicking the question mark on the support page.

2. **Additional resources**: External resources, including the link to the Caring for Children resource and Australian Dietary Guidelines website, can be accessed by clicking on the links provided under the *Additional resources* heading. These resources provide further information and guidance to support your service to meet the healthy eating practices.

3. **Contact information**: Your service can also find the contact details for your local support officer on the Childcare EATS support page.

4. **Quick question feature:** To send a quick question to your health promotion officer, type your name, email address and subject into the relevant lines. Write your question into the 'healthy eating question' text box and click send. Your health promotion officer will then reply to your service email address.



Childcare EATS

Childcare EATS (Electronic Assessment Tool and Support)

Memorandum of Understanding

Background

Early Childhood Education and Care (ECEC) services play an important role in promoting the health and wellbeing of young children, in particular establishing and encouraging lifelong healthy eating habits. The overall aim of Childcare EATS is to support childcare services in meeting healthy eating practices to improve children's dietary intake in care. As such, the Childcare EATS team would like to provide your service with additional support to meet healthy eating practices through a combined approach of a web-based program in addition to Health Promotion Officer support.

The Childcare EATS team is within a wider Health Promotion team established through the collaboration between University of Newcastle and Hunter New England Population Health. The team has been working in the ECEC setting for more than 10 years to deliver healthy eating and physical activity programs. These programs have driven changes in policies and practices within childcare services, which in turn have improved health outcomes among young children.

Purpose

This Memorandum of Understanding (MoU) describes the collaboration between the Health Promotion Officers from Hunter New England Population Health and [Service Name], for the duration of the Childcare EATS study.

Objective

This MoU defines the elements of the agreement that will support implementation of Childcare EATS. By having this document in place, each party is able to monitor how they are progressing on their part and which areas require more support, and work together to achieve the common goal improve children's dietary intake in care.

Artwork: 'Heart of a child' by Lara West Norris artist

Childcare EATS

Based on today's discussion, the Health Promotion Officer (HPO) will finalise the MOU to guide the work of all parties involved, so that it reflects the needs, priorities and ways of working that are agreeable to all parties. The HPO will then circulate the MOU for NS and SC approval (or further amendments) and signing. The HPO will sign the version the Nominated Supervisor and Service Champion approve and send the final signed copy to the service.

Principles/Values

This MoU is underpinned by a spirit of collaboration, goodwill and commitment to the success of Childcare EATS in improving children's dietary intake in care.

From the Hunter New England Population Health point of view, this means that we are committed to child health, we discuss and co-design our roles and responsibilities within Childcare EATS and that staff within your service are provided with adequate support to fulfil their roles and responsibilities. This also means there are opportunities for ongoing consultation, feedback and requests for further supports.

Discuss: What do these principles/values mean to you and your service? Are there some other shared principles/values you SC think are important to underpin our work ? (write below)

Artwork: 'Heart of a child' by Lara West Norris artist

Childcare EATS

The Parties

This MoU describes the roles and responsibilities of two parties within this agreement.

Hunter New England Population Health	[Childcare service name]	
Health Promotion Officer:	**Nominated Supervisor:**	**Service Champion:**
Contact Details: [phone number] [E-mail]	**Contact Details:** [phone number] [E-mail]	**Contact Details:** [phone number] [E-mail]

Roles and Responsibilities (this is a draft only, for point of discussion)

The Health Promotion Officer agrees to:

1. Provide tailored support to enable ongoing use of Childcare EATS at [Service Name], whilst acknowledging that each service has their unique philosophies and contexts.
2. Reinforce the importance of improving children's dietary intake in care by meeting healthy eating practices, and advocate for the use of Childcare EATS to support services to achieve this by:
   - Monitoring service progress with goals within the action plan
   - Providing regular telephone support to the Nominated Supervisor and Service Champion to discuss barriers to using Childcare EATS and meeting healthy eating practices
   - Identifying practical solutions to address the barriers
3. Provide additional support to the Nominated Supervisor and the Service Champion in the use of Childcare EATS when needed.

The Nominated Supervisor agrees to:

Artwork: 'Heart of a child' by Lara West Warmi artist

Childcare EATS

1. Regularly use Childcare EATS to monitor service progress in meeting healthy eating practices; identify goals and create an action plan to facilitate change in practice; and use the resources provided by the program to support the service in meeting healthy eating practices.
2. Communicate service goals and action plan to staff (including educators), and advocate for the use of the program, supporting resources and completion of the action plan to improve children's dietary intake in care.
3. Provide support to educators in creating a healthy eating environment within the service by allocating time to allow educators to meet goals within the service's action plan.
4. Regularly monitor and report back to staff on service progress with goals within the action plan to facilitate progress towards meeting healthy eating practices.
5. Communicate with the Service Champion regularly to identify and discuss barriers, and identify strategies to address these barriers
6. Communicate with the Health Promotion Officer via telephone (approximately one month and three months post training) regarding service progress, barriers to meeting healthy eating practices, and request additional support when needed.

The Service Champion agrees to:

1. Regularly use the Childcare EATS to monitor service progress towards meeting healthy eating practices; identify goals and create action plan; and use the resources provided to support the service in meeting healthy eating practices
2. Be an advocate among educators to improve child diet in care, by using the supporting resources within Childcare EATS to meet healthy eating practices within the service.
3. Facilitate discussion with educators to identify barriers to meeting healthy eating practices and strategies to address these barriers.
4. Be mindful of privacy of educators. While noting challenges and barriers experienced by others, do not report their names or other identifying information.
5. Regularly communicate with the Nominated Supervisor regarding staff-identified barriers to meeting healthy eating practices, and strategies to address these barriers.

Artwork: 'Heart of a child' by Lara West Warmi artist

Childcare EATS

6. Communicate with the Health Promotion Officer via telephone (approximately one month and three months post-training) regarding service progress, and barriers to meeting healthy eating practices, and request additional support when needed.

Signatories (note: the document will be signed once final version is agreed upon)

This MoU is made between Hunter New England Population Health and [Service Name] on [Day] of [Month] 2019.

Hunter New England Population Health

Health Promotion Officer Name _____ Signature _____

[Service Name]

Nominated Supervisor Name _____ Signature _____

Service Champion Name _____ Signature _____

Artwork: 'Heart of a child' by Lara West Norris artist

Childcare EATS

Date: 18/11/2019

Dear [name of nominated supervisor],

Nomination of Service Champion

As part of the Childcare EATS we will help your service to identify a staff member to champion meeting healthy eating practices, including the use of Childcare EATS, within your service. Having a champion within the service who is able to learn about the challenges other staff experience in meeting healthy eating practices, who can be a role model, and help staff to overcome challenges, will help the service to meet healthy eating practices.

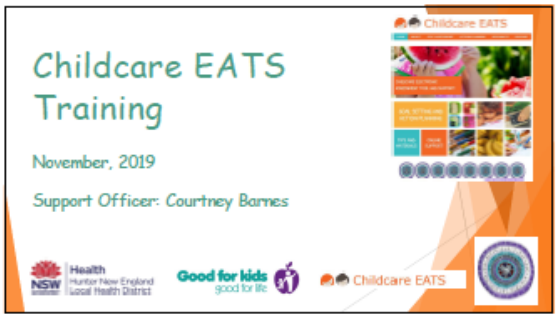
To assist you with selecting a Service Champion, we have outlined below the role and desirable characteristics. Pending the best option for you and your service, the role of the Service Champion may be held by one or more staff members. This role is not intended to substantially add to the workload of the nominated staff member(s); in fact, the nominated person(s) may already be doing a number of the activities below.

We would like to invite both you and the nominated Service Champion to attend our initial training visit where we will further discuss everyone's roles and the supports that both of you may want to access.

Role of a Service Champion during Childcare EATS:

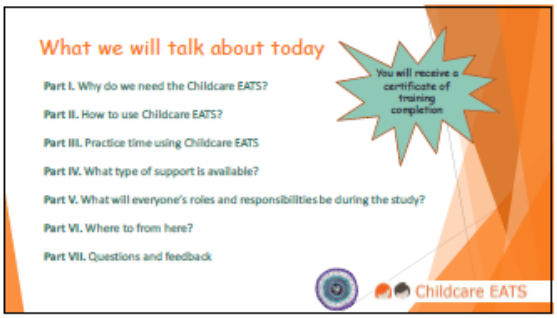
- Actively use Childcare EATS, including the self-assessment tool, goal setting and action planning, and resources to support the service in meeting healthy eating practices
- Advocate for use of the supporting resources within Childcare EATS amongst educators to meet healthy eating practices within the service
- Drive the progress towards achieving goals developed within the action plan
- Facilitate discussion with educators to identify barriers to meeting healthy eating practices and strategies to address these barriers
- Regularly communicate with the Nominated Supervisor regarding staff-identified barriers to meeting healthy eating practices, and strategies to address these barriers

Artwork: 'Heart of a child' by Lara West Norris artist

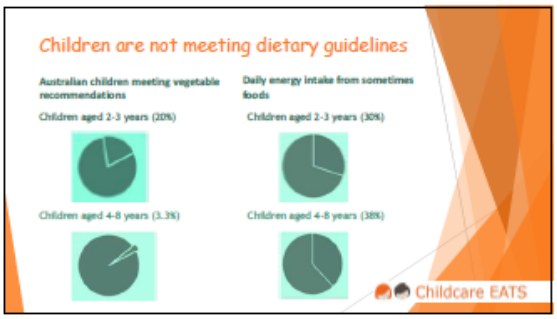

Childcare EATS Training
November, 2019
Support Officer: Courtney Barnes
Health
Hunter New England Local Health District
Good for kids
good for life
Childcare EATS


Acknowledgment of country
I would like to acknowledge the original custodians of this land and pay my respects to Elders both past, present and future for they hold the memories, the traditions, the culture and hopes of Aboriginal Australia
Childcare EATS


Background
Good for Kids has 10+ years of experience working with Early Childhood Education and Care services
What we do:
Munch & Move
Research Programs
Service Support
Good for kids
good for life
Childcare EATS


What we will talk about today
You will receive a certificate of training completion
Part I. Why do we need the Childcare EATS?
Part II. How to use Childcare EATS?
Part III. Practice time using Childcare EATS
Part IV. What type of support is available?
Part V. What will everyone's roles and responsibilities be during the study?
Part VI. Where to from here?
Part VII. Questions and feedback
Childcare EATS


Part I. Why is healthy eating so important?
Healthy eating habits start from an early age with balance and variety every day!
Good nutrition is important for...
Healthy growth and development
Energy to learn & play
Attention
Cognitive performance
Good nutrition helps to prevent...
Illness
Tooth decay
Unhealthy weight gain
Childcare EATS


Children are not meeting dietary guidelines
Australian children meeting vegetable recommendations
Daily energy intake from sometimes foods
Children aged 2-3 years (20%)
Children aged 2-3 years (30%)
Children aged 4-8 years (3.3%)
Children aged 4-8 years (38%)
Childcare EATS

The good news….

- Risk factors associated with poor nutrition are modifiable
- Children who develop healthy lifestyle habits are more likely to continue these habits into adulthood

Childcare EATS

Why Early Childhood Education and Care?

- **Many children attend ECEC**, which allows us to reach a large amount of children during a crucial period of development
- **Whole of service approach** - educators support healthy eating messages through positive role modelling, healthy eating learning experiences and discussions with families.
- ECEC's are encouraged to meet **healthy eating practices** (e.g. *Munch & Move*) to provide a healthy eating environment and support child diet

Childcare EATS

What are these healthy eating practices?

1. Service provides healthy eating information to families
2. Service monitors children's lunchboxes and communicates with families when lunchboxes are not consistent with the Australian Dietary Guidelines
3. Service provides intentional learning experiences about healthy eating to children
4. Service uses feeding practices that support children's healthy eating
5. Service participates in professional development in nutrition
6. Service has a comprehensive written nutrition policy that outlines key healthy eating practices

Childcare EATS

Aligning these healthy eating practices with the National Quality Framework

By meeting these healthy eating practices, it also supports centres to address the following areas of the NQF and EYLF:

- NQF Quality Area 1: Educational program and practices
- NQF Quality Area 2: Children's health and safety
- NQF Quality Area 3: Physical environment
- NQF Quality Area 6: Collaborative partnerships with families and communities
- EYLF Outcome 3: Children have a strong sense of wellbeing
- EYLF Outcome 4: Children are confident and involved learners

Australian Children's Education & Care Quality Authority

What is Childcare EATS

Childcare EATS is a web-based program to help ECEC services meet healthy eating practices

What's in it for you?

- Childcare EATS is web-based, which makes it easy for services to use it any time they like
- Childcare EATS helps services check how they are doing with meeting healthy eating practices, and are then provided with tailored feedback
- Service staff work together to develop goals and action plans to achieve healthy eating practices, assigns tasks amongst themselves, and share ideas and strategies to reach the goals
- Health promotion officers are here to help you

A similar program has helped ECEC's in the USA to meet healthy eating practices ☺

Childcare EATS

Part II. How to use Childcare EATS?

Childcare EATS

Part III. Hands on practice

Childcare EATS

Part IV. Support available

- Hands on training on how to use Childcare EATS, including the support page
- Contact with the HPO via contact details provided on Childcare EATS
- Check in call within a week to see how you went logging into the program
- Two short support phone calls:
  - **Chat about progress** with action plans and goals
  - **Discuss any challenges** you or educators experienced in using the program and/or meeting healthy eating practices
  - **Identify practical solutions** to address challenges to meeting your service goals

Please let us know how you are going/request additional support. We are here to help!

Childcare EATS

Part V. What will everyone's roles be during the study?

- A Memorandum of Understanding (MOU) will be developed between HPO's and the service
- The MOU will allow the Childcare EATS team to provide tailored support to the service in the spirit of collaboration, goodwill and commitment
- An MOU will be drafted today, and agreed upon. This will help to guide our work, including the support we provide, in the next six months

Childcare EATS

What I (health promotion officer) will help with...

I (HPO) will....

- deliver initial training
- provide background and justification for the program
- provide ongoing support (outlined earlier)

Childcare EATS

What Nominated Supervisor will help with...

- How do you see your role in the study?

Childcare EATS

What Nominated Supervisor will help with... (suggestions)

- Regularly use Childcare EATS
- Communicate service goals and action plan to educators, and advocate for the use of the program
- Provide support to educators
- Regularly monitor and report back to educators on service progress
- Communicate with the Service Champion
- Communicate with the Health Promotion Officer via telephone

Childcare EATS

What Service Champion will help with…

- How do you see your role in the study?
- Please note, being a Service Champion is not intended to substantially add to your workload; in fact, you may be already doing some of the things that we suggest.

Childcare EATS

What Service Champion will help with… (suggestions)

- Regularly use Childcare EATS
- Be an advocate among educators
- Facilitate discussion with educators
- Be mindful of privacy of educators.
- Regularly communicate with the Nominated Supervisor
- Communicate with the Health Promotion Officer via telephone

Childcare EATS

Reflection on everyone's roles

- Do we have a clear understanding of our roles within the program?
- Do we agree on shared values to underpin our work?
- Is there other support from the Childcare EATS team that you would find helpful?

Childcare EATS

Part VI. Where to from here?

What we did today?

- ✓ **Completed a self-assessment quiz** to check how your service was going with meeting healthy eating practices.
- ✓ **Developed an action plan** based on the results of the self-assessment quiz, including goals and action steps, roles and timelines to help achieve those goals.

What's next?

- Within the next week, **we will email you to summarise today's discussion and send you MOU we drafted today** for your review and sign-off.
- **We encourage you to meet with the Educators** to discuss results of self-assessment and to engage in action planning for how you as a service are planning to work towards goals.

Childcare EATS

Part VII. Questions and feedback

- Questions?
- Please take 2-5 minutes to complete a quick evaluation form on the training

A certificate of training completion

Childcare EATS

General note for HPO: *There are 4 sections of questions, 7 pages all together. Each new section starts on a new page (with section I starting on p. 2). You may not need to cover all 4 sections if you find that service was not able to do things specified in a previous section, i.e. Wherever the first 'no' occurs is probably where the bulk of the call will be dedicated. That is why it is important to familiarise yourself with the content of the script prior to call to make sure you adapt the call based on NS/SC responses.*

Childcare EATS follow up call#1- if call with NS and SC together

INTRO Hi, it's [NAME OF HPO] from Hunter New England Local Health District. I'm calling about the Childcare EATS study, could I please speak with [NS name]?

I'm ringing in regards to the Childcare EATS study. We had a phone call scheduled for today at [TIME] to speak with you and your nominated Service Champion [SC NAME] about how you have been going with using Childcare EATS program.

Is this still a good time to chat?

[if no longer a good time, ask when a good time would be, record date/time, let them know you will send a reminder email, thank for their time]

Is [SC NAME] available to join us?

(once NS and SC available to chat…)

Great, thank you, this should not take longer than 10-15 mins.

[continue with the script starting on p. 2 of this document]

Childcare EATS follow up call#1- if separate calls with NS and SC. Adjust NS/SC in relevant places, depending on whom you speak to

INTRO Hi, it's [NAME OF HPO] from Hunter New England Local Health District. I'm calling about the Childcare EATS study, could I please speak with [NS name]?

I'm ringing in regards to the Childcare EATS study. We had a phone call scheduled for today at [TIME] to speak with you about how you have been going with using Childcare EATS program. We also separately spoke/will be speaking with [NS/ SC NAME] about this.

Is this still a good time to chat?

[if no longer a good time, ask when a good time would be, record date/time, let them know you will send a reminder email, thank for their time]

Great, thank you, this should not take longer than 10-15 mins.

[continue with the script starting on p. 2 of this document]

The remaining of the script- use same if you are speaking with NS/SC together or separately

Section I: Let me start by asking about your experience with using Childcare EATS program and resources....

1.1. After training session which took place on [date], and which was attended by [names of attendees], have you had a chance to use Childcare EATS?

If not:	If yes:
It is not easy to use a new program while carrying on your normal workload!	Great to hear!
i. What would be some of the challenges that you have experienced using Childcare EATS program? (note barriers/challenges with using the program)	i. How did you go using the program? (probe: ease of use, availability of time to use it, frequency of accessing it etc)
i. Are there some ways that help you to overcome challenges in using the program? What have you tried so far? (note strategies they tried and whether they have worked)	i. What features have you accessed most/found most relevant to you? (note these)
If NS/SC doesn't have any suggestions on how to overcome barriers, see below for strategies to address access/usage barriers	i. What features have you accessed least/found least relevant to you? (note these)

Barrier	Possible Strategies/Solutions
Computer/IT literacy	Provide available options, such as: • Refer to user manual that is provided at F2F training • Contact HPO via 'quick question' feature or contact details on Support page of Childcare EATS Ask if there is someone at the service who is competent in computer or IT that could assist with using the program
Time poor	Acknowledge that the service is very busy even before this study and making changes take time and effort. Reinforce the aim of this study and it is worth starting early to encourage healthy eating habits among children. Ask about staff allocation and the time set aside for staff to make changes and work towards meeting the healthy eating practices. Is there a need to make amendments to the plan?

1.2. Have you received any feedback from staff regarding Childcare EATS program and/ resources? (probe: are these accepted among staff? Are these used by staff? Are there some resources that are liked most/least? What do staff and/or families say about the usefulness of resources?) (note these)

Section II. Great, thanks, let's now talk about staff engagement....

2.1 Were you able to present the study and the reports generated at training session (self-assessment, goals, action plans) to staff during a staff meeting or other?

If not:

It is not easy fit in presenting the study during staff meetings, given all other issues that need to be covered during those times!

i. What would be some of the challenges that you have experienced in organising a time to present the study and reports to staff? [note barriers/challenges....]

Thanks for letting me know. These are complex challenges...

ii. Are there some ways that could help you organise a time to present the study and reports to staff? What have you tried so far? [note strategies they tried and whether they have worked]

[if NS/SC doesn't have any suggestions on how to overcome barriers, see below for strategies to address time poor]

Barriers	Possible Strategies/Solutions
Time poor	Acknowledge that the service is very busy even before this study and making changes take time and effort. Reinforce the aim of this study and it is worth starting early to encourage healthy eating habits among children. Ask about staff allocation and the time set aside for staff to make changes and work towards meeting the healthy eating practices. Is there a need to make amendments to the plan?

If yes:

Great to hear!

i. How did your discussion with staff go? (probe: how was it received? what did they think about the program? [note these]

ii. What did they think about goals/action plans? [note these]

iii. Any concerns voiced by staff re: sharing responsibilities to progress on the program? i.e. staff no time, competing priorities, unclear how to progress, needs more supports etc) [note these]

Section III. Thank you for this. Now I would like to ask how you have been going with putting things to practice.

3.1 Looking at the report you generated during the training session, have you managed to achieve the steps in your action plans?

If not:	If yes:
It is not easy make changes in a short amount of time with your service day to day workload! i. What are some of the challenges that you have experienced in achieving the steps in your action plan/meeting healthy eating practices? [note barriers/challenges] These are complex challenges…It is not easy to <tailor to service response> ii. What might be some ways to overcome these? Is there something that has worked particularly well and/or helped you overcome challenges/barriers encountered by staff to meet healthy eating practices? (here you are probing around real and feasible strategies that have worked for this service to help with meeting healthy eating practices …i.e. they schedule time every Monday to review, they put it on staff agenda etc.) [if NS/SC don't have any suggestions, see below for strategies to address barriers in meeting healthy eating practices….]	What has been working well? [briefly note] Are there still some challenges that you experience in meeting healthy eating practices? [briefly note]

Potential barriers	Potential ways to address
Staff believes service is already implementing all required healthy eating practices- why a need for another intervention?	*Acknowledge that staff may be already implementing six recommended healthy eating practices (well done! Great job!) and that Childcare EATS program may still help services to exceed practices. The program provides new resources and supports, and helps you tailor these based on how you are going with practices, to help you achieve all recommended healthy eating practices.* *Ask: If your services is meeting all practices, could you complete a self-assessment quiz to identify which practices you may want to focus on to exceed? These 4 practices are:* *- Lunchbox practice (i.e. monitoring lunchboxes and communicating with families)* *- Positive healthy eating environment* *- Educator PD (i.e. have more than 50% of educators exceed)* *- Written nutrition policy (i.e. have more than just the 3 elements within the policy)* *Encourage service to exceed the practices*
Time poor	*Acknowledge the service is very busy even before this study and making changes take time and effort. Reinforce the aim of study and it is worth starting early to encourage healthy eating among children. Ask about staff allocation and the time set aside for staff to make changes and work towards meeting the healthy eating practices. Is there a need to make amendments to the plan?*
Low staff motivation,	*Acknowledge that it is difficult to try to fit in anything into an already busy workload/work day*

	competing priorities	*Reinforce that: Childcare EATS program provides action plans tailored to goals, so these do not need to be drafted by service (reduces times it takes to set goals and draft plans). Also, Service Champion Service in your service will model the practices and will help staff address challenges they encounter- including, how to incorporate practices within competing priorities.*	
	Inadequate staffing to run intervention	*Acknowledge that it is difficult to allocate staff and take their time and capacity into consideration.* *Reinforce that as part of Childcare EATS service generates a detailed plan with realistic timeframe and staffing requirements/allocations, and that staff are encouraged to discuss these at the staff meeting.* *Ask if there is anyone that can swap roles, or step in and take up the role, in particular if a staff member has skills in an area such as puppetry, craft and cooking. Also, ask if there are opportunities for educators to network and reflect on new ideas/share tips (i.e. weekly emails or meetings to share news)*	
	Change in NS/SC and/or need extra training	*Acknowledge that it is a hard time to transition* *Ask if there is something that we could do to support the service in that transition (i.e. we can offer an online booster training session to new NS and/or SC)*	
	Feels like another change/idea imposed from top rather than practice led by educators	*Acknowledge that some staff may feel that this an idea coming from the top* *Reinforce that the Child EATS will help service achieve healthy eating practices that are recommended by policy. Also, all staff are encouraged to actively shape how goals and actions related to meeting healthy eating practices are implemented, who is doing what and within what timeline etc. (NS/SC will have discussed reports generated at the training during staff meeting)* *Encourage NS/SC to engage staff in discussions around shaping who/what/when in regards to goals and actions related to meeting healthy eating practices*	
	Staff feeling leadership is not supportive of the program and time/resources required to implement it	*Acknowledge that some staff may not feel supported to dedicate time to trying out a new program and/or changing their practices* *Reinforce that Nominated Supervisor and Service Champion have co-drafted a document that outlines their roles and responsibilities and expresses their commitment to the program. Service Champion is a staff member who is supported by HPO and who advocates among staff on how to implement healthy eating practices, listens to staff's concerns and helps address challenges they encounter* *Ask whether there are opportunities/mechanisms for staff to safely voice/feedback concerns and requests for extra support from Service Champion and/or from Nominated Supervisor?*	
	This program may not be culturally appropriate	*Acknowledge that some staff may feel that the program may not be culturally appropriate. We are humble and listening, we would appreciate an opportunity to hear how to make the program more culturally appropriate* *Reinforce that while there is always room for improvement, in designing the program we have consulted with Aboriginal colleagues at the Hunter New England Population* *Encourage staff to provide us with ideas for how to improve cultural appropriateness of the program*	

Section IV. We are almost done. I would now like to discuss some short-term goals…

(HPOs- the section below is not in addition to what services are already doing in terms of working on goals towards meeting/exceeding healthy eating practices. Rather, the conversation that follows should be tailored to where on the continuum of change the service is- the purpose is simply to nudge service to progress on meeting/exceeding their selected practices. So, familiarise yourself with options (A- D) before the phone call, and during the call, discuss only that option with NS/SC that suits their individual circumstance…)

A. *[if a service has achieved everything in their action plan]*

Great going with achieving everything in your action plan! May I suggest you re-take a self-assessment to identify new practices you could work on or exceed?

You may also want to take a look through the resource page and identify any resources you might like to incorporate into your practice?

[note NS/SC reply/comments made]

B. *[if a service is hesitant or insists they are already meeting/exceeding healthy eating practices]*

May I suggest you complete the self-assessment to generate an up to date feedback report to display in the service using to tracker? You may want to show to your staff/parents the improvements taking place and also include the results of the self-assessment in your service Quality Improvement Protocol.

You may also want to take a look through the resource page and identify any resources you might like to incorporate into your practice?

[note NS/SC reply/comments made]

C. *[if a service has not achieved everything in their action plan]*

May I suggest that you pick one practice you would like to focus on achieving in the next couple of weeks? What would that practice be? (if a whole practice is too overwhelming, offer to focus on a step towards achieving a practice)

[note NS/SC reply/comments made]

D. *[if a service hasn't used the program at all]*

May I help you schedule a time to start using Childcare EATS? When do you think you would have some time to start using the program?

[note NS/SC reply/comments made]

Finally, are there some ways in which I can better support you to help your service implement healthy eating goals?

[note if any requests for further support]

Thank you for your time. It has been great to chat. I am here to help you with using Childcare EATS and in meeting your healthy eating practices, so please let me know how I can help. I will call again in a couple of months to see how you are going.

Do you have any questions before we finish?

Thanks again. *[FINISH INTERVIEW].*

PART A: SETTING THE SCENE

Proposed level and method of scale up

Name of intervention: _____

The following questions set the scene for completing the tool. They relate to the level of scale up and the likely scale up pathway being considered.

Question 1: What is the ultimate level of scale up you are trying to achieve? (Select as many as necessary)

- ☐ Scaled up across multiple sites within a region
- ☐ Scaled up across a local region or province
- ☐ State or large jurisdiction scale up
- ☐ National or country level scale up
- ☐ Other level of scale up *(please describe)* _____
- ☐ Don't know

Question 2: How are you proposing to scale up?

☐ Vertical approach (Simultaneous approach)

Note: Scaling up using a **vertical approach** involves the introduction of an intervention simultaneously across a whole system and results in institutionalisation of a change through policy, regulation, financing or health systems change.[3]

☐ Horizontal scale up (Stepwise approach)

Note: Scaling up using a **horizontal approach** involves the introduction of an intervention across different sites or groups in a phased manner, often beginning with a pilot program, followed by stepwise expansion, learning lessons along the way to help refine further expansion.[3]

☐ Other _____

DOMAIN A1: THE PROBLEM

This domain considers the problem being addressed. In this domain, describe the problem, who it affects, what it affects and how it is currently being addressed (if at all). Where possible, draw on recent data available that provides evidence of the problem and its impacts. This may include population survey data either at the local, regional or national level, or secondary data sources as examples.

Domain A1: The problem	
The problem – Describe what is known about the current nature of the problem	
A1.1: What is the problem and who does it affect? Describe the nature and scope of the problem using epidemiological data (e.g. Who is affected? How widespread is the problem? What is known about the causes?)	
A1.2: How does the problem impact on the health of the population? Describe the impact of the problem on health and wellbeing of the population (e.g. burden of disease and costs to the health system and society)	
A1.3: What is current practice to address the issue? Describe how this problem is currently addressed in the system	

Readiness assessment Domain A1: The problem

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
1. Is the problem of sufficient concern to warrant scale up of the intervention/program to address it?	N/A	0	1	2	3
Total score for Domain A1					

DOMAIN A2: THE INTERVENTION

This domain requires a description of the proposed program or intervention to address the problem described in A1. The aims, objectives, key elements and methods of delivery should be documented.

Domain A2: The program/ intervention	
Current situation – Describe what is currently known about the intervention proposed for scale up	
A2.1: Describe the aims/objectives and intended outcomes of the intervention proposed for scale up Provide (1) a summary description of the intervention and (2) its aims and objectives	
A2.2: Describe the key elements of the intervention proposed for scale up (including the process of delivery) What are the key intervention components? (e.g. Frequency and intensity of the intervention, etc.)	

Readiness assessment Domain A2: Intervention characteristics

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
2. Will the outcomes delivered by this intervention address the needs of the target group (and/or) problem?	N/A	0	1	2	3
Total score for Domain A2					

12

DOMAIN A3: STRATEGIC AND POLITICAL CONTEXT

This domain requires consideration of the current strategic, political, and environmental context. It may also help to consider other influences that may contribute to the context such as industry/commercial players or the non-government sector.

Domain A3: Strategic and political context	
Strategic and political context – Describe what is known about the current strategic/political/environment context	
A3.1: Is addressing the problem consistent with national, state or regional policy directions or priorities? (Yes, No, Don't know). Provide evidence where possible to justify assessment.)	
A3.2: Is addressing the problem an identified need of funding agencies? (Funding in agencies in this case may include central agencies such as NHMRC, Treasury, Cabinet Office, individual departments, non-government organisations or other advocacy groups) (Yes, No, Don't know). Consider if there are any targets/indicators/goals at the local or international level that need to be met.	
A3.3: How well will the intervention proposed for scale up align with the broader strategic and/or political context? Consider if there are any political, strategic or environmental priorities or strategies this intervention might align with. Also consider the influence of industry and private and non-government sector.	

Readiness assessment Domain A3: Strategic/political context

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
3. Is addressing the problem consistent with policy/strategic directions or priorities?	N/A	0	1	2	3
4. Will scaling up the intervention be strategically useful to funders/funding agency?	N/A	0	1	2	3
Total score for Domain A3					

13

DOMAIN A4: EVIDENCE OF EFFECTIVENESS

This domain considers the level of evidence available to support the scale up of the proposed intervention. This includes the consideration of evidence from various sources such as the scientific literature and/or from results of any other known evaluations of the intervention if it has been piloted/trialled in your area or by someone else in another area. In some cases, you may have access to both types of evidence, but in others you may be limited to one only. It is important that you read and consider both if available.

In this section, the target population is defined as the group of people the intervention is intended for. In some cases, your target population can be very specific, for example, those with a certain health condition/risk factor. In others, the target population can be broad, for example all those within a specific geographical area. It is important that a target population is defined as it will have an impact on future monitoring and evaluation activities.

Domain A4: Evidence of effectiveness	
Level of evidence available	
A4.1 What is the strength of evidence of effectiveness for the intervention in addressing the problem described in Domain A1 and A2, based on literature? National Health and Medical Research Council evidence levels I Systematic review of level II evidence demonstrating benefit II RCT or cluster RCT demonstrating benefit III A pseudo-randomised controlled trial demonstrating benefit III Comparative study with no concurrent controls (non-randomised experimental trial, cohort study, case-control study, interrupted time series with a control) demonstrating benefit III Comparative study without concurrent controls (historical control study, two or more single arm study, interrupted time series analysis without a control group) demonstrating benefit IV Case series with either post-test or pre-test/post-test outcomes	
A4.2 What was the size of the intervention effect (if known)? (Mean difference, relative risk, odds ratio, hazard ratio, sensitivity, specificity and statistical significance) Note: It is important to know that intervention effects generally decline from controlled setting to implementation at scale in the real world.	
A4.3 Describe core intervention components (as described in Domain A2) that contribute to intervention effectiveness (if known)	
A4.4 Is the effect size of the intervention meaningful from a population health policy perspective? Note: A statistically significant difference, though a good start, is not necessarily a difference of policy/clinical significance. Intervention effects of policy/clinical significance are meaningful changes on an individual or group that, if scaled up, can make a substantial improvement to the outcome of interest.	

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Domain A4: Evidence of effectiveness	
A4.5 Did the intervention have differential effects on the target population? Note: Differences in effectiveness amongst target populations/settings.	
A4.6 Did the intervention have any known unintended consequences and/or adverse outcomes that were reported (in the literature or elsewhere)? Note: Unintended consequences can be positive or negative.	
A4.7 Is there evidence that the intervention has a relative advantage over existing interventions to address the same problem?	
A4.8 Has the intervention been implemented at a: (a) Larger scale (either in literature or elsewhere) (b) Other delivery settings (from original intention)? If Yes to either, was it found to be effective? Describe the results	

Readiness assessment Domain A4: Evidence of effectiveness

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
5. Is there compelling evidence (from the literature or elsewhere) to indicate that the intervention is effective in addressing the problem in the target population?	N/A	0	1	2	3
Total score for Domain A4					

15

DOMAIN A5: INTERVENTION COSTS AND BENEFITS

This domain considers the known costs of the intervention delivery as well as any quantifiable benefits. Economic evaluation is dependent on information on the costs and benefits of programs. Methods include cost effectiveness analysis, cost benefit analysis, cost utility analysis, etc.[4] In some circumstances, intervention costs may not be well known, but it is preferable that some indication of costs be gathered so that more informed consideration of scalability can be made.

Domain A5: Intervention costs and benefits	
Level of evidence available	
A5.1 What were the intervention costs reported (if available)? Consider costs associated with start-up (e.g. building infrastructure, conducting training), costs associated with ongoing delivery as well as cost per participant or cost per unit of outcome	
A5.2 Was there any evidence of benefit outweighing the costs? Describe any evidence that the benefits of the program outweighed the costs Potential measures may include: incremental cost-effectiveness ratio, cost-benefit analysis, cost per QALY etc.	

Readiness assessment Domain A5: Intervention costs and benefits

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
6. Is there evidence that the benefits of the intervention exceeded the costs?	N/A	0	1	2	3
Total score for Domain A5					

16

DOMAIN A5: INTERVENTION COSTS AND BENEFITS

This domain considers the known costs of the intervention delivery as well as any quantifiable benefits. Economic evaluation is dependent on information on the costs and benefits of programs. Methods include cost effectiveness analysis, cost benefit analysis, cost utility analysis, etc.[4] In some circumstances, intervention costs may not be well known, but it is preferable that some indication of costs be gathered so that more informed consideration of scalability can be made.

Domain A5: Intervention costs and benefits	
Level of evidence available	
A5.1 What were the intervention costs reported (if available)? Consider costs associated with start-up (e.g. building infrastructure, conducting training), costs associated with ongoing delivery as well as cost per participant or cost per unit of outcome	
A5.2 Was there any evidence of benefit outweighing the costs? Describe any evidence that the benefits of the program outweighed the costs Potential measures may include: incremental cost-effectiveness ratio, cost-benefit analysis, cost per QALY etc.	

Readiness assessment Domain A5: Intervention costs and benefits

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
6. Is there evidence that the benefits of the intervention exceeded the costs?	N/A	0	1	2	3
Total score for Domain A5					

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PART B: INTERVENTION IMPLEMENTATION PLANNING

Part B is about consideration for implementation of the intervention (as implemented currently or in the literature), as well as the proposed implementation for scale up. This section covers four domains:

1. Fidelity and adaptation
2. Reach and acceptability
3. Delivery settings and workforce
4. Implementation infrastructure.

As noted previously, while there may be some overlap with the information sought here with information required for future scale up implementation planning, completing this tool does not negate the need for a more detailed implementation scale up plan, if scale up is found to be warranted. The questions in Part B are designed to promote early thinking about potential implementation needs and strategies that would contribute to its potential for scalability.

DOMAIN B1: FIDELITY AND ADAPTATION

This domain considers whether there are any proposed changes to the intervention required for scale up. For example, if the original intervention (described in Domain A2) required the delivery of 10 separate elements and only 8 elements are to be delivered in the scale up, record this. Any known impacts of these changes should also be noted.

Domain B1: Fidelity and adaption	
Considerations for scale up –What might change from the current situation if the intervention is scaled up?	
B1.1: Will there be any changes and/or adaptations made to the intervention from what was described in Domain A2 if the intervention is scaled up? (Yes, No, Unsure). If Yes, please indicate what those changes will be. Note: Adaptions to intervention components may have positive or negative impacts on intervention effectiveness	
B1.2: Are those changes and/or adaptations likely to have any impact on the intended outcomes of the intervention as described in Domain A2? (Yes, No, Unsure). If Yes, please indicate what those changes/impacts will be	
B1.3: How will intervention fidelity be monitored and maintained?	

Readiness assessment Domain B1: Fidelity and adaptation

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
7. Will the core components of the scaled-up intervention be consistent with what was previously shown to be effective?	N/A	0	1	2	3
8. If the core components of intervention are to be changed/adapted from its original form during scale up, will the impact of the changes/adaptations likely be favourable?	N/A	0	1	2	3
9. Can program fidelity be monitored and/or maintained if implemented at scale?	N/A	0	1	2	3
Total score for Domain B1					

18

DOMAIN B2: REACH AND ACCEPTABILITY

This domain considers the reach and acceptability of the intervention for the target population.

Domain B2: Reach and acceptability	
Previous/current situation	
B2.1 Describe the target population for the intervention Describe who was targeted in the literature or in pilot program	
B2.2 How were the target population identified and recruited? Describe how the target population(s) were identified and/or recruited in the literature or pilot program, e.g. what recruitment strategies were used	
B2.3 What was the level of participation and/or completion rate in the target population? Describe the level of participation and/or rate of completion of the target population in the literature or pilot program	
B2.4 Was the intervention acceptable to the target population? Was there any evidence (from literature or pilot program) to suggest that the intervention was acceptable to the intervention population?	
Considerations for scale up - Consider what might change from the current situation if the intervention is scaled up	
B2.5 Describe the target population for the intervention at scale	
B2.6 How will the intended target group be identified and recruited at scale?	
B2.7 Have there been any projections/estimations developed for scale up, to consider: • Likely level of participation and/or completion rates of the target population • Likely required timeframe required to achieve desired level of participation and/or reach? If yes, what are they and how likely are they to be achieved within available resources?	
B2.8 Are there any foreseeable facilitators and/or barriers for reaching the target populations as part of the scale up process? Facilitators or barriers in this case can be in terms of process, persons, practices, policies, budget	

Readiness assessment Domain B2: Reach and acceptability

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
10. Does the intervention have the potential to reach the intended target population at scale?	N/A	0	1	2	3
11. Is the intervention likely to be acceptable to the target population?	N/A	0	1	2	3
Total score for Domain B2					

20

DOMAIN B3: DELIVERY SETTING AND WORKFORCE

This domain considers the setting within which the intervention is delivered as well as the delivery workforce. In this domain, we refer to the delivery setting as the 'setting' in which the intervention is to be implemented, for example, schools, canteens, community, child care centres, hospitals. The delivery organisation, on the other hand, refers to the individual organisations that will implement the intervention. Delivery organisations may be newly created for the purpose of scaling up or they may already exist. Finally, the delivery workforce refers to those directly involved in delivering or administering the intervention to the target population.

Domain B3: Delivery setting and workforce	
Current situation	
B3.1 Describe the delivery setting/s where the intervention has been delivered Describe where the intervention has been implemented (in pilot or literature). Delivery setting in this case means the context in which the intervention has been delivered e.g. schools, school canteens, sexual health clinics, community health centres, early childhood settings	
B3.2 Describe the delivery workforce required for the administering the program/ intervention Who were they and what did they do?	
B3.3 Was the intervention deemed acceptable to the delivery workforce? For example, was there any feedback from the delivery workforce in relation to the intervention? Consider feedback from referrers to/from the intervention as well	
B3.4 How was the delivery workforce supported to deliver the intervention implementation? For example, were resources provided to assist with implementation, how much time was required to assist with implementation?	
B3.5 Were there any facilitators and/or barriers identified in the delivery setting when the intervention was implemented? If yes, what were they?	
Considerations for scale up – what might change from the current situation if the intervention is scaled up	
B3.6 Will the intervention be implemented in the same settings at scale? Yes, No, Unsure. If no, in which other settings will the intervention be implemented?	
B3.7 Who will deliver the intervention at scale? For example, will the same delivery workforce be used? Will the same referrers be involved at scale?	
B3.8 Is the intervention likely to be acceptable to the delivery workforce involved if implemented at scale?	
B3.9 Does the intervention require a small or a large departure from current practices and cultures of delivery organisations and workforce? Note: Consider the impact the implementation of the intervention will have on current practices and cultures of the organisation and whether those impacts will be well received	

Domain B3: Delivery setting and workforce	
B3.10 Have there been any projections/estimations developed for scale up, to consider: • Likely level of adoption/uptake rates of delivery organisations • Likely required timeframe required to achieve desired level of adoption/uptake by delivery organisations • Likely required timeframe to achieve the desired levels of resourcing/recruitment of the delivery workforce If yes, what are they and how likely are they to be achieved within available resources?	
B3.11 Are there similar programs/interventions already in place in the proposed delivery setting that might facilitate or hinder scale up? Does the intervention duplicate other services or interventions already in place or link with or leverage existing settings and/or services?	
B3.12 Are there any foreseeable facilitators and/or barriers for the delivery settings as part of the scale up process? Facilitators or barriers in this case can be in terms of process, people, practices, policies, budget	

Readiness assessment Domain B3: Delivery setting and workforce

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
12. Is the delivery setting(s) selected to deliver the program at scale consistent with that used in previous studies?	N/A	0	1	2	3
13. Is the delivery workforce selected to deliver the program at scale consistent with that used in previous studies?	N/A	0	1	2	3
14. Is the intervention likely to be acceptable to the delivery workforce involved in its delivery at scale?	N/A	0	1	2	3
15. If the intervention requires integration into existing organisational or community structures, how likely is it to be feasible?	N/A	0	1	2	3
Total score for Domain B3					

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DOMAIN B4: IMPLEMENTATION INFRASTRUCTURE

This domain requires consideration of the potential implementation infrastructure required for scale up. Some of the answers to these questions may be known or could be extrapolated given known information.

For the purposes of the ISAT, implementation infrastructure comprises the organisational and workforce support systems required for implementation at scale, including training, accreditation processes, competency frameworks, information and performance monitoring systems.

Implementation support team for the purposes of the ISAT can be taken to refer to the additional human resources required to assist in the implementation at scale. Their roles may include, but are not limited to, assistance with the delivery setting and workforce, managing or providing oversight of the scale up process, training and providing advice.

Domain B4: Implementation infrastructure	
Current situation	
B4.1 Describe the infrastructure requirements for the delivery of the program/ intervention i.e. classrooms, clinic facilities, sporting fields, community centres, IT equipment, etc.	
B4.2 Describe the operational requirements for delivery of the intervention i.e. training, education, monitoring and feedback systems, accreditation processes etc.	
B4.3 Were there facilitators and/or barriers to the creation and maintenance of implementation infrastructure?	
Considerations for scale up – what might change from the current situation if the intervention is scaled up	
B4.4 Have there been any projections/estimations made for scale up, to consider: • Likely implementation infrastructure required • Likely resources and timeframe required to build or procure the implementation infrastructure? If yes, what are they and how likely are they to be achieved within available resources?	
B4.5 Will implementation at scale require the creation of an implementation support team? If yes, could they be created within proposed resources?	
B4.6 Are there any foreseeable facilitators and/or barriers to building implementation infrastructure as part of the scale up process? Facilitators or barriers in this case can be in terms of acceptability to workforce, changes to practice, workload, etc.	

Readiness assessment Domain B4: Implementation infrastructure

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
16. Are the implementation infrastructure requirements of the intervention/program feasible for scale up?	N/A	0	1	2	3
Total score for Domain B4					

24

DOMAIN B5: SUSTAINABILITY

The purpose of this domain is to consider the longer-term outcomes of the scale up, and how, once scaled up, the intervention could become sustainable over the medium to longer term. Some of these questions will be difficult to answer or, in some cases, impossible.

However, they are listed to promote thinking and to facilitate planning, which may increase the likelihood of future success. It is worth noting that 'sustainability' is context dependent and it will be necessary to consider your context when determining what timeframe would be appropriate for the intervention to be considered sustainable or how best to define what sustainability means.

Domain B5: Sustainability of the intervention	
B5.1 What level of integration into existing service delivery settings or organisations will the intervention require if scaled up? Also consider whether the level of integration is feasible or sustainable	
B5.2 If the intervention is implemented at scale, will it require a large commitment of funds (initial or ongoing)? If yes to either or both, consider if an internal funding model such as co-payment schemes or sourcing from other agencies is possible, or whether it would be feasible to implement a self-funding model to pay for parts or all of the intervention through co-payments from individuals or organisations	
B5.3 Is the proposed delivery workforce required for implementation at scale sustainable (e.g. financially and/or in terms of supply)? Is there an alternative delivery workforce that can deliver the implementation at scale, e.g. using fitness leaders to deliver exercise classes instead of physiotherapists	

Readiness assessment Domain B5: Sustainability

Question	Not applicable	Not at all	To a small extent	Somewhat	To a large extent
17. Is the level of integration of the intervention into delivery settings required for implementation at scale sustainable?	N/A	0	1	2	3
18. Is the level of resourcing required to implement the intervention at scale sustainable?	N/A	0	1	2	3
19. Is the delivery workforce selected for implementation at scale sustainable?	N/A	0	1	2	3
Total score for Domain B5					

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PART C: SUMMARY OF SCALABILITY ASSESSMENT

In this section, provide a brief summary based on the information gathered from domains A1–A5 and B1–B5.

Domains	Summary	Overall score
Domain A1: The problem		
Domain A2: The intervention		
Domain A3: Strategic/political context		
Domain A4: Evidence of effectiveness		
Domain A5: Intervention costs and benefits		
Domain B1: Fidelity and adaptation		
Domain B2: Reach and acceptability		
Domain B3: Delivery settings and workforce		
Domain B4: Implementation infrastructure		
Domain B5: Sustainability		

MEDLINE search strategy

1. exp obesity/
2. Weight Gain/
3. exp Weight Loss/
4. obes*.mp.
5. (weight gain or weight loss).mp.
6. (overweight or over weight or overeat* or over eat*).mp.
7. weight change*.mp.
8. ((bmi or body mass index) adj2 (gain or loss or change)).mp.
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. exp Exercise/
11. physical inactivity.mp.
12. physical activity.mp.
13. Motor Activity/
14. (physical education or physical training).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
15. "Physical Education and Training"/
16. Physical Fitness/
17. sedentary.mp.
18. exp Life Style/
19. exp Leisure Activities/
20. Dancing/
21. (exercise* adj2 aerobic*).mp.
22. sport*.mp.
23. ((lifestyle or life style) adj5 activ*).mp.
24. (dance* or dancing).mp.
25. 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24
26. exp Diet/
27. nutrition*.mp.
28. (health* adj2 eat*).mp.
29. Child Nutrition Sciences/
30. exp Fruit/ or fruit*.mp.
31. Vegetables/ or vegetable*.mp.
32. "Fruit and Vegetable Juices"/
33. canteen*.mp.
34. Food Services/
35. menu*.mp.
36. (calorie or calories or kilojoule*).mp.
37. energy density.mp.
38. Eating/
39. Feeding Behaviour/ or feeding behavio?r*.mp.
40. dietary intake.mp.
41. Food Habits/
42. Food/
43. Carbonated Beverages/ or soft drink*.mp.
44. soda.mp.
45. sweetened drink*.mp.
46. Dietary Fats/
47. confectionary.mp.
48. (school adj2 (lunch* or meal*)).mp.
49. Menu Planning/
50. feeding program*.mp.
51. food program*.mp.
52. (nutrition* adj2 program*).mp.
53. cafeteria*.mp.

54. Nutritional Status/
55. 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54
56. 9 or 25 or 55
57. Child, Preschool/
58. (pre-school* or preschool*).mp.
59. Child Day Care Centres/
60. (childcare* or child care*).mp.
61. (daycare* or day care*).mp.
62. early child*.mp.
63. (nursery or nurseries).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
64. Kinder*.mp.
65. 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64
66. randomized controlled trial.pt.
67. controlled clinical trial.pt.
68. clinical trials as topic.sh.
69. exp Cohort studies/
70. Controlled Before-After Studies/
71. Interrupted Time Series Analysis/
72. comparative study.pt.
73. trial*.tw.
74. double blind.tw.
75. single blind.tw.
76. experiment*.tw.
77. (pretest or pre test).tw.
78. (posttest or post test).tw.
79. (pre post or prepost).tw.
80. before after.tw.
81. qua?i randomi?ed.tw.
82. stepped wedge.tw.
83. (non randomi?ed or nonrandomi?ed).tw.
84. interrupted time series.tw.
85. multiple baseline.tw.
86. regression discontinuity.tw.
87. comprehensive cohort.tw.
88. random*.ab.
89. 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 or 83 or 84 or 85 or 86 or 87 or 88
90. implement*.mp.
91. Health Promotion/mt [Methods]
92. "Outcome and Process Assessment (Health Care)"/
93. "Process Assessment (Health Care)"/
94. "Outcome Assessment (Health Care)"/
95. Program Evaluation/
96. Interrupted Time Series Analysis/
97. dissemin*.mp.
98. adopt*.mp.
99. practice*.mp.
100. organi?ational change*.mp.
101. diffus*.mp.
102. (system* adj2 change*).tw.
103. quality improvement*.mp.
104. transform*.mp.
105. translat*.mp.
106. transfer*.mp.
107. uptake*.mp.

108. sustainab*.mp.
109. institutionali*.mp.
110. routin*.mp.
111. maintenance.mp.
112. capacity.mp.
113. incorporat*.mp.
114. adher*.mp.
115. ((polic* or practice* or program* or innovation*) adj5 (performance or feedback or prompt* or reminder* or incentive* or penalt* or communicat* or social market* or professional development or network* or leadership or opinion leader* or consensus process* or change manage* or train* or audit*)).mp.
116. integrat*.mp.
117. scal* up.mp.
118. 90 or 91 or 92 or 93 or 94 or 95 or 97 or 98 or 99 or 100 or 101 or 102 or 103 or 104 or 105 or 106 or 107 or 108 or 109 or 110 or 111 or 112 or 113 or 114 or 115 or 116 or 117
119. 56 and 65 and 89 and 118

CENTRAL search strategy

1. MeSH descriptor: [Obesity] explode all trees
2. MeSH descriptor: [Weight Gain] this term only
3. MeSH descriptor: [Weight Loss] explode all trees
4. obes*:ti,ab,kw
5. ("weight gain" or "weight loss"):ti,ab,kw
6. (overweight or "over weight" or overeat* or "over eat*"):ti,ab,kw
7. "weight change*":ti,ab,kw
8. ((bmi or "body mass index") near/2 (gain or loss or change)):ti,ab,kw
9. {or #1-#8}
10. MeSH descriptor: [Exercise] explode all trees
11. "physical inactivity":ti,ab,kw
12. "physical activity":ti,ab,kw
13. MeSH descriptor: [Motor Activity] this term only
14. ("physical education" or "physical training"):ti,ab,kw
15. MeSH descriptor: [Physical Education and Training] explode all trees
16. MeSH descriptor: [Physical Fitness] this term only
17. sedentary:ti,ab,kw
18. MeSH descriptor: [Life Style] explode all trees
19. MeSH descriptor: [Leisure Activities] explode all trees
20. MeSH descriptor: [Dancing] this term only
21. (exercis* near/2 aerobic*):ti,ab,kw
22. sport*:ti,ab,kw
23. (("life style" or lifestyle) near/5 activ*):ti,ab,kw
24. (dance* or dancing):ti,ab,kw
25. {or #10-#24}
26. MeSH descriptor: [Diet] explode all trees
27. nutrition*:ti,ab,kw
28. (health* near/2 eat*):ti,ab,kw
29. MeSH descriptor: [Child Nutrition Sciences] this term only
30. fruit*:ti,ab,kw
31. MeSH descriptor: [Fruit] this term only
32. vegetable*:ti,ab,kw
33. MeSH descriptor: [Vegetables] this term only
34. canteen*:ti,ab,kw
35. MeSH descriptor: [Fruit and Vegetable Juices] this term only
36. MeSH descriptor: [Food Services] this term only
37. menu*:ti,ab,kw
38. (calorie or calories or kilojoule*):ti,ab,kw
39. "energy density":ti,ab,kw
40. MeSH descriptor: [Eating] this term only

41. MeSH descriptor: [Feeding Behaviour] this term only
42. "feeding behavio*":ti,ab,kw
43. "dietary intake":ti,ab,kw
44. MeSH descriptor: [Food] this term only
45. MeSH descriptor: [Carbonated Beverages] this term only
46. "soft drink*":ti,ab,kw
47. soda:ti,ab,kw
48. "sweetened drink*":ti,ab,kw
49. MeSH descriptor: [Dietary Fats] this term only
50. confectionary:ti,ab,kw
51. (school near/2 (lunch* or meal*)):ti,ab,kw
52. MeSH descriptor: [Menu Planning] this term only
53. "feeding program*":ti,ab,kw
54. "food program*":ti,ab,kw
55. (nutrition* near/2 program*):ti,ab,kw
56. cafeteria*:ti,ab,kw
57. MeSH descriptor: [Nutritional Status] this term only
58. {or #26-#57}
59. {or #1-#57}
60. MeSH descriptor: [Child, Preschool] this term only
61. ("pre-school*" or preschool*):ti,ab,kw
62. MeSH descriptor: [Child Day Care Centres] this term only
63. (childcare* or "child care*"):ti,ab,kw
64. (daycare* or "day care*"):ti,ab,kw
65. "early child*":ti,ab,kw
66. (nursery or nurseries):ti,ab,kw
67. Kinder*:ti,ab,kw
68. {or #60-#67}
69. implement*:ti,ab,kw
70. dissemin*:ti,ab,kw
71. adopt*:ti,ab,kw
72. practice*:ti,ab,kw
73. "organi?ational change*":ti,ab,kw
74. diffus*:ti,ab,kw
75. system* near/2 change*:ti,ab,kw
76. "quality improvement*":ti,ab,kw
77. transform*:ti,ab,kw
78. translat*:ti,ab,kw
79. transfer*:ti,ab,kw
80. uptake*:ti,ab,kw
81. sustainab*:ti,ab,kw
82. institutionali*:ti,ab,kw
83. routin*:ti,ab,kw
84. maintenance:ti,ab,kw
85. capacity:ti,ab,kw
86. incorporat*:ti,ab,kw
87. adher*:ti,ab,kw
88. ((polic* or practice* or program* or innovation*) near/5 (performance or feedback or prompt* or reminder* or incentive* or penalt* or communicat* or social market* or professional development or network* or leadership or opinion leader* or consensus process* or change manage* or train* or audit*)):ti,ab,kw
89. integrat*:ti,ab,kw
90. "scal* up":ti,ab,kw
91. MeSH descriptor: [Health Promotion] this term only and with qualifier(s): [methods - MT]
92.MeSH descriptor: [Outcome and Process Assessment (Health Care)] this term only
93. MeSH descriptor: [Process Assessment (Health Care)] this term only
94. MeSH descriptor: [Outcome Assessment (Health Care)] this term only
95. MeSH descriptor: [Program Evaluation] this term only

96. {or #69-#95}
97. {and #59, #68, #96} with Publication Year from 2016 to 2019, in Trials

EMBASE search strategy

1. exp obesity/
2. weight gain/
3. Weight Loss.mp. or exp weight reduction/
4. obes*.mp.
5. (weight gain or weight loss).mp.
6. (overweight or over weight or overeat* or over eat*).mp.
7. weight change*.mp.
8. ((bmi or body mass index) adj2 (gain or loss or change)).mp.
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. exp exercise/
11. physical inactivity.mp. or physical inactivity/
12. exp physical activity/
13. exp motor activity/
14. (physical education or physical training).mp.
15. physical education/
16. physical fitness.mp. or fitness/
17. sedentary.mp.
18. lifestyle/
19. Leisure Activities.mp. or leisure/
20. exp sport/
21. dancing/
22. (exercise* adj2 aerobic*).mp.
23. sport*.mp.
24. ((lifestyle or life style) adj5 activ*).mp.
25. (dance* or dancing).mp.
26. 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
27. exp diet/
28. nutrition*.mp. or nutrition/
29. (health* adj2 eat*).mp.
30. Child Nutrition Sciences.mp. or nutritional science/
31. fruit*.mp. or fruit/ or "fruit and vegetable juice"/
32. vegetable*.mp. or vegetable/
33. canteen*.mp.
34. Food Services.mp. or catering service/
35. Menu*.mp.
36. (calorie or calories or kilojoule*).mp.
37. Energy Intake.mp. or caloric intake/
38. energy density.mp.
39. eating/
40. feeding behavio?r*.mp. or feeding behaviour/
41. dietary intake.mp. or dietary intake/
42. Food Habit*.mp.
43. food/
44. carbonated beverage/ or soft drink*.mp. or soft drink/
45. soda.mp.
46. sweetened drink*.mp.
47. Dietary Fats.mp. or fat intake/
48. confectionary.mp.
49. (school adj2 (lunch* or meal*)).mp.
50. Menu Planning.mp.
51. feeding program*.mp.
52. food program*.mp.

53. (nutrition* adj2 program*).mp.
54. cafeteria*.mp.
55. nutritional status/
56. 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55
57. 9 or 26 or 56
58. Child, Preschool/
59. (pre-school* or preschool*).mp.
60. day care/
61. child care/ or childcare*.mp.
62. (daycare* or day care*).mp.
63. early child*.mp.
64. nurseries.mp. or nursery/
65. Kinder*.mp.
66. 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65
67. randomized controlled trial/
68. controlled clinical trial/
69. "clinical trial (topic)"/
70. trial*.tw.
71. double blind.tw.
72. single blind.tw.
73. experiment*.tw.
74. (pretest or pre test).tw.
75. (posttest or post test).tw.
76. (pre post or prepost).tw.
77. before after.tw.
78. qua?i randomi?ed.tw.
79. stepped wedge.tw.
80. (non randomi?ed or nonrandomi?ed).tw.
81. interrupted time series.tw.
82. multiple baseline.tw.
83. regression discontinuity.tw.
84. comprehensive cohort.tw.
85. random*.ab.
86. cohort analysis/ 87. 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 or 83 or 84 or 85 or 86
88. implement*.mp.
89. dissemin*.mp.
90. adopt*.mp.
91. organi?ational change*.mp.
92. diffus*.mp.
93. (system* adj2 change*).tw.
94. quality improvement*.mp.
95. practice*.mp.
96. transform*.mp.
97. translat*.mp.
98. transfer*.mp.
99. uptake*.mp.
100. sustainab*.mp.
101. institutionali*.mp.
102. routin*.mp.
103. maintenance.mp.
104. capacity.mp.
105. incorporat*.mp.
106. adher*.mp.
107. ((polic* or practice* or program* or innovation*) adj5 (performance or feedback or prompt* or reminder* or incentive* or penalt* or communicat* or social market* or professional development or network* or leadership or opinion leader* or consensus process* or change manage* or train* or audit*)).mp.

108. integrat*.mp.
109. scal* up.mp.
110. health care quality/
111. quality control/
112. program evaluation/
113. total quality management/
114. 88 or 89 or 90 or 91 or 92 or 93 or 94 or 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103 or 104 or 105 or 106 or 107 or 108 or 109 or 110 or 111 or 112 or 113
115. 57 and 66 and 87 and 114

PsychINFO search strategy

1. Obesity/
2. Weight Gain/
3. Weight Loss/
4.obes*.mp.
5. (weight gain or weight loss).mp.
6. (overweight or over weight or overeat* or over eat*).mp.
7. weight change*.mp.
8. ((bmi or body mass index) adj2 (gain or loss or change)).mp.
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. exp Exercise/
11. physical inactivity.mp.
12. physical activity.mp. or Physical Activity/
13. Motor Activity.mp.
14. (physical education or physical training).mp.
15. Physical Education/
16. Physical Fitness/
17. sedentary.mp.
18. exp Lifestyle/
19. leisure time/ or recreation/
20. exp Sports/
21. Dance/
22. (exercise* adj2 aerobic*).mp.
23. sport*.mp.
24. ((lifestyle or life style) adj5 activ*).mp.
25. (dance* or dancing).mp.
26. 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
27. Diets/
28. exp Nutrition/ or Nutrition*.mp.
29. (health* adj2 eat*).mp.
30. Child Nutrition Sciences.mp.
31. fruit*.mp.
32. vegetable*.mp.
33. canteen*.mp.
34. Food Services.mp.
35. menu*.mp.
36. (calorie or calories or kilojoule*).mp.
37. Food Intake/ or Energy Intake.mp.
38. energy density.mp.
39. Eating.mp.
40. Eating Behaviour/
41. feeding behavio?r*.mp.
42. dietary intake.mp.
43. Food/
44. ((carbonated or sweetened or soft) adj (drink* or beverage*)).mp.
45. soda.mp.
46. Dietary Fat*.mp.

47. confectionary.mp.
48. (school adj2 (lunch* or meal*)).mp.
49. feeding program*.mp.
50. food program*.mp.
51. (nutrition* adj2 program*).mp.
52. cafeteria*.mp.
53. 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52
54. 9 or 26 or 53
55. preschool students/ or nursery school students/
56. (pre-school* or preschool*).mp.
57. Day Care Centres/ or Child Day Care/
58. (childcare* or child care*).mp.
59. (daycare* or day care*).mp.
60. early child*.mp.
61. (nursery or nurseries).mp.
62. Kindergarten Students/ or Kinder*.mp.
63. 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62
64. randomi?ed controlled trial*.mp.
65. Clinical Trials/
66. trial*.tw.
67. double blind.tw.
68. single blind.tw.
69. experiment*.tw.
70. (pretest or pre test).tw.
71. (posttest or post test).tw.
72. (pre post or prepost).tw.
73. before after.tw.
74. qua?i randomi?ed.tw.
75. stepped wedge.tw.
76. (non randomi?ed or nonrandomi?ed).tw.
77. interrupted time series.tw.
78. multiple baseline.tw.
79. regression discontinuity.tw.
80. comprehensive cohort.tw.
81. random*.ab.
82. 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81
83. implement*.mp.
84. dissemin*.mp.
85. adopt*.mp.
86. practice*.mp.
87. organi?ational change*.mp.
88. diffus*.mp.
89. (system* adj2 change*).tw.
90. quality improvement*.mp.
91. transform*.mp.
92. translat*.mp.
93. transfer*.mp.
94. uptake*.mp.
95. sustainab*.mp.
96. institutionali*.mp.
97. routin*.mp.
98. maintenance.mp.
99. capacity.mp.
100. incorporat*.mp.
101. adher*.mp.

102. ((polic* or practice* or program* or innovation*) adj5 (performance or feedback or prompt* or reminder* or incentive* or penalt* or communicat* or social market* or professional development or network* or leadership or opinion leader* or consensus process* or change manage* or train* or audit*)).mp.
103. integrat*.mp.
104. scal* up.mp.
105. Quality Control/
106. quality of services/
107. Program Evaluation/
108. 83 or 84 or 85 or 86 or 87 or 88 or 89 or 90 or 91 or 92 or 93 or 94 or 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103 or 104 or 105 or 106 or 107
109. 54 and 63 and 82 and 108

ERIC search strategy

(obes* OR "weight gain" OR "weight loss" OR overweight OR "over weight" OR overeat* OR over eat* OR "weight change*" OR ((bmi OR “body mass index”) AND (gain OR loss OR change)) OR Exercise* OR "physical inactivity" OR "physical activity" OR "Motor Activity" OR "physical education" OR “physical training” OR "Physical Fitness" OR sedentary OR "leisure activit*" OR sport* OR dance* OR ((“life style” OR lifestyle) AND activ*) OR Diet OR nutrition* OR (health* AND eat*) OR "Child Nutrition*" OR fruit* OR vegetable* OR canteen* OR menu* OR calorie OR calories OR kilojoule* OR "Energy Intake" OR "energy density" OR Eating OR "Feeding Behavio*" OR "dietary intake" OR food OR ((carbonated OR sweetened OR soft) AND (drink* OR beverage*)) OR soda OR "Dietary Fat*" OR confectionary OR (school AND (lunch* OR meal*)) OR "feeding program*" OR cafeteria*)
AND (“pre-school*” or preschool* or childcare* or “child care*” or daycare* or “day care*” or “early child*” or nursery or nurseries or Kinder*)
AND (Random* or trial* or “double blind” or “single blind” or experiment* or pretest or “pre test” or posttest or “post test” or “pre post” or prepost or “before after” or “stepped wedge” or nonrandomi?ed or “interrupted time series” or “multiple baseline” or “regression discontinuity” or “comprehensive cohort” or “cohort stud*” OR “cohort analysis”)
AND (“quality control” OR “health promotion” OR “quality assessment” OR “outcome assessment” OR “process assessment” OR “program evaluation” OR “total quality management” OR “health care quality” OR Implement* or dissemin* or adopt* or practice* or “organi?ational change*” or diffuse* or (system* and change*) or “quality improvement*” or transform* or translat* or transfer* or uptake* or sustainab* or institutionali* or routin* or maintenance or capacity or incorporate* or adher* or ((polic* or practice* or program* or innovation*) and (performance or feedback or prompt* or reminder* or incentive* or penalt* or communicat* or social market* or professional development or network* or leadership or opinion leader* or consensus process* or change manage* or train* or audit*)) or integrat* or “scal* up”)

CINAHL search strategy

S1. (MH "Obesity+")
S2. (MH "Weight Gain")
S3. (MH "Weight Loss+")
S4. "weight gain" or "weight loss"
S5. overweight or "over weight" or overeat* or "over eat*"
S6. "weight change*"
S7. ((bmi or "body mass index") n2 (gain or loss or change))
S8. obes*
S9. S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8
S10. (MH "Exercise+")
S11. "physical inactivity"
S12. (MH "Physical Activity") OR "physical activity"
S13. (MH "Motor Activity+")
S14. "physical education" or "physical training"
S15. (MH "Physical Education and Training+")
S16. (MH "Physical Fitness")

S17. "sedentary"
S18. (MH "Life Style+")
S19. (MH "Leisure Activities+")
S20. (MH "Sports+")
S21. (MH "Dancing+")
S22. exercis* n2 aerobic*
S23. sport*
S24. ("life style" or lifestyle) n5 activ*
S25. dance* or dancing
S26. S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25
S27. (MH "Diet+")
S28. "nutrition*"
S29. (MH "Nutrition")
S30. health* n2 eat*
S31. (MH "Child Nutrition")
S32. (MH "Fruit+")
S33. (MH "Vegetables") OR "vegetable*"
S34. fruit*
S35. "canteen*"
S36. (MH "Food Services")
S37. (MH "Menu Planning") OR "menu*"
S38. calorie or calories or kilojoule*
S39. (MH "Energy Intake") OR (MH "Food Intake")
S40. (MH "Energy Density") OR "Energy Density"
S41. "feeding behavio?r*"
S42. (MH "Eating") OR (MH "Eating Behaviour")
S43. "dietary intake"
S44. (MH "Food Habits")
S45. (MH "Food")
S46. (MH "Carbonated Beverages") OR "soft drink*"
S47. soda
S48. "sweetened drink*"
S49. (MH "Dietary Fats")
S50. "confectionary" OR (MH "Candy")
S51. school n2 (lunch* or meal*)
S52. "feeding program*"
S53. "food program*"
S54. (nutrition* n2 program*)
S55. cafeteria*
S56. (MH "Nutritional Status")
S57. S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53 OR S54 OR S55 OR S56
S58. S9 OR S26 OR S57
S59. (MH "Child, Preschool")
S60. "pre-school*" or preschool*
S61. (MH "Child Day Care") OR (MH "Child Care Providers") OR (MH "Child Care (Saba CCC)") OR (MH "Child Care")
S62. childcare* or "child care*"
S63. daycare* or "day care*"
S64. "early child*"
S65. (MH "Schools, Nursery")
S66. nursery or nurseries
S67. Kinder*
S68. S59 OR S60 OR S61 OR S62 OR S63 OR S64 OR S65 OR S66 OR S67
S69. (MH "Randomized Controlled Trials")
S70. (MH "Clinical Trials")

S71. TI trial* OR AB trial*
S72. (MH "Double-Blind Studies") OR "double blind"
S73. (MH "Single-Blind Studies") OR "single blind"
S74. (MH "Experimental Studies") OR "experiment*"
S75. TI (pretest or "pre test") OR AB (pretest or "pre test")
S76. TI (posttest or "post test") OR AB (posttest or "post test")
S77. TI ("pre post" or prepost) OR AB ("pre post" or prepost)
S78. TI "before after" OR AB "before after"
S79. TI "qua?i randomi?ed" OR AB "qua?i randomi?ed"
S80. TI "stepped wedge" OR AB "stepped wedge"
S81. TI ("non randomi?ed" or nonrandomi?ed) OR AB ("non randomi?ed" or nonrandomi?ed)
S82. TI "interrupted time series" OR AB "interrupted time series"
S83. TI "multiple baseline" OR AB "multiple baseline"
S84. TI "regression discontinuity" OR AB "regression discontinuity"
S85. TI "comprehensive cohort" OR AB "comprehensive cohort"
S86. AB random*
S87. S69 OR S70 OR S71 OR S72 OR S73 OR S74 OR S75 OR S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82 OR S83 OR S84 OR S85 OR S86
S88. implement*
S89. dissemin*
S90. adopt*
S91. practice*
S92. "organi?ational change*"
S93. diffus*
S94. system* n2 change*
S95. "quality improvement*"
S96. transform*
S97. translat*
S98. transfer*
S99. uptake*
S100. sustainab*
S101. institutionali*
S102. routin*
S103. maintenance
S104. capacity
S105. adher*
S106. ((polic* or practice* or program* or innovation*) n5 (performance or feedback or prompt* or reminder* or incentive* or penalt* or communicat* or social market* or professional development or network* or leadership or opinion leader* or consensus process* or change manage* or train* or audit*))
S107. integrat*
S108. scal* up
S109. incorporat*
S110. (MH "Health Promotion")
S111. (MH "Quality Assessment")
S112. (MH "Process Assessment (Health Care)")
S113. (MH "Program Evaluation")
S114. S88 OR S89 OR S90 OR S91 OR S92 OR S93 OR S94 OR S95 OR S96 OR S97 OR S98 OR S99 OR S100 OR S101 OR S102 OR S103 OR S104 OR S105 OR S106 OR S107 OR S108 OR S109 OR S110 OR S111 OR S112 OR S113
S115 S58 AND S68 AND S87 AND S114 Limited to June 21016+

SCOPUS search strategy

TITLE-ABS-KEY ((obes* OR "weight gain" OR "weight loss" OR overweight OR "over weight" OR overeat* OR over AND eat* OR "weight change*" OR ((bmi OR "body mass index") AND (gain OR loss OR change)) OR exercise* OR "physical inactivity" OR "physical activity" OR "Motor Activity" OR "physical education" OR "physical training" OR "Physical Fitness" OR sedentary OR "leisure activit*" OR sport* OR dance* OR (("life style" OR lifestyle) AND activ*) OR diet OR nutrition* OR (health* AND

eat*) OR "Child Nutrition*" OR fruit* OR vegetable* OR canteen* OR menu* OR calorie OR calories OR kilojoule* OR "Energy Intake" OR "energy density" OR eating OR "Feeding Behavio*" OR "dietary intake" OR food OR ((carbonated OR sweetened OR soft) AND (drink* OR beverage*)) OR soda OR "Dietary Fat*" OR confectionary OR (school AND (lunch* OR meal*)) OR "feeding program*" OR cafeteria*)) AND TITLE-ABS-KEY (("pre-school*" OR preschool* OR childcare* OR "child care*" OR daycare* OR "day care*" OR "early child*" OR nursery OR nurseries OR kinder*)) AND TITLE-ABS-KEY ((random* OR trial* OR "double blind" OR "single blind" OR experiment* OR pretest OR "pre test" OR posttest OR "post test" OR "pre post" OR prepost OR "before after" OR "stepped wedge" OR nonrandomi?ed OR "interrupted time series" OR "multiple baseline" OR "regression discontinuity" OR "comprehensive cohort" OR "cohort stud*" OR "cohort analysis")) AND TITLE-ABS-KEY (("quality control" OR "health promotion" OR "quality assessment" OR "outcome assessment" OR "process assessment" OR "program evaluation" OR "total quality management" OR "health care quality" OR implement* OR dissemin* OR adopt* OR practice* OR "organi?ational change*" OR diffuse* OR (system* AND change*) OR "quality improvement*" OR transform* OR translat* OR transfer* OR uptake* OR sustainab* OR institutionali* OR routin* OR maintenance OR capacity OR incorporate* OR adher* OR ((polic* OR practice* OR program* OR innovation*) AND (performance OR feedback OR prompt* OR reminder* OR incentive* OR penalt* OR communicat* OR social AND market* OR professional AND development OR network* OR leadership OR opinion AND leader* OR consensus AND process* OR change AND manage* OR train* OR audit*)) OR integrat* OR "scal* up"))

Helland 2016

Trial name or title	Study protocol for a multi-component kindergarten-based intervention to promote healthy diets in toddlers: a cluster-randomised trial
Methods	Study design: Cluster-randomised controlled trial
Participants	Centre type: Kindergarten departments for toddlers Region: Vest-Agder and Aust-Agder counties of Norway Number of centres participating: 18 centres
Interventions	Number of experimental conditions: 2 (intervention, control) Policies, practices or programmes targeted by the intervention: -Kindergarten personnel feeding practices -Ten meal principles regarding responsive feeding and food joy in the meal setting Implementation strategies: -Educational meetings
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: Implementation of kindergarten staff feeding practices
Starting date	Sissel H. Helland. sissel.h.hellandg@gmail.com
Contact information	Trial registration: ISRCTN74823448 DOI 10.1186/ISRCTN74823448
Notes	Sissel H. Helland. sissel.h.hellandg@gmail.com

Hennink-Kaminskia 2017

Trial name or title	Parent and ECEC provider partnerships: Protocol for the Healthy Me, Healthy We (HMHW) cluster-randomised control trial
Methods	Study design: Cluster-randomised controlled trial
Participants	Centre type: ECEC centres with dedicated classrooms for 3-4-year-olds Region: Rural and suburban counties of North Carolina Number of centres participating: 96 centres
Interventions	Number of experimental conditions: 2 (intervention, waiting-list control) Policies, practices or programmes targeted by the intervention: -Nutrition and physical activity practices Implementation strategies: -Two training sessions delivered face-to-face for ECEC centres -Check-in visits to ECEC centres -Provision of resources to ECEC centres
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: Change in ECEC centres' environmental characteristics related to nutrition and physical activity will be assessed using the Environment and Policy Assessment and Observation (EPAO)
Starting date	June 2017
Contact information	Heidi Hennink-Kaminskia. h2kamins@unc.edu
Notes	Clinical trials register: NCT0233-345

Kobel 2017

Trial name or title	Design, implementation, and study protocol of a kindergarten-based health promotion intervention
Methods	Study design: Cluster-randomised longitudinal trial
Participants	Centre type: Kindergarten, children aged 3-6 years Region: Southwest Germany Number of centres participating: 62 centres
Interventions	Number of experimental conditions: 2 (intervention, control)

	Policies, practices or programmes targeted by the intervention: Not specified Implementation strategies: Not specified
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: -Change in environment of kindergarten -Child nutrition intake (consumption of sugar-sweetened beverages, fruit, vegetables, high-calorie food)
Starting date	September 2016
Contact information	Susanne Kobel; susanne.kobel@uni-ulm.de
Notes	The study is registered at the German Clinical Trials Register (DRKS), Freiburg University, Germany, ID: DRKS00010089.

Messiah 2016

Trial name or title	Healthy caregivers - healthy children (HC2) phase 2
Methods	Study design: randomised controlled trial
Participants	Centre type: ECEC centres Region: U.S. Number of centres participating: 24
Interventions	Number of experimental conditions: 2 (intervention, control) Policies, practices or programmes targeted by the intervention: -implementation of the snack, screen time, physical activity, and beverage policies -Child health behaviours and parent and teacher health behaviours Implementation strategies: Not specified
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: -Change in centre nutrition and physical activity environment -Change in centre menus
Starting date	2015
Contact information	S.E. Messiah, smessiah@med.miami.edu
Notes	Clinical Trials.gov number NCT02697565

NCT01890681

Trial name or title	Baby NAPSACC intervention study
Methods	Study design: randomised controlled trial
Participants	Centre type: ECEC centres Region: North Carolina, U.S. Number of centres participating: not specified
Interventions	Number of experimental conditions: 2 (intervention, control) Policies, practices or programmes targeted by the intervention: not specified Implementation strategies: -Centre and family self-assessment -Targeted technical assistance provided by Baby NAPSACC consultant for providers and parents -Training workshops for ECEC providers -Parent outreach and support
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: Change in ECEC centre policies and practices
Starting date	2013
Contact information	Sara Benjamin Neelon, sara.benjamin@dm.duke.edu
Notes	ClinicalTrials.gov Identifier: NCT01890681

NCT02375490

Trial name or title	A multilevel intervention to increase physical activity and improve healthy eating among young children (ages 3 to 5) attending early ECEC centres: the Healthy Start Study
Methods	Study design: randomised controlled trial
Participants	Centre type: early ECEC centre Region: Canada Number of centres participating: not specified
Interventions	Number of experimental conditions: 2 (intervention, control) Policies, practices or programmes targeted by the intervention: not specified Implementation strategies: - Intersectoral partnerships that leads to promoting healthy weights in communities and ECEC centres - The Healthy Start guide for educators - Customised training - Role modelling and monitoring - An evidence-based resource for both families and educators and supplementary resources from governmental partners - Knowledge development and exchange - Communication strategy
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: Early ECEC centre practices and policies for physical activity and nutrition
Starting date	2015
Contact information	Holly Hallikainen, hlh664@mail.usask.ca
Notes	ClinicalTrials.gov Identifier: NCT02375490

NCT03075085

Trial name or title	Developing and testing implementation strategies for evidence-based obesity prevention in child- care
Methods	Study design: Randomised controlled trial
Participants	Centre type: Head Start early childhood agencies Region: U.S. Number of centres participating: not specified
Interventions	Number of experimental conditions: 2 (experimental, active comparator) Policies, practices or programmes targeted by the intervention: Evidence-based obesity practices Implementation strategies: Not specified
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: Change in educators' observed implementation fidelity scores for use of evidence-based obesity practices
Starting date	January 2018
Contact information	Taren Swindle, tswindle@uams.edu
Notes	ClinicalTrials.gov identifier: NCT03075085

NCT03279926

Trial name or title	Preschoolers Learning and Active in PlaY (PLAY)
Methods	Study design: Randomised controlled trial
Participants	Centre type: Preschool Region: U.S. Number of centres participating: not specified
Interventions	Number of experimental conditions: 3 (all experimental) Policies, practices or programmes targeted by the intervention: -Active play opportunities, including teacher-led, child-initiated, outdoor and indoor

	Implementation strategies: Not specified
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: Change in active play opportunities
Starting date	September 2017
Contact information	Pooja Tandon, pooja.tandon@seattlechildrens.org
Notes	ClinicalTrials.gov identifier: NCT03279926

NCT03590834

Trial name or title	Míranos! Program, a preschool obesity prevention
Methods	Study design: randomised controlled trial
Participants	Centre type: Head Start ECEC centres, aged 3-5 years Region: U.S. Number of centres participating: 12
Interventions	Number of experimental conditions: 3 (centre-based, home-based, active control) Policies, practices or programmes targeted by the intervention: Nutrition and physical activity policies and environments within the ECEC centres Implementation strategies: -Nutrition and Physical activity policy modification to increase fruit and vegetable servings and more physical activity throughout the day. -Staff training and assistance -Health education and contests
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: -Change in centre physical activity and nutrition PA policies and environments
Starting date	August 2018
Contact information	Vanessa Estrada, vanessa.estrada@utsa.edu
Notes	ClinicalTrials.gov Identifier: NCT03590834

NCT03695523

Trial name or title	PLAY (PhysicaL ActivitY) policy study
Methods	Study design: Randomised controlled trial
Participants	Centre type: ECEC centres Region: London, Canada Number of centres participating: approximately 8
Interventions	Number of experimental conditions: 2 (intervention, control) Policies, practices or programmes targeted by the intervention: -encouraging children to engage in higher intensity energetic play often -aiming to accumulate 40 minutes each day -exposing children to a variety of indoor and outdoor physical activities -child-directed and teacher-facilitated active play daily -short bouts of outdoor time for a total of 120 minutes each day made up of primarily unstructured free play -encouraging physical literacy by practicing fundamental movement skills -not exposing children to screen-based technology during ECEC Implementation strategies: Not specified
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: -Changes in children's sedentary time -Changes in children's Moderate-to-Vigorous Physical Activity (MVPA) -Environment and policy assessment and observation self-report -Director environment and policy assessment and observation self-report
Starting date	October, 2018
Contact information	Trish Tucker, ttucker2@uwo.ca
Notes	ClinicalTrials.gov Identifier: NCT03695523

Yoong 2016b

Trial name or title	A randomised controlled trial of an online menu planning intervention to improve ECEC centre adherence to dietary guidelines
Methods	Study design: randomised controlled trial
Participants	Centre type: ECEC centres (preschool and long daycare centres) Region: New South Wales, Australia Number of centres participating: 54
Interventions	Number of experimental conditions: 2 (intervention, control) Policies, practices or programmes targeted by the intervention: Menu compliance with Caring for Children dietary guidelines Implementation strategies: -Web-based menu planning tool with decision support -Face-to-face training and support to use the programme -Provision of online resources -Reminders -Provision of portable computer tablets -Communication strategies and managerial support
Outcomes	Outcome relating to the implementation of ECEC centre policies, practices or programmes: Mean number of food groups on ECEC centre menus that comply with dietary guidelines (Caring for Children resource) regarding food provision to children in care
Starting date	December 2016
Contact information	Dr Alice Grady, Alice.Grady@hnehealth.nsw.gov.au
Notes	Australian New Zealand Clinical Trials Registry: ACTRN12616000974404

Study	Reason for exclusion
Adamo 2015	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Adamo 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Bardid 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Bell 2015	Non-controlled study
Birnbaum 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Brand 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Brian 2017a	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Brian 2017b	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Burkart 2018	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Byun 2018	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Chuang 2018	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Davis 2016	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
De Craemer 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Driediger 2018	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Foulkes 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Gelli 2017	Inappropriate participants - did not include ECEC centres (e.g. study targets primary or secondary schools)
Goldfield 2016	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Hu 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
ISRCTN94022291	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Jones 2016	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Lau 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Lumeng 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Malden 2018	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Mattingly 2016	Non-controlled study
McSweeney 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Natale 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
NCT02789215	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
NCT03022472	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Nezami 2018	Inappropriate participants - did not include ECEC centres (e.g. study targets primary or secondary schools)
Pate 2016	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice

Pinket 2016	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Razak 2018	Inappropriate intervention - did not aim to improve the implementation of policies, practices or programmes by usual ECEC centre staff
Roth 2015	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Truelove 2016	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Truelove 2018	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Tucker 2016	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Tucker 2017	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice
Vanderloo 2016	Inappropriate outcomes - did not aim to improve implementation of a policy, programme or practice

Alkon 2014

Methods	**Study design:** Cluster-RCT **Intervention duration**: 7 months **Length of follow-up from baseline:** 7 months **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre (child behaviour and weight status were assessed at the level of the individual)
Participants	**Centre type:** ECEC centres **Region:** California, Connecticut and North Carolina, U.S. **Demographic/socioeconomic characteristics:** children between the ages of 3 and 5 years of age from racial/ethnically diverse backgrounds and primarily of low-income families **Inclusion/exclusion criteria:** inclusion criteria: English-speaking centre manager, onsite kitchen, racial/ethnic diversity among the children, participation by at least 60% of families, and a population of children in care primarily comprised of low-income children between the ages of 3 and 5 years of age **Number of centres randomised:** 18 (9 intervention, 9 control) **Numbers by trial group:** n (controls baseline) = 9 n (controls follow-up) = 9 (2 small centres under same ownership analysed as 1 centre) n (interventions baseline) = 9 n (interventions follow-up) = 9 **Recruitment:** Centre: 42 ECEC centres were recruited, of which 24 centres did not meet the inclusion criteria. ECEC health consultants from California and North Carolina recruited the convenience sample of centres for their respective states while Connecticut centres were recruited by the Connecticut principal investigator. **Child:** Physical activity: 8 children at each centre, randomly selected by a statistician BMI: the research assistants selected children at the pre-intervention period for height and weight measurements from centre-specific randomly ordered lists of enrolled children. Those with pre-intervention measurements (268) were prioritised for measurement post-intervention (336); 209 children had useable data at both time points. **Recruitment rate:** 43%
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** Nutrition and Physical Activity Self-Assessment for Child Care (NAPSACC) programme including: -Childhood obesity -Healthy eating for young children -Physical activity for young children -Personal health and wellness -Working with families to promote healthy behaviours **Implementation strategies:** -Workshop: the ECEC health consultants facilitated 5 x 1-hour NAPSACC workshops for ECEC providers and other staff (e.g. cooks, administrators) at each of the intervention centres on i) childhood obesity; ii) healthy eating for young children; iii) physical activity for young children; iv) personal health and wellness; and iv) working with families to promote healthy behaviours. -Consultation: ECEC health consultants provided at least monthly onsite consultations and additional phone or email consultations and materials and resources. The ECEC health consultants conducted a mean of 11 onsite visits and 8 offsite consultations per centre over the 7-month intervention, in addition to the provider and parent workshops. -Policy support: ECEC health consultants worked with the centre managers to write or update the centre nutrition and physical activity policies.

	Parent workshop: 7 of the intervention centres also received the parent workshop "Raising Healthy Kids". **Who delivered the intervention:** previously trained nurse ECEC health consultants **Theoretical underpinning**: not reported **Description of control:** delayed NAPSACC intervention in year 2 of the study
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Centre nutrition and physical activity policies:* **Data collection method:** Californian ECEC Health Programme Health and Safety Checklist (CHPHSPC) completed by blinded research assistants and used to determine if the centre written policies adhered to national guidelines **Validity of measures used:** unclear - this policy measurement technique was used in another study and was shown to be a valid measure of the effect of ECEC health consultant interventions on ECEC centre environments. *Provider nutrition and physical activity practices:* **Data collection method:** modified version of the Environment and Policy Assessment and Observation (EPAO) was completed by a research assistant. Mean scores for the nutrition and physical activity scales were calculated for each centre then aggregated by intervention and control centre. **Validity of measures used:** although these items were modified from a reliable instrument, they were not previously validated in the format included in this study. **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** *Child physical activity:* **Data collection method**: the Observation System for Recording Activity in Preschools (OSRAP) - data collection was completed by a trained research assistant. Children were observed in 15-second intervals for a total of 12 to 16 minutes per child; the observations were conducted over an 8-hour day. Data were aggregated as the mean percentage of physical activity intensity (1 = stationary to 5 = fast). **Validity of measures used**: the OSRAP has been validated and has been compared favourably with accelerometer data. *Child weight status:* **Data collection method:** BMI z-score - the research assistants used a portable foldable stadiometer to measure height and a digital scale to measure weight. Pre/post BMI z-score and % underweight, healthy weight, overweight and obese children **Validity of measures used:** unclear – appears to be an objective measure **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Penetration:* **Data collection method:** intervention receipt **Validity of measures used:** not reported

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Authors indicated that the centres were randomly assigned to treatment groups, but the sequence generation procedure was not described. One control group centre that was not able to adequately complete baseline data collection was replaced by a matched centre (unclear if this was randomly chosen).
Allocation concealment (selection bias)	Unclear risk	Method of concealment not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	We assumed that due to the nature of the intervention, ECEC centre staff and study personnel delivering the intervention were not blind to the study allocation and therefore there was a potential high risk of performance bias.

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessment was undertaken by blinded research personnel and therefore the risk of detection bias was considered to be low.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Complete data collected for all centres (8 control and 9 intervention), with no centres excluded from the analysis - therefore risk of attrition bias was considered to be low.
Selective reporting (reporting bias)	Unclear risk	No prospective trial protocol or trial registration so it was unclear whether there was selective outcome reporting.
Recruitment to cluster	Low risk	Selection of participants from each centre for measurement of child diet, physical activity and BMI outcomes was random, so risk of bias through selection to cluster was considered to be low.
Baseline imbalance	Unclear risk	There was baseline imbalance in parent and ECEC provider characteristics but they adjusted for some of these in the analysis.
Loss of clusters	Unclear risk	In the control group, the investigators replaced 1 cluster with a matched cluster and then merged 2 clusters (centres that came under same management) for analysis.
Incorrect analysis	Low risk	Hierarchical linear models conducted to assess child-level BMI z-score outcomes (accounting for clustering within the centre)
Compatibility with individually randomised RCTs	Unclear risk	Unable to determine if a herd effect existed

Bell 2014

Methods	**Study design:** non-randomised trial **Intervention duration**: average of 22 months between initiation of intervention and collection of follow-up data **Length of follow-up from baseline:** average 22 months (between initiation of intervention and collection of follow-up data) **Differences in baseline characteristics**: reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** preschools and long daycare centres **Region:** Intervention: Hunter New England region, New South Wales, Australia; **Control:** New South Wales, Australia **Demographic/socioeconomic characteristics:** Intervention: the Hunter New England region - a geographically large area (130,000 km2) with a demographically diverse population including metropolitan urban and suburban areas, regional centres, and rural and isolated remote communities. The region included pockets of wealth and poverty, and an overall socioeconomic status lower than the New South Wales state average. Control: not reported **Inclusion/exclusion criteria:** all centres located within the intervention region were invited to participate. Centres were excluded that catered for children with special needs such as intellectual or physical disabilities. **Number of centres randomised:** 583 (287 intervention, 296 control) **Numbers by trial group:** n (control baseline) = 251 n (control follow-up) = 191 n (intervention baseline) = 261 n (intervention follow-up) = 240 **Recruitment:** Intervention: all centres (n = 287) located within the intervention region were invited to participate. Control: a simple random sample of eligible centre-based

	ECEC centres in all other regions of the state of New South Wales were invited to participate in the study as the comparison group (n = 296) **Recruitment rate:** Intervention: 91%; Control: 85%
Interventions	**Number of experimental conditions**: 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** Healthy eating policies and practices of ECEC centres including: -Staff training in nutrition -Policy guiding the content of food and drinks provided to children by the centre -Policy guiding the content of food and drinks packed for children by parents -Provision of non-sweetened drinks (milk and water) only to children during care -Parent participation in nutrition policy or programmes -Provision of foods to children consistent with dietary guidelines (for centres that provide meals to children) and accreditation requirements **Implementation strategies:** -Identifying leaders and obtaining their support and endorsement of the programme and targeted policy and practices -Provision of professional development for staff (2 x 6-hour workshops) -Small incentives -Resource provision -Performance monitoring and feedback -Follow-up support (20-minute phone call once, 5 newsletters) **Who delivered the intervention:** Health centre staff who worked with regional representatives of the Department of Community Centres and ECEC centre staff to implement the intervention strategies **Theoretical underpinning:** The intervention was based on practice change and capacity-building theoretical frameworks. **Description of control:** From July 2008 onwards, preschool centres in New South Wales were able to access implementation support via a government-supported programme that aimed to promote physical activity and healthy eating for children.
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Centre healthy eating policies and practices:* -Staff with nutrition training -Centres with a policy guiding the content of food and drinks provided to children by the centre -Centres with a policy guiding the content of food and drinks packed for children by parents -Centres providing only water or plain milk to children -Parent participation in nutrition policy or programmes **Data collection method:** computer-assisted telephone interview with centre managers **Validity of measures used:** not reported *Nutritional quality of lunch menus:* -Number of times processed foods high in fat, salt and/or sugar were listed on the menu each day -Number of times sweetened drinks were listed on the menu each day -Number of times water was listed on the menu each day -Number of 'child size' servings of fruit listed on the menu each day -Number of 'child size' servings of vegetables listed on the menu each day Classification into the following categories: -No high-fat, salt and/or sugar processed food menu items -No sweetened drink menu items -Water with every eating occasion -1 child-size serving of fruit listed on the menu each day -The number of child-size servings of vegetables listed on the menu each day **Data collection method:** All centres were invited to submit a copy of their current 2-week menu. **Validity of measures used:** not reported **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable

	Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness: not applicable	
Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Non-randomised design. High risk of selection bias as intervention centres were recruited from a selected area. Control centres were randomly selected from a comparison region. There were no details provided regarding the sequence generation procedure used to randomise control centres for selection.
Allocation concealment (selection bias)	High risk	Non-randomised experimental design. Intervention centres were recruited from a selected area, therefore high risk of bias as no concealment of allocation.
Blinding of participants and personnel (performance bias) All outcomes	High risk	We assumed that, due to the nature of the intervention, ECEC centre staff and study personnel delivering the intervention were not blind to the study allocation and therefore there was a potential high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Self-reported policies and practices. There was no blinding of research personnel or participants (centre managers) and due to the self-report of this outcome, risk of bias was considered to be high
Incomplete outcome data (attrition bias) All outcomes	High risk	There was a large difference in the proportion of centres followed up amongst intervention and control groups and the proportion that provided a menu for assessment: Intervention group: 91% of centres surveyed at baseline were followed up and 61% provided a menu. Control group: 76% of centres from the control area (NSW) were followed up and 49% provided a menu. Due to the magnitude of difference in the proportions of participants followed up between groups, the risk of bias was assessed as high.
Selective reporting (reporting bias)	Unclear risk	No prospective trial protocol or trial registration so it was unclear whether there was selective outcome reporting
Potential confounding	Unclear risk	Authors stated that "Characteristics of centres were not adjusted for in the logistic regression model as we were looking at change within centres and the baseline score of the centres effectively controlled for potential differences in baseline characteristics between the two regions." It is unknown whether this was adequate to reduce bias due to known confounders.
Other bias	Unclear risk	This research was funded by NSW Ministry of Health. The Ministry of Health had no role in the design, analysis or writing of this article.

Benjamin 2007

Methods	**Study design:** Cluster-RCT **Intervention duration**: 6 months

	Length of follow-up from baseline: approximately 10 months (assessments occurred 4 months after the 6-month intervention) **Differences in baseline characteristics:** not reported **Unit of allocation:** county **Unit of analysis:** ECEC centre
Participants	**Centre type**: ECEC centres **Region:** North Carolina, U.S. **Demographic/socioeconomic characteristics:** not reported **Inclusion/exclusion criteria:** inclusion criteria: size of the ECEC centre (between 20 and 150 children); participation in the Child and Adult Care Food Program; rating of 3, 4 or 5 stars on the NC 1-5 Star Rating System for quality ECEC. Exclusion criteria: open case of child abuse or neglect; centre provided centres to a special population of children only; Head Start centre; classified as a family ECEC home **Number of centres randomised:** 19 (15 intervention, 4 control) **Numbers by trial group:** n (control baseline) = 4 n (control follow-up) = 4 n (intervention baseline) = 15 (2 intervention centres withdrew because their manager had left their position) n (intervention follow-up) = 13 **Recruitment:** convenience sampling – the North Carolina ECEC regulatory agency provided a list of eligible ECEC centres for each intervention and comparison county. 2 centres were selected per county, except for 1 large county where 5 centres participated. **Recruitment rate:** not reported
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** The programme focused on 15 nutrition and physical activity areas. Nutrition areas of focus included: fruits and vegetables; fried food and high-fat meats; beverages; menus and variety; meals and snacks; food items outside of regular meals and snacks; supporting healthful eating; nutrition education for children, parents and staff; and nutrition policy. Key physical activity areas of focus included: active play and inactive time; TV use and TV viewing; play environment; supporting physical activity; physical activity education for children, parents and staff; and physical activity policy. **Implementation strategies:** -Self-assessment: ECEC centre managers, with assistance from key centre staff, completed the self-assessment instrument to identify current centre nutrition and physical activity policies and practices. -Action plan: NAPSACC-trained ECEC health consultants worked with the centres to develop an action plan to improve at least 3 areas identified from the self-assessment instrument. ECEC centre managers were asked to select their priority areas for improvement in order to facilitate the most fitting and lasting environmental changes at the centre. -Workshops: the trained ECEC health consultants delivered 3 x 30-minute workshops on being overweight, healthful eating and physical activity. -Provision of technical assistance: ongoing technical assistance (visits and calls) were provided by the ECEC health consultants to centre managers to support policy and practice changes. **Who delivered the intervention:** NAPSACC-trained ECEC health consultants **Theoretical underpinning:** NAPSACC is a theory-based programme that employs components of social cognitive theory against a backdrop of the socioecological framework. Social cognitive theory identifies several factors that influence behaviour change, including expectancies, observational learning, self-efficacy, behavioural capability, reinforcement and reciprocal determinism, which were all principles used to guide the NAPSACC intervention. **Description of control:** the comparison centres did not receive any training or technical assistance from an ECEC health consultant but completed only the pre- and post-self-assessment instrument.
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:**

	Total nutrition and physical activity score assessed using the self-assessment instrument Which included 29 nutrition and 15 physical activity questions with either a demonstrated or a perceived relationship to childhood overweight. Each question had 3 response categories, assigned 1, 2 or 3 points (1= minimum standard, 2 = good, 3 = best practice). **Data collection method:** self-assessment instrument **Validity of measures used:** not established at time of study - additional work tests the reliability and validity of the NAPSACC self-assessment instrument in a sample of ECEC centres. **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Acceptability* **Data collection method:** self-report with ECEC centre directors collected via focus groups, questionnaires and telephone interviews **Validity of measures used:** not reported
Notes	Given the small sample size (n = 4) in the comparison group, no between-group comparisons were made. This project was funded by the Division of Public Health, North Carolina Department of Health and Human Centres.

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Counties were matched and randomly allocated to control or intervention groups. The sequence generation procedure was not described.
Allocation concealment (selection bias)	Unclear risk	Unclear as to whether concealment of allocation occurred
Blinding of participants and personnel (performance bias) All outcomes	High risk	We assumed that due to the nature of the intervention, ECEC centre staff and study personnel delivering the intervention were not blind to the study allocation and therefore there was a potential high risk of performance bias
Blinding of outcome assessment (detection bias) All outcomes	High risk	Self-assessment conducted by ECEC centre staff for nutrition and physical activity policies and practices No blinding of research personnel or participants (centre managers) and due to the self-report of this outcome, the risk of bias was considered high.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	17 of the 19 intervention group centres had full data available and 4 of 4 control centres. No information was provided on the characteristics of the centres that dropped out, nor sensitivity analysis undertaken to test assumptions regarding missing data.
Selective reporting (reporting bias)	Unclear risk	No prospective trial protocol or trial registration so it was unclear whether there was selective outcome reporting.
Recruitment to cluster	Unclear risk	All centres within the county invited to participate and chosen to participate on first-come basis – 2 per county, but 1 county was given permission to have 5 centres participate.
Baseline imbalance	Unclear risk	A convenience sample of 6 intervention and 2 comparison counties, matched on urban/rural status randomly allocated to intervention or comparison group. Unclear if baseline characteristic imbalances were present as this was not reported. Outcome measures at baseline were similar

Loss of clusters	Unclear risk	Unclear whether the 2 lost centres were from the same county
Incorrect analysis	High risk	No statistical analysis completed due to small sample size
Compatibility with individually randomised RCTs	Unclear risk	Unable to determine if a herd effect existed

Esquivel 2016

Methods	**Study design:** Intervention trial within a larger RCT **Intervention duration:** 7 months **Length of follow-up from baseline:** 1 year **Differences in baseline characteristics:** reported **Unit of allocation**: ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** centre **Region:** 2 communities on O'ahu, Hawaii **Demographic/socioeconomic characteristics:** Head Start (HS) is a federally funded preschool programme serving low-income children aged 3–5 years within remote underserved minority populations in the Pacific region. **Inclusion/exclusion criteria:** Not described **Number of centres randomised:** 23 centres **Numbers by trial group:** n (controls baseline) = 12 n (controls follow-up) = 11 n (interventions baseline) = 12 n (interventions follow-up) = 11 **Recruitment:** Centre: This research was embedded within the randomised community trial, the Children's Healthy Living Program for Remote Underserved Minority Populations in the Pacific Region. Total of 23 HS classrooms from 18 HS joined the study. Child: Child sample included 349 children from the 23 classes from 18 centres (n = 173 intervention, n = 176 delayed intervention). **Recruitment rate:** not reported
Interventions	**Number of experimental conditions**: 2 (intervention, waiting-list control) **Policies, practices or programmes targeted by the intervention:** -Nutrition and physical activity environment -Meal centre style and types of foods and beverages served teachers in implementing wellness policies to promote nutrition and PA in their classrooms -To affect multiple contributing factors to the availability of foods high in sugar and fat, classroom activities and practices, and social norms. Implementation strategies: Educational materials: Classroom resources from the Healthy Habits for Life curriculum Educational meetings: Training and technical assistance Other: Monthly employee wellness activities that reinforced their role as models for healthy eating and PA in the classroom **Who delivered the intervention:** Staff members for policy component, but unclear for staff health component **Theoretical underpinning:** Social ecological model **Description of control:** Waiting-list control (delayed intervention)
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Nutrition and physical activity environment of the classroom as a result of policy:* **Data collection method:** Environment and Policy Assessment and Observations (EPAO) of the classroom environment **Validity of measures used:** EPAO is a validated tool. **Outcome relating to cost:** not applicable

	Outcome relating to adverse consequences: not applicable **Outcome relating to child diet, physical activity or weight status:** *Child BMI:* **Data collection method:** Child height was measured by a stadiometer to the nearest 0.1 cm. Child weight was measured using a portable scales to the nearest 0.1 kg. BMI was calculated using the measured mean height and weight. **Validity of measures used:** Child BMI variables were calculated based on 2000 CDC Growth Charts, BMI for Age and Sex. zBMI and change in zBMI over the programme year were calculated to measure change in BMI status, adjusting for age and sex. *Child dietary intake:* **Data collection method:** Dietary intake of children was assessed by observed plate waste, as recommended by the IOM's plan for measuring obesity prevention efforts. **Validity of measures used:** not reported **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** not applicable
Notes	This project was supported by the Agriculture and Food Research Initiative, Grant No. 2011-68001-30335 from the U.S. Department of Agriculture, National institute of Food and Agricultural Science Enhancement Coordinated Agricultural Program

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The random sequence generation procedure was not described
Allocation concealment (selection bias)	Unclear risk	There was no information provided about allocation concealment and therefore it was unclear if allocation was concealed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Environment and Policy Assessment and Observation (EPAO). Although the assessor was blinded, there was no mention that the participants were blinded and therefore there was a high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Environment and Policy Assessment and Observation (EPAO). The EPAOs were completed by graduate student interns who were blinded to the study arm of the classrooms being observed.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	There was no attrition for the EPAOs (this was completed for all 23 classrooms).
Selective reporting (reporting bias)	Unclear risk	The Wilkin protocol paper was for the main study and the research reported by Equivel was embedded within it. The Wilkin protocol paper may not have intended to report the outcomes for the embedded research and therefore it was unclear whether there was selective outcome reporting.

Finch 2012

Methods	**Study design:** non-randomised trial **Intervention duration:** 3 months (staggered) **Length of follow-up from baseline:** 18 months (follow-up was conducted approximately 12 months after the initiation of the intervention with wave 1 centres, and approximately 6 months after the initiation of the intervention for wave 2 centres) **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** long daycare centres and preschools **Region:** Intervention: Hunter New England region, New South Wales, Australia; **Control:** New South Wales, Australia

	Demographic/socioeconomic characteristics: Intervention: the intervention region included a large non-metropolitan area (more than 130,000 km2) encompassing urban and rural communities with a population of 60,970 children aged 0 to 5 years. Control: the comparison region of New South Wales had an area of 801,305 km2 and included major cities, inner regional centres, outer regional centres, remote and very remote areas. New South Wales has a population of 506,095 children aged 0 to 5 years. **Inclusion/exclusion criteria:** inclusion criteria: long daycare centres and preschools in the Hunter New England area (intervention group) or the remainder of New South Wales (comparison group) as recorded by the licensing agency for such centres. Exclusion criteria: centres catering solely for children with special needs such as intellectual or physical disabilities **Number of centres randomised:** 484 centres participated in baseline measures. Intervention: 275 (not randomised - those centres approached who agreed to participate and completed baseline data collection). Control: 209 (of those randomly approached and who took part in baseline evaluation). **Numbers by trial group:** n (control baseline) = 209 n (control follow-up) = 164 n (intervention baseline) = 275 n (intervention follow-up) = 228 **Recruitment:** Intervention: all centres (n = 338) located within the intervention region were invited to participate. Control: a simple random sample of eligible centre-based ECEC centres in all other regions of the state of New South Wales were invited to participate in the study as the comparison group (n = 298). **Recruitment rate:** Intervention: 81%; Control: 83%
Interventions	**Number of experimental conditions**: 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** Physical activity policy: -Conducting daily fundamental movement sessions with recommended components -Time spent on structured physical activities -All staff usually participate in free active play -All staff usually provide verbal prompts for physical activity -Children are allowed to watch small screen recreation less than once per week -Children participate in seated activities for no longer than 30 minutes at a time -Staff trained in physical activity **Implementation strategies:** -Offer of staff training (1 x 6-hour workshop) -Offer of information programme resources and instructional materials -Offer of follow-up support (2 x 15-minute support calls, 2 support emails/faxes, 6 project newsletters) -Provision of performance monitoring and feedback regarding policy and practice adoption -Offer of incentives **Who delivered the intervention:** the staff training was delivered by external experts and follow-up support and performance monitoring and feedback (telephone) was delivered by health centre staff. **Theoretical underpinning:** not reported **Description of control:** -ECEC centre staff were invited to attend a full day workshop provided by a non-government organisation. -Provision of a printed resource folder -Provision of a small financial grant to support staff attendance at training or the purchase of equipment -Opportunity for additional support strategies to be provided by local health centres at their discretion
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Centres with a physical activity policy that referred to:* -Child fundamental movement skills development -Limits on small screen recreation and TV

	-Physical activity training for staff -Centres conducting daily fundamental movement sessions with recommended components -Time spent on structured physical activities -Centres where all staff usually participate in free active play (role modelling) -Centres where all staff usually provide verbal prompts for physical activity -Centres where children are allowed to watch small screen recreation less than once per week -Centres where children participate in seated activities for no longer than 30 minutes at a time -Centres with staff trained in physical activity **Data collection method:** centre manager self-report via computer-assisted telephone interview **Validity of measures used:** unclear (developed following review of existing validated tools and pretested prior to use) **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Acceptability* **Data collection method:** telephone interview conducted with ECEC centre managers **Validity of measures used:** not reported *Penetration* **Data collection method:** not reported **Validity of measures used:** not reported
Notes	The study had multiple outcomes but did not appear to adjust the P value for multiple comparisons. This work was supported by funding received from the NSW Ministry of Health ASSIST programme. The project also received infrastructure support from the Hunter Medical Research Institute (HMRI) and Hunter New England Population Health.

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Non-randomised experimental design. High risk of selection bias as the intervention centres were recruited from a selected area. Control centres were randomly selected from a comparison region. No detail was provided regarding the sequence generation procedure used to randomise control centres for selection. Table 2 shows that centres within the intervention and comparison sites differed significantly in terms of socioeconomic areas, geographic locality and centres with children of an Aboriginal background.
Allocation concealment (selection bias)	High risk	Non-randomised experimental design. Intervention centres were recruited from a selected area, therefore high risk of bias as there was no concealment of allocation.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	We assumed that due to the nature of the intervention, ECEC centre staff and study personnel delivering the intervention were not blind to the study allocation, however, as the control group may have also received some form of intervention, systematic bias between groups in terms of performance bias was unknown.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Self-reported physical activity policies and practices. No blinding of research personnel or participants (centre managers) and due to the self-report of this outcome, the risk of bias was considered to be high.

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	83% of intervention group centres included in final post-test data analysis; 78% of comparison group centres included in final post-test data analysis. While these proportions were similar, it was unclear whether the centres lost to follow-up differed between groups. No sensitivity analysis reported to test assumptions regarding missing data
Selective reporting (reporting bias)	Unclear risk	No prospective trial protocol or trial registration so it was unclear whether there was selective outcome reporting.
Potential confounding	Unclear risk	Authors stated that "Characteristics of centres were not adjusted for in the logistic regression model as we were looking at change within centres and the baseline score of the centres effectively controlled for potential differences in baseline characteristics between the two regions." It is unknown whether this was adequate to reduce bias due to known confounders.

Finch 2014

Methods	**Study design:** Cluster-RCT **Intervention duration:** 7 months **Length of follow-up from baseline**: 8 months **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre (child physical activity was assessed at the level of the individual)
Participants	**Centre type:** centre-based long daycare centres **Region:** Hunter region, New South Wales **Demographic/socioeconomic characteristics:** the Hunter region encompasses nonmetropolitan 'major cities' and 'inner regional' areas with 14,061 children aged 3 to 5 years residing in the area. 5% of residents speak languages other than English and 2% of residents are of Aboriginal or Torres Strait Islander origin. The Hunter region has lower indices of socioeconomic status than the New South Wales state average. **Inclusion/exclusion criteria:** inclusion criteria: centre-based long daycare centres. Centres were required to have at least 25 enrolled children aged between 3 to 5 years. Children aged 3 to 5 years attending participating centres were eligible for the study if they attended on the day of the week nominated by the centre manager for baseline data collection. **Number of centres randomised:** 20 centres (10 intervention (242 children), 10 control (215 children) **Numbers by trial group:** n (controls baseline) = 10 centres n (controls follow-up) = 10 centres n (interventions baseline) = 10 centres n (interventions follow-up) = 10 centres **Recruitment:** a total of 70 ECEC centres in the study region served as the sampling frame. **Recruitment rate:** 54%
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** -Fundamental movement skill development activity sessions -Staff delivery of structured physical activity -Staff role modelling of active play and delivery of verbal prompts -Limiting small screen recreation and sedentary time -Providing children with a physical activity-promoting indoor and outdoor physical environment

	-Physical activity policy **Implementation strategies:** -Staff training (6-hour workshop for ECEC centre staff) -Provision of resources -Follow-up support (2 telephone support calls and a 2-hour centre visit) -Performance feedback via project newsletter on 2 occasions -Incentives -Opinion leaders **Who delivered the intervention:** workshop and follow-up component delivered by experts **Theoretical underpinning:** the multi-level intervention was designed using the social ecological models of health behaviour change. **Description of control:** waiting-list control group that did not receive the intervention or any intervention support or materials during the study period and were offered the intervention after collection of all follow-up data
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *-Fundamental movement skill development activity sessions* *-Staff delivery of structured physical activity* *-Staff role modelling of active play and delivery of verbal prompts* *-Limiting small screen recreation and sedentary time* *-Physical activity-promoting resources and materials* *-Portable equipment* *-Physical activity policy* **Data collection method:** observational audit - EPAO was conducted by 2 trained research staff **Validity of measures used:** unclear – EPAO has reported high inter-observer agreement but other psychometric properties of this tool were not reported **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** *The number of child injuries recorded at the centre in the month of data collection at baseline and follow-up* **Data collection method:** centre manager self-report via interview **Validity of measures used:** unclear **Outcome relating to child diet, physical activity or weight status:** *Child step count:* **Data collection method:** pedometer worn for 1 day during attendance at the ECEC centre **Validity of measures used:** a valid measure of physical activity in preschool age children **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Acceptability* **Data collection method:** written survey conducted with ECEC centre managers **Validity of measures used:** not reported *Penetration* **Data collection method:** Programme records collected by the research team during implementation **Validity of measures used:** not reported
Notes	The trial had multiple outcomes but did not appear to adjust the P value for multiple comparisons. This work was supported by funding received from the NSW Ministry of Health ASSIST programme and the Hunter Medical Research Institute (HMRI).

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computerised random number function in Microsoft Excel was used to generate random number sequence.

Allocation concealment (selection bias)	Low risk	Statistician not involved in the project allocated the centres to groups using a computerised programme.
Blinding of participants and personnel (performance bias) All outcomes	High risk	We assumed that, due to the nature of the intervention, ECEC centre staff and study personnel delivering the intervention were not blind to the study allocation and therefore there was a potential high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Implementation of policies and practices measured using observational audit-research staff undertaking audits were blind to group allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Implementation of policies and practices - no loss to follow-up (10 intervention centres; 10 control centres)
Selective reporting (reporting bias)	Low risk	There were no unreported outcomes according to those planned in the published protocol.
Recruitment to cluster	Low risk	For the child physical activity measure, children were recruited by centre managers at the centre selecting a day of the week for measurement to occur. Allocation was not revealed to centres until after baseline data collection.
Baseline imbalance	High risk	Baseline imbalance in centres in areas of higher socioeconomic status (intervention 90%, control 60%) and average years of operation (intervention 8 years, control 20 years) and no mention of adjustment within analysis
Loss of clusters	Low risk	100% followed up
Incorrect analysis	Low risk	Generalised linear mixed model accounting for children nested within centres
Compatibility with individually randomised RCTs	Unclear risk	Unable to determine if a herd effect existed

Finch 2019

Methods	**Study design:** Cluster-RCT **Intervention duration:** 10 months **Length of follow-up from baseline:** 12 months **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** Centre **Region:** Hunter New England region of NSW, Australia **Demographic/socioeconomic characteristics:** The Hunter New England Region encompasses non-metropolitan 'major cities', 'inner regional', 'outer regional' and 'remote' areas, as described by the Australian Standard Geographic Classification system. The Hunter New England Region has lower indices of socioeconomic status than the NSW state average. **Inclusion/exclusion criteria:** Centres catering exclusively for children requiring specialist care, mobile preschools, and Department of Education and Communities preschools were excluded, as were centres already involved in an alternative RCT currently underway in the Hunter New England region. Centres already identified through local health centre data as comprehensively implementing healthy eating and physical activity policies and practices were also excluded. **Number of centres randomised:** 131 **Numbers by trial group:** n (controls baseline) = 46 n (controls follow-up) = 43 n (interventions baseline) = 62

	n (interventions follow-up) = 57 **Recruitment:** Centre: Of the 366 ECEC centres in the region, 128 were excluded given their involvement in an alternative RCT, a further 30 did not meet inclusion criteria, and an additional 77 were identified as comprehensively implementing healthy eating and physical activity policies and practices. A total of 131 centres were randomised, among which 68 were allocated to the intervention and 63 to the control. Six centres allocated to the intervention and 17 centres allocated to the control group did not provide baseline data and were therefore excluded. **Recruitment rate:** 82%
Interventions	**Number of experimental conditions**: 2 (intervention, waiting-list control) **Policies, practices or programmes targeted by the intervention:** -Centre having written nutrition, physical activity, and small screen recreation policies -Centre providing information to families -Centre providing structured and specific learning experiences about healthy eating at least two times per week -Centre supplying age-appropriate drinks to children -Centre conducting fundamental movement skills activities for children aged 3–5 years every day to at least 90% of children -Centre limiting the use of small screen recreation by children aged 3–5 years to only educational purposes and for learning experiences **Implementation strategies:** Educational materials: Intervention centres were provided with resources to support the implementation of these policies (policy templates, DVD, manuals, posters, and parent lunchbox resources). Audit with feedback: Facilitated performance feedback was provided to centres regarding implementation of targeted policies and practices. Continuous quality improvement: processes including review of progress, positive reinforcement, and discussion of deficits identified from feedback reports, problem-solving, goal setting, and action planning were incorporated. Educational outreach or academic detailing: The initial performance review was completed in-person by trained support officers. Opinion leaders: Nominated supervisors were expected to endorse implementation of the targeted practices and to communicate goals and action plans, as well as progress to centre staff. Tailored interventions: Where centres were already meeting a policy or practice, implementation support was directed towards policies and practices not yet achieved. **Who delivered the intervention:** Local Health District Support Officers **Theoretical underpinning**: Consolidated Framework for Implementation Research **Description of control:** Control group centres received the same four electronic newsletters during the intervention period, but did not receive any other resources. At completion of the intervention period, control centres were offered the intervention.
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Change in prevalence of centres implementing all six targeted healthy eating and physical activity policies and practices at 12 months* **Data collection method:** telephone interview with nominated supervisor or lead educator to determine mean number policies and practices and proportion of centres implementing practices **Validity of measures used:** not reported **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Acceptability* **Data collection method:** Computer-assisted telephone interview with nominated supervisor or lead educator to determine centre satisfaction with the intervention components. Eleven items were assessed using a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree).

	Validity of measures used: not reported	
Notes	Infrastructure funding for the study was provided in kind by Hunter New England Population Health, together with funding from the Hunter Medical Research Institute, University of Newcastle Priority Research Centre for Health Behaviour and Cancer Council NSW (grant ID: PG 16-05). Associate Professor Luke Wolfenden receives salary support as a Hunter New England Clinical Research Fellow and is supported by Heart Foundation Future Leader Fellowship (Award No. 101175) and an NHMRC Career Development Fellowship (APP1128348). Dr Alice Grady receives salary support from a NHMRC grant (grant ID: APP1102943). Dr Sze Lin Yoong is a postdoctoral research fellow funded by the National Heart Foundation (Award No. 100547) and Australian Research Council (DE170100382).	
Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	While a computerised random number generator was used to randomise ECEC centres into treatment groups, following randomisation 6 of 68 (8.8%) intervention centres and 17 of 63 (28%) control centres were removed because they did not provide baseline data. It was unclear whether, following this removal of centres, the groups remained similar at baseline as was intended by the randomisation.
Allocation concealment (selection bias)	Low risk	All allocation undertaken at one time by a computer system
Blinding of participants and personnel (performance bias) All outcomes	High risk	ECEC centres were not blinded to group allocation and therefore there was a high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	High risk	The nominated supervisor completed the computer-assisted telephone interview and was not blinded to condition and therefore the risk of detection bias was high.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Overall, 11/68 (17.7%) centres randomised to the control group had missing follow-up data; and 20/63 (31.7%) centres allocated to the control group had missing follow-up data.
Selective reporting (reporting bias)	Unclear risk	The primary outcome aligned with that reported in the protocol paper. However, other measures were not prospectively registered, such as the proportion of centres that implemented each of the policies and practices and the mean number of practice centres that were compliant.

Gosliner 2010

Methods	**Study design:** RCT **Intervention duration:** not reported **Length of follow-up from baseline:** 10 months **Differences in baseline characteristics:** not reported by group **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre staff
Participants	**Centre type:** ECEC centres **Region:** California, U.S. **Demographic/socioeconomic characteristics:** ECEC centres were located in low-income neighbourhoods in Northern California. **Inclusion/exclusion criteria:** inclusion criteria: centres that were already participating in a health education and policy development project (Child Health and Nutrition Centre Enhancement) with the Contra Costa Child Care Council

	Number of centres randomised: 18 (9 intervention, 9 control) **Numbers by trial group:** n (controls baseline) = 7 n (controls follow-up) = 7 n (interventions baseline) = 6 n (interventions follow-up) = 6 **Recruitment:** 9 pairs of eligible centres were matched on city of location and programme size and were randomised to either the intervention or control group. **Recruitment rate:** 84% entered the study.
Interventions	**Number of experimental conditions**: 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** Nutrition and physical activity policies, children's food and physical activity environment **Implementation strategies:** -Training and technical assistance regarding children's health and nutrition -Received a set of nutrition and physical activity policies -Staff wellness programme consisting of: -Kick-off wellness training with individual health consultations including education, individual health assessments -Monthly newsletters and information with paychecks promoting healthy eating and physical activity -Group walking programme with awards for reaching milestones -Staff follow-up support visits **Theoretical underpinning:** not reported **Description of control:** received training and technical assistance regarding children's health and nutrition and received a set of nutrition and physical activity policies
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *- Staff providing fresh fruits in children's meals and snacks more often during the past year* *- Staff providing fresh vegetables in children's meals and snacks more often during the past year* *- Staff providing sweetened beverages in children's meals and snacks more often during the past year* *- Staff providing sweetened foods in children's meals and snacks more often during the past year* *- Staff providing fresh fruits in children's celebrations more often during the past year* *- Staff providing fresh vegetables in children's celebrations more often during the past year* *- Staff providing sweetened beverages in children's celebrations more often during the past year* *- Staff providing sweetened foods in children's celebrations more often during the past year* **Data collection method:** ECEC centre staff self-report via questionnaire **Validity of measures used:** unclear **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Penetration* **Data collection method:** self-administered questionnaires with staff at participating ECEC centres **Validity of measures used:** not reported
Notes	The study did not report baseline values for the implementation outcomes. This study was supported by the Food Nutrition Education programme of the U.S. Department of Agriculture.

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**

Random sequence generation (selection bias)	Unclear risk	Centres were matched on city of location and programme size and were randomised to intervention or control group. The sequence generation procedure was not reported.
Allocation concealment (selection bias)	Unclear risk	Whether pending allocation was concealed was unclear as no information was provided on concealment
Blinding of participants and personnel (performance bias) All outcomes	High risk	We assumed that, due to the nature of the intervention, ECEC centre staff and study personnel delivering the intervention were not blind to the study allocation and therefore there was a potential high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Self-reported by centre managers, therefore high risk of bias due to managers being aware of allocation
Incomplete outcome data (attrition bias) All outcomes	High risk	Data were available for 50 (56%) participants in the intervention group and 39 (44%) in the control group. Of those not returning at end point, most had changed employment (80%) or were on leave or vacation (14%). 7 intervention staff who reported participating in fewer than half of the intervention activities were considered inadequately exposed and were excluded from the analysis, leaving 43 staff in the intervention group. Therefore, the intention-to-treat principle was not applied
Selective reporting (reporting bias)	Unclear risk	No prospective trial protocol or trial registration so it was unclear whether there was selective outcome reporting

Hardy 2010

Methods	**Study design:** Cluster-RCT **Intervention duration:** 5 months Lengt**h of follow-up from baseline**: 5 months **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** preschools **Region:** Sydney, New South Wales, Australia **Demographic/socioeconomic characteristics**: not described **Inclusion/exclusion criteria:** inclusion criteria: preschools operating under the auspices of the New South Wales Department of Education and Training located in the Sydney, Western Sydney and South Western Sydney education regions of New South Wales **Number of centres randomised:** 29 (15 intervention, 14 control) **Numbers by trial group:** n (controls baseline) = 14 n (controls follow-up) = 14 n (interventions baseline) = 15 n (interventions follow-up) = 15 **Recruitment:** all eligible preschools were invited to participate in the study (n = 61) **Recruitment rate:** 48%
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** *'Munch & Move'* programme: - Healthy eating and ways of incorporating food-based activities into the education programme

	- Physical activity and ways of incorporating fun, games-based skills activities into the programme - Strategies to encourage children to limit their recreational screen time - Providing opportunities for children to engage in unstructured physically active play - Developing and implementing healthy nutrition and physical activity fundraising policies **Implementation strategies:** - 1-day professional development workshop for up to 2 staff, delivered by a specialised early childhood training organisation - Resources for preschools that included a manual and a small grant to support staff to attend training or purchase physical activity equipment for the centre - Contact with health promotion professionals from the local health centre, to provide additional advice to preschools to support the delivery of the programme including 2 visits post-workshop **Who delivered the intervention:** experts and health centre staff **Theoretical underpinning:** not reported **Description of control:** control preschools received health information on unrelated topics (road safety and sun safety) during the intervention period.
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *-Structured play time (minutes per session)* *-Frequency of structured play (sessions per week)* *-Unstructured play time (minutes per session)* *-Frequency of unstructured play (sessions per week)* *-Fundamental movement skill activities (minutes per session)* *-Frequency of fundamental movement skill activities (sessions per week)* *-Conduct of food-based activities* *-Rules concerning food and drink brought in from home* *-Food policies* *-Communicating food rules and policies to parents* **Data collection method**: interview with the centre manager **Validity of measures used:** unclear **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Penetration* **Data collection method:** not reported **Validity of measures used:** not reported *Acceptability* **Data collection method:** self-report questionnaires with ECEC centre staff **Validity of measures used:** not reported
Notes	The *Munch & Move* programme and this evaluation study were funded by Centre for Health Advancement, NSW Department of Health.

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The procedure for random sequence generation was not described.
Allocation concealment (selection bias)	Unclear risk	Whether pending allocation was concealed was unclear as no information was provided on concealment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	We assumed that, due to the nature of the intervention, ECEC centre staff and study personnel delivering the intervention were not blind to the study allocation and therefore there was a potential high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Policies and practices - self-reported by centre managers in interviews with research staff,

		therefore high risk of bias due to managers being aware of allocation
Incomplete outcome data (attrition bias) All outcomes	Low risk	All centre managers followed up in both groups - therefore, low risk of bias for outcome regarding implementation of policies and practices
Selective reporting (reporting bias)	Unclear risk	No prospective trial protocol or trial registration so it was unclear whether there was selective outcome reporting.
Recruitment to cluster	Low risk	All parents of participating centres were invited to allow their children to participate.
Baseline imbalance	Unclear risk	Unclear response rate of children in each group – imbalance in numbers of students (intervention 263, control 167); some imbalances in baseline characteristics (mean years teaching experience: intervention 4.5 years, control 6 years; teacher's aide: intervention 11.1 years, control 8.9 years; children attending 2 days per week: intervention 22%, control 11%; children attending 3 days per week: intervention 21%, control 42%; English speaking: intervention 58%, control 41%) – unknown if any were significantly different. Adjustment of some characteristics in analysis
Loss of clusters	Low risk	No loss of clusters
Incorrect analysis	Low risk	CSPlan procedure used to allow for clustering within centre class
Compatibility with individually randomised RCTs	Unclear risk	Unable to determine if a herd effect existed

Johnston Molley 2013

Methods	**Study design:** parallel-group RCT **Intervention duration:** not specified **Length of follow-up from baseline:** not specified **Differences in baseline characteristics:** not reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** preschools **Region:** Republic of Ireland **Demographic/socioeconomic characteristics:** preschools were situated in towns, villages and the countryside across 4 Midland counties in a geographical area defined as disadvantaged. **Inclusion/exclusion criteria:** inclusion criteria: preschools providing a "full day care centre". Exclusion criteria: preschools that provided only sessional or part-time care for children; preschools designated as ineligible by the Preschool Inspection Team due to insufficient standard in other predefined areas of inspection; preschools that had not been inspected by the Preschool Inspection Team in the previous 12-month period **Number of centres randomised:** 61 (30 intervention group 'manager trained', 31 intervention group 'manager and staff trained') **Numbers by trial group:** n (intervention group 'manager trained' baseline) = 30 n (intervention group 'manager trained' follow-up) = 24 n (intervention group 'manager and staff trained' baseline) = 31 n (intervention group 'manager and staff trained' follow-up) = 18 **Recruitment:** convenience sampling was undertaken. An up-to-date list of preschools (n = 100) providing a 'full daycare centre' was obtained and these preschools were invited to participate. **Recruitment rate:** 61%

Interventions	**Number of experimental conditions:** 2 (intervention group 'manager trained', intervention group 'manager and staff trained') **Policies, practices or programmes targeted by the intervention:** -Adequate meal and snack composition -Healthy foods and fluids -Appropriate serving size provision -Family-style food centre -Healthy preschool policy development **Implementation strategies:** Intervention 'manager trained' -1-hour manager training session with a research dietitian -Provision of resources and best practice criterion -Provision of individualised 'written feedback record' from a pre-intervention observation visit and suggested strategies for improvement discussed with the manager **Implementation strategies:** Intervention 'manager and staff trained' -1-hour manager training session with a research dietitian -1.5-hour structured staff education session with a research dietitian including presentation, group work exercises and discussion -Provision of resources and best practice criterion -Provision of individualised 'written feedback record' from a pre-intervention observation visit and suggested strategies for improvement discussed with the manager and staff **Who delivered the intervention:** dietitians **Theoretical underpinning:** adult learning methodologies
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *-Environment* *-Food centre* *-Meals* *-Snacks* *-Overall score* **Data collection methods:** 1 day observation, preschool manager self-report **Validity of measures used:** used the validated Preschool Health Promotion Activity Scored Evaluation Form **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Penetration* **Data collection method:** postal survey completed by ECEC centre staff **Validity of measures used:** not reported
Notes	This material was based upon works supported by safefood, the Food Safety Promotion Board (under safefood grant no. 01-2008); in association with the Health Centre Executive, Ireland

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	A random-number table was used to allocate centres to treatment groups
Allocation concealment (selection bias)	Low risk	We assumed that allocation was conducted in a single, automated process via the random-number table and therefore allocation could not be pre-empted.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Due to nature of the intervention (training), ECEC centre staff and study personnel delivering the intervention were not blind to study allocation, however, as both groups received some form of intervention, it was unknown if there was a systematic difference in the potential for performance enhancement and therefore bias

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information provided on whether the individuals conducting the outcome assessment (audits) were blind to group allocation
Incomplete outcome data (attrition bias) All outcomes	High risk	Of 31 centres allocated to the 'manager and staff training' intervention, only 18 received the intervention and had follow-up data collected. Of the 30 centres allocated to the 'manager training' group, 27 received the intervention and 24 had follow-up data collected. Although data were provided to demonstrate no significant difference between those who participated and did not, this analysis was conducted for all centres, not by group. Rated as high risk of bias due to the magnitude of differences in participants lost to follow-up between groups
Selective reporting (reporting bias)	Unclear risk	No prospective trial protocol or trial registration so it was unclear whether there was selective outcome reporting.

Jones 2015

Methods	**Study design:** parallel-group RCT **Intervention duration:** 12 months **Length of follow-up from baseline:** 21 months **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** Centre-based ECEC centres included preschools and long daycare centres **Region:** Hunter region of New South Wales, Australia **Demographic/socioeconomic characteristics:** Children of aboriginal and/or Torres Strait Islander background enrolled - Intervention: 68 (56, 80), control: 78 (67, 89) Centre socioeconomic area -Top 50% of NSW: intervention 30 (18, 42), control 27 (16, 39) -Bottom 50% of NSW: intervention 70 (58, 82), control 73 (61, 84) Centre geographical location -Urban: intervention 50 (37, 63), control 59 (46, 72) -Rural: intervention 50 (37, 63), control 41 (28, 53 **Inclusion/exclusion criteria:** Centres in the region were ineligible if they: catered exclusively for children requiring specialist care, provided all onsite meals to children or were fully government funded, as the ethical clearance and intervention design were not appropriate for such centres. **Number of centres randomised:** 128 centres **Numbers by trial group:** n (controls baseline) = 64 n (controls follow-up) = 60 n (interventions baseline) = 64 n (interventions follow-up) = 62 **Recruitment:** Centre: 253 centres were assessed for eligibility. Of these centres, 56 did not meet the inclusion criteria and a further 67 declined to participate. Following the completion of baseline data collection, ECEC centres were randomly allocated to either the intervention or control condition by a research assistant using a random number function in a 1:1 (intervention: control) ratio. **Recruitment rate:** 65%
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:**

	The healthy eating and physical activity policies and practices implemented by centres included the following: -Development of written nutrition and physical activity policies -Staff monitoring of children's lunchboxes every day against written nutritional guidelines, provision of feedback to parents when a non-compliant food was packed -Provision of water or reduced fat milk (for children over the age of 2 years) only - Staff role modelling of physically active play and healthy eating every day - Staff provision of prompts and positive comments to children to encourage physical activity and healthy eating every day - Provision of adult-guided fundamental movement skill development activities every day for at least 75% of children - Restriction of sedentary screen time to less than weekly **Implementation strategies:** Opinion leaders: Nominated supervisors were asked to lead the development and implementation of nutrition and physical activity policies, co-facilitate training workshops with implementation support staff and communicate expectations regarding the implementation of policies and practices to ECEC centre staff. Educational meetings: A series of three 1-h training workshops which focused on policy and practice implementation were provided onsite to ECEC centre staff and included both didactic and interactive components. Local consensus process: Implementation support staff facilitated a discussion with nominated super- visors and ECEC centre staff to reach group agreement regarding an implementation strategy for the targeted policies and practices. Educational outreach or academic detailing: Academic detailing visit was conducted which involved support staff observing and providing immediate feedback to ECEC centre staff as they implemented the practices targeted by the intervention. Educational materials: All centres received an electronic and hard copy package of tools and resources. Audit and feedback: Verbal and written feedback describing centre progress toward implementation of the targeted policies and practices was delivered at six intervals throughout the 12-month intervention. Employment of a communications strategy: Centres received hard copy and electronic bimonthly newsletters which communicated key messages relating to the healthy eating and physical activity policies and practices. Implementation support staff: A support staff member provided ongoing implementation support and positive reinforcement via face-to-face visits, telephone and email contact. **Who delivered the intervention:** ECEC staff members **Theoretical underpinning:** The design of the intervention to support implementation of the policies and practices utilised Damschroder's Consolidated Framework for Implementation Research. **Description of control:** The control group received three newsletters at the commencement, mid-point and conclusion of the 12-month intervention, containing information on healthy eating and physical activity unrelated to the specific policies and practices targeted by the intervention.
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Implementation of seven healthy eating and physical activity policies and practices* **Data collection method:** questionnaire via a computer-assisted telephone interview **Validity of measures used:** Nominated supervisors and room leaders were asked to report on their centre's implementation of the seven healthy eating and physical activity policies and practices using items validated in a previous sample of 42 Australian ECEC centres. Agreement between nominated supervisor report and independent observation: Presence of written nutrition (75%, K = 0.50) and physical activity policies (79%, K = 0.59). Staff monitoring of children's lunchboxes against written nutritional guidelines (84%, K = 0.69) and provision of feedback to parents when a non-compliant food was packed (68%, K = 0.34). Provision of water (89%, K = 0.78) or reduced fat milk only (79%, K = 0.57) to children. Staff role modelling of physically active play (69%, K = 0.39) and healthy eating (94%, K = 0.89) every day. Staff provision of prompts and

	positive comments to children to encourage physical activity (80%, K = 0.60) and healthy eating (86%, K = 0.71) every day. Provision of adult-guided fundamental movement skill development activities (53%, K= 0.06) every day to at least 75% of children (60%, K = 0.20). Restriction of sedentary screen time (58%, K = 0.17) to less than weekly **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** *Staff and child injury:* **Data collection method:** Nominated supervisors and room leader CATI **Validity of measures used:** not reported **Outcome relating to child diet, physical activity or weight status:** *Mean number of food groups consumed:* **Data collection method:** Child dietary intake was assessed during the 1-day observation using a modified version of the Dietary Observation for Child Care protocol. **Validity of measures used:** The Dietary Observation for Child Care is a validated method for recording child level dietary intake in 2 to 5 year-olds and has been used extensively in the ECEC setting. *Proportion of children engaged in sedentary, walking or very active physical activity during all observations, structured physical activity and outdoor free play sessions* **Data collection method:** Child physical activity levels were assessed at the same 1-day observation by the same observer, using a modified version of the System for Observing Play and Leisure in Youth (SOPLAY) tool and protocol. **Validity of measures used:** SOPLAY has been found to be both valid and reliable in school-aged children and has been previously used to assess physical activity in the ECEC setting. **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Acceptability:* **Data collection method:** Nominated supervisors and room leader CATI **Validity of measures used:** not reported *Penetration:* **Data collection method:** Project records maintained by each implementation support staff member **Validity of measures used:** not reported
Notes	The research team acknowledges the funding support of the Australian National Preventive Health Agency (reference 95WOL2011), Hunter New England Population Health and Hunter Medical Research Institute.

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	A random number function was used to generate the random sequence
Allocation concealment (selection bias)	Low risk	Random number function was used to randomly allocated each centre so allocation concealment assumed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Centres were not blind to study allocation and therefore high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Centres were not blind to study allocation and therefore high risk of detection bias.
Incomplete outcome data (attrition bias) All outcomes	Low risk	120/128 centres (95%) provided follow-up data.
Selective reporting (reporting bias)	Unclear risk	The primary outcome was reported as pre-specified, however the secondary outcomes of child dietary intake and physical activity levels and adverse effects were not pre-specified in the protocol paper.

Recruitment to cluster	Low risk	The children were randomly selected by asking the room leader at each centre to identify the three children with the most recent birthdays.
Baseline imbalance	Low risk	No baseline imbalances in centre characteristics. No baseline measures of secondary outcomes taken
Loss of clusters	Unclear risk	Only follow-up data collected from random sample of centres that had remained in trial at follow-up
Incorrect analysis	Low risk	The analysis appeared appropriate. Clustering effects adjusted for
Compatibility with individually randomised RCTs	Unclear risk	No evidence to make assessment

Mazzucca 2017

Methods	**Study design:** Cluster-RCT **Intervention duration:** 10 weeks **Length of follow-up from baseline:** Date of follow up data collection not specified **Differences in baseline characteristics:** Reported **Unit of allocation:** ECEC centre **Unit of analysis:** Not reported
Participants	**Centre type:** ECEC centre **Region:** Orange, Durham, Alamance and Guilford Counties, North Carolina, U.S. **Demographic/socioeconomic characteristics:** Not reported **Inclusion/exclusion criteria:** Eligible centres had at least a 2-star rating on NC's quality rating and improvement system. An additional eligibility criterion for this study was that centres had to have at least one preschool classroom with children between 3-5 years of age and at least 10 preschool children enrolled in that classroom to ensure our ability to recruit sufficient numbers of children. Centres were excluded if directors reported in the screening call that they were already providing the recommended 120 minutes of physical activity to children. Teachers were eligible for participation if they had not completed a programme to improve physical activity within the preceding six months and were willing to attend both in-person group workshops. **Number of centres randomised:** 26 centres **Numbers by trial group:** n (controls baseline) = 13 n (controls follow-up) = 13 n (interventions baseline) = 13 n (interventions follow-up) = 13 **Recruitment:** Centre: 64 ECEC centres were invited to participate, of which 17 centres did not meet the inclusion criteria and a further 21 centres refused to participate. Twenty-six ECE centre teachers (1 teacher per centre) were randomised 1:1 into either the intervention or waiting-list control arms. Randomisation took place after completion of all baseline measures. Child: not reported **Recruitment rate:** 41%
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** The physical activity environment within centres including: - Teachers encouraging children to be more active and less sedentary - Teachers joining in active play with children - Withholding of physical activity as punishment for bad behaviour - Teachers reporting that they made portable play equipment available during play sessions **Implementation strategies:** Educational meetings: Workshops were held at the beginning and at the midpoint of the intervention period (5 weeks). Teachers attended two in-person, half-day

	workshops, which presented information about children's physical activity and sedentary behaviour at ECE centres based on prior research studies. Educational materials: During both workshops, participants received intervention materials: MPL! activity lesson plans, activity cards corresponding to each MPL! activity, and $30 worth of portable play equipment. Classroom-based modules: After teachers completed the first in-person training workshop, they implemented intervention activities during four two-week modules. Within each module, newsletters, goal setting and self-monitoring, weekly technical assistance, and text message reminders were used to support implementation of classroom activities and teacher practices. Newsletters: Sent at the beginning: each module reviewed information covered on that segment of the ECEC day in the training workshop and gave them guidance on how to modify their behaviour to increase physical activity during that segment. Educational outreach: Weekly technical assistance to each teacher through phone calls, emails, or text messages based on teacher preferences for communication to help teachers overcome challenges during implementation, increase their behavioural capacity and self-efficacy Tailored interventions: Teachers were reminded to set goals around the amount of time they would implement intervention activities and to share those with the interventionist. Reminders: Teachers were sent text message reminders about implementing intervention activities about 2 times/week at the start of their day or during children's nap time. **Who delivered the intervention:** Teachers **Theoretical underpinning:** Not described **Description of control:** Control group participants were asked to proceed according to their normal practices
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *ECE centre physical activity and sedentary behaviour environment:* **Data collection method:** Assessed using a modified version of the Environment and Policy Assessment and Observation – Self-Report (EPAO-SR) instrument. The EPAO-SR is a validated, comprehensive mea- sure of both the nutrition and physical activity environments of ECEC centres reported by centre directors and classroom teachers. Only items related to physical activity and sedentary behaviour were included in this study (149 items). **Validity of measures used:** EPAO-SR is a validated measure. **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** *Child physical activity:* **Data collection method:** Accelerometer-measured minutes of children's non-sedentary time using GT3X accelerometers. Children wore accelerometers during waking hours for five ECEC days at each data collection time point, which was used to estimate usual behaviour at each measurement point. Three days of wear for ≥ 4 hours (excluding nap time) were required to be included in the analytic sample. **Validity of measures used**: Objective measure of PA *Child sedentary behaviour and intensities of physical activity:* **Data collection method:** As above and Epoch-level files were obtained using the ActiLife software, and data processing was done in SAS v9.4 using dates and times logged by teachers. Minutes per hour of sedentary behaviour and different intensities of physical activity were then calculated to account for differences in total wear time. An average of epoch-level counts per minute was calculated as an intensity-weighted daily average of physical activity. **Validity of measures used:** Not described **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness** *Acceptability* **Data collection method:** Data was collected via teacher self-report, interventionist report/logs, teacher surveys and exit interviews.

	Validity of measures used: not described *Penetration* **Data collection method:** Data was collected via teacher self-report, interventionist report/logs, teacher surveys and exit interviews. **Validity of measures used:** not described
Notes	No sources of funding reported

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The random sequence generation procedure was not described.
Allocation concealment (selection bias)	Unclear risk	There was no information provided about allocation concealment and therefore it was unclear if allocation was concealed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Measured using the Environment and Policy Assessment and Observation – Self-report (EPAO-SR). There was no mention whether the teachers and ECEC personnel were blinded and therefore there was a high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome: Physical activity environment (measured using the Environment and Policy Assessment and Observation – Self-report (EPAO-SR)) – teacher-reported There was no mention whether the teachers were blinded and therefore there was a high risk of detection bias.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All 13 centres provided post-intervention data. Seven children (4 intervention, 3 control) of the 182 children did not provide post-intervention data (4% attrition).
Selective reporting (reporting bias)	Low risk	The reported outcomes aligned with those outlined in the trial registration.
Recruitment to cluster	Low risk	All children within participating centres/classes invited to participate
Baseline imbalance	Low risk	No baseline imbalances in centre characteristics or outcomes
Loss of clusters	Low risk	No loss of sites
Incorrect analysis	Low risk	Adjustment for potential clustering in analysis
Compatibility with individually randomised RCTs	Unclear risk	No evidence to make assessment

Morshed 2016

Methods	**Study design:** Controlled trial with a stratified, group-randomised design at the site level **Intervention duration:** 2 years **Length of follow-up from baseline:** 2 years (Fall 2008 to Spring 2010) **Differences in baseline characteristics:** Reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** ECEC centres (Head Start centres) **Region:** Rural New Mexico, U.S. **Demographic/socioeconomic characteristics:** Head Start (HS) centres in American-Indian and predominantly Hispanic communities Inclusion/exclusion criteria: Potential HS centres were identified for participation in the study based on the following criteria: - Head Start centre enrolled predominantly Hispanic or American-Indian children - Head Start centre enrolled a minimum of 20 3-year-old children

	- Head Start retained at least 80% of its students for 2 years. HS centres in metropolitan areas were not eligible for inclusion, and HS centres within 150 miles of Albuquerque were prioritised to minimise travel expense. **Number of centres randomised:** 16 centres **Numbers by trial group:** n (controls baseline) = 8 n (controls follow-up) = 8 n (interventions baseline) = 8 n (interventions follow-up) = 8 **Recruitment:** Centre: 20 centres were recruited, of which 16 centres participated. Centres were assigned to an intervention (N = 8) or comparison (N = 8) group after being stratified by ethnicity (American-Indian N = 6, Hispanic N = 10) and HS BMI (lower-BMI ≤ 16.4, N = 8, higher BMI > 16.4, N = 8). The BMI cutoff point of 16.4, chosen on the basis of a prerandomisation sample of 3-year-old children measured by centre staff, was close to the median and allowed a balanced distribution of HS centres within each racial/ethnic group. Among American-Indian centres, 3 were in each BMI group. Among Hispanic centres, 5 were in each BMI group. Within each of the 4 categories of median BMI and site ethnicity, centres were randomly assigned to intervention and comparison groups. **Recruitment rate:** 80%
Interventions	**Number of experimental conditions:** 2 (intervention, comparison) **Policies, practices or programmes targeted by the intervention:** - Increase structured physical activity by 30 minutes/day - Provide repeated opportunities to try new fruit and vegetables - Increase the variety of fruit and vegetables served - Servings of target fruit and vegetables at least 4 times per quarter - Increase the amount of whole-grain foods and low-fat dairy products served - Improve food preparation methods - Increase consumption of fruit, vegetables and whole grains - Decrease consumption of sugar-sweetened beverages and high-fat foods - Increase physical activity - Decrease sedentary time - Increase availability and visibility of healthier foods - Provide nutrition information and recipes to HS families - Reinforce CHILE messages during clinic visits and at HS family events **Implementation strategies:** Educational materials: The CHILE curriculum component formed the core of the intervention and consisted of nutrition and physical activity lessons delivered to children in classrooms. Educational meetings: The food centre staff received quarterly training aimed at making policy and behavioural changes to food purchasing and menus. **Who delivered the intervention:** Staff **Theoretical underpinning:** Socioecological Transcommunity model **Description of control:** Comparison sites followed classroom activities and food centre as usual
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *- Total daily vegetable and whole-grain servings* *- Grams of discretionary fat, which is fat in a food above the amount that would be found in a lean, low- fat, or fat-free form of the food; and teaspoons of added sugar provided, which are sugars added to foods during processing or preparation* *- Grams of fat contributed daily by milk was calculated to measure changes in the fat content of milk* *- Daily fruit servings (which excluded fruit juice from the fruit servings calculation)* **Data collection method:** Direct observations of food centre staff during announced visits to HS sites. These data were collected in each HS centre during 5 weekdays. Observations of food centre staff during all meals and snacks prepared on each data collection day using the CHILE Food Centre Data Collection protocol and forms **Validity of measures used:** Not reported **Outcome relating to cost**: not applicable

	Outcome relating to adverse consequences: not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** not applicable
Notes	This study was funded by the National Institute of Diabetes and Digestive and Kidney Diseases at the National Institutes of Health (#1-R01DK72958-1).

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The random sequence generation procedure was not described.
Allocation concealment (selection bias)	Unclear risk	There was no information provided about allocation concealment and therefore it was unclear if allocation was concealed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Outcome: Observations of food centre staff using the CHILE Food Centre Data Collection protocol and forms. There was no mention that the participants and personnel were blinded and therefore there was a high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Outcome: Observations of food centre staff using the CHILE Food Centre Data Collection protocol and forms. There was no mention that the participants and personnel were blinded however using audit of nutritional content of food and therefore risk of detection bias was unclear.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All recruited sites were retained throughout the study (from Cruz, p 8).
Selective reporting (reporting bias)	Unclear risk	The associated papers did not explicitly state the primary and secondary outcomes and therefore it was unclear if there was selective outcome reporting (there was a secondary analysis not originally planned as part of the CHILE study p 418).

O'Neill 2017

Methods	**Study design:** non-randomised study with a 2-group pretest–post-test design **Intervention duration:** 6 months **Length of follow-up from baseline:** 9 months **Differences in baseline characteristics:** Reported **Unit of allocation:** By state **Unit of analysis:** ECEC centre
Participants	**Centre type:** ECEC centre **Region:** Columbia, South Carolina, and Raleigh, North Carolina, area. **Demographic/socioeconomic characteristics:** South Carolina centres in the ABC Program served low-income families. Centres in North Carolina that also served low-income families by accepting state subsidies were enrolled. **Inclusion/exclusion criteria:** Centres were eligible to participate if they were classified by the state as a centre and not a family ECEC home. Because South Carolina centres participating in the ABC Child Care Program served low-income families, centres in North Carolina also needed to serve low-income families by accepting state subsidies to make the samples more comparable. Centres were excluded if they had an open case of abuse or neglect on file with either state. **Number of centres randomised:** 64 **Numbers by trial group:** n (controls baseline) = 30 n (controls follow-up) = 26 n (interventions baseline) = 34 n (interventions follow-up) = 33

	Recruitment: Centre: Invitation letters were mailed to 342 centres, 174 eligible centres in South Carolina and 168 in North Carolina. The first 30 centres from each state that agreed to participate were enrolled. In the Columbia area, South Carolina, 34 centres were enrolled because of high interest. In the Raleigh area, North Carolina, 30 centres were enrolled. **Recruitment rate:** 19%
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** Consistency with ABC Child Care programme nutrition standards: - Only skim or 1% milk for children 2 y and older - Sugar-sweetened beverages will not be served - Juice allowed only once per day or less in 4-oz servings - At least 2 different fruits served 2 or more times per day - Vegetable other than white potatoes served at least 1 time per day - Fried or pre-fried vegetables served 1 time per week or less - Whole-grain foods served once per day - High-fat meats served 2 times per week or less - Sweet food items served 2 times per week or less - Staff attend nutrition training at least 1 time per year - Children learn about nutrition at least 1 time per week - Do not use food as a reward or punishment - Create and consistently implement a written nutrition policy Physical activity practices related to 8 standards that applied to 3- to 5-year-old children, including: - Encourage children to be physically active indoors and outdoors - Create and consistently implement a written physical activity policy - Require teachers to attend physical activity training at least once per year - Do not use or withhold physical activity as punishment - Implement 5 to 10 minutes of teacher-planned physical activity 2 or more times per day - Provide active outdoor play, weather permitting, 2 to 3 times per day, totalling 90 to 120 minutes - Provide a variety of play materials that promote physical activity indoors - Provide a variety of play materials that promote physical activity outdoors Implementation strategies: Educational meetings: Four meetings were conducted across South Carolina to introduce directors to the standards, but no technical assistance or training was provided. Release of guidelines/standards: South Carolina implemented 13 nutrition standards through the ABC Child Care programme, a state-wide initiative to provide subsidised ECEC to families in need. The nutrition standards applied to toddlers and preschoolers in care and targeted beverages, fruits and vegetables, whole grains, other foods, and policies and practices within the centres. **Who delivered the intervention:** not reported **Theoretical underpinning:** not reported **Description of control:** usual practice
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *ECEC centre implementation of physical activity practices:* **Data collection method:** Trained data collectors used the Environment and Policy Assessment and Observation (EPAO) tool to conduct observations in centres before implementation of the standards and 9 months after implementation. The EPAO assesses ECEC physical activity environments, policies, and practices. It includes 8 physical activity subscales; the Physical Activity Environment Total Score is the mean of the subscale scores. **Validity of measures used:** EPAO is a validated tool. *ECEC centre implementation of nutrition policies and practices:* **Data collection method:** Menu review (a component of the Environment and Policy Assessment and Observation) was used to evaluate the standards limiting sweet foods, high-fat meats, and fried or pre-fried vegetables, because these practices needed to be

	considered during the course of a full week. For the remaining food and beverage standards, data collected via the Diet Observation in Child Care were used to evaluate consistency with each standard. **Validity of measures used:** The Environment and Policy Assessment and Observation assessed ECEC nutrition environments, policies, and practices; the protocol and information about interrater reliability were reported elsewhere. The Diet Observation in Child Care (DOCC) was designed to assess foods and beverages served to three children in ECEC settings and has demonstrated moderate to high reliability and validity. **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** not applicable
Notes	This study was supported, in part, by a grant from the Robert Wood Johnson Foundation (RWJF), Healthy Eating Research #69551.

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Study that involved no randomisation. Therefore high risk of selection bias
Allocation concealment (selection bias)	High risk	South Carolina centres were compared to North Carolina centres – no allocation concealment and high risk of selection bias
Blinding of participants and personnel (performance bias) All outcomes	High risk	Outcome: Environment and Policy Assessment and Observation (EPAO) scores for physical activity (O'Neill 2017). There was no mention that participants and personnel were blinded, therefore high risk of performance bias
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Outcome: Environment and Policy Assessment and Observation (EPAO) scores for physical activity (O'Neill 2017). It was unclear if personnel were blinded, therefore unclear risk of detection bias
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	59/64 (92%) completed the study (33/34 (97%) in South Carolina and 26/30 (87%) in North Carolina). It was unclear if there was differential attrition
Selective reporting (reporting bias)	Unclear risk	There was no study protocol therefore it was unclear if there was selective outcome reporting.
Baseline imbalance	Low risk	Logistic regressions were conducted to evaluate consistency with each standard, adjusting for baseline and potential confounders.
Potential confounding	Low risk	Some baseline imbalances –adjustments made in analysis. Logistic regressions were conducted to evaluate consistency with each standard, adjusting for baseline and potential confounders.

Seward 2017

Methods	**Study design:** RCT **Intervention duration:** 6 months **Length of follow-up from baseline:** not reported **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** Long daycare centres **Region:** Hunter New England Local Health District. NSW, Australia

	Demographic/socioeconomic characteristics: The Australian Statistical Geography Standard describes the region as encompassing non-metropolitan 'major cities' and 'inner regional' areas. Major city + inner regional - intervention 23.92% - control 17.85% Outer regional/remote Australia - intervention 2.8% - control 2.10% **Inclusion/exclusion criteria:** Eligible ECEC centres were those that prepared and provided one main meal and two mid-meals to children while in care, and that were open for at least 8 h/d. Centres that did not prepare and provide meals to children onsite or that did not have a cook with some responsibility for menu planning were excluded. Centres catering exclusively for children requiring specialist care, mobile preschools and family daycare centres were also excluded, given the different operational characteristics of these centres compared with centre-based long daycare centres. **Number of centres randomised:** 54 ECEC centres **Numbers by trial group:** n (controls baseline) = 20 n (controls follow-up) = 20 n (interventions baseline) = 25 n (interventions follow-up) = 24 **Recruitment:** Centre: 106 centres were assessed for eligibility. Of these, 16 centres did not meet the inclusion criteria, 11 centres declined to participate and a further 25 centres were allocated to an alternative intervention. Consenting ECEC centres were immediately randomly allocated to an intervention or control group in a 1:1 ratio via block randomisation using a random number function in the statistical software package SAS version 9.3. Block size ranged between 2 and 6. **Recruitment rate:** 88% NB: twenty-five of the 79 centres were allocated to receive an alternative intervention. They have been included in the recruitment rate.
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** - Full compliance with nutrition guidelines - Compliance with nutrition guidelines for individual food groups **Implementation strategies:** Opinion leaders: A memorandum of understanding outlining each party's responsibilities to implement the nutrition guidelines was signed by the implementation support officer, the centre manager and the centre cook. Educational meetings: A one-day face-to-face menu-planning workshop was provided to centre managers and cooks aiming to improve their knowledge and skills in the application of nutrition guidelines to ECEC food centre. Educational materials: All intervention centres received a resource pack to support the implementation of the nutrition guidelines which included the Caring for Children resource, menu-planning checklists, recipe ideas and budgeting fact sheets. Audit and feedback: Intervention centres had a dietitian complete an audit of their two-week menus at two time points, with written and verbal menu feedback provided at each time point. Educational outreach or academic detailing: Support officer offered two face-to-face contacts with the centre following the menu-planning workshop. In addition to the support visits, two newsletters were distributed to intervention centres during the intervention period. **Who delivered the intervention**: Long daycare centre managers and centre cooks **Theoretical underpinning:** The Theoretical Domains Framework (TDF) was used to identify factors that influenced ECEC centres' implementation of nutrition guidelines. **Description of control:** Centres randomised to the control group were posted a hard copy of the Caring for Children resource and received usual care from the local health district health promotion staff

Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Compliance with nutrition guidelines:* **Data collection method**: An independent dietitian, blinded to group allocation, assessed the menu and calculated servings of food groups per child based on the Australian Guide to Healthy Eating food groups. Menu compliance with nutrition guidelines was assessed via a menu assessment undertaken by a dietitian at baseline and follow-up. **Validity of measures used**: not reported **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** *Negative feedback regarding centre menu:* **Data collection method:** Pen and paper questionnaire **Validity of measures used:** not reported *Average percentage of each meal not consumed by the children and classified as waste:* **Data collection method:** Pen and paper questionnaire **Validity of measures used:** not reported **Outcome relating to child diet, physical activity or weight status:** *Child food group consumption:* **Data collection method:** On the day of data collection, the research assistants collected the centres' menu and the pre- and post-serving weights of two mid-meals (morning and afternoon tea) and one main meal (lunch). **Validity of measures used:** Aggregated plate waste has been reported to be a valid method of assessing food intake at the group level and has been previously used in studies assessing the food intake of children in the school setting. **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Penetration:* **Data collection method:** Project records maintained by implementation support staff were used to monitor the delivery of the intervention strategies. **Validity of measures used:** not reported
Notes	This project was funded by the Priority Research Centre for Health Behaviour and received infrastructure funding from Hunter New England Population Health and the University of Newcastle. L.W. is supported by a National Health and Medical Research Council Career Development Fellowship and a Heart Foundation Future Leaders Fellowship

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	A random number function in Microsoft Excel was used to generate the random sequence.
Allocation concealment (selection bias)	Low risk	Consenting ECEC centres were immediately randomly allocated using a random number function in the statistical software package SAS.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Full compliance with nutritional guidelines, compliance with nutritional guidelines for individual AGHE food groups, menu compliance score, servings of each food group provided ECEC centre staff were aware of their group allocation
Blinding of outcome assessment (detection bias) All outcomes	Low risk	An independent dietitian blinded to group allocation assessed the menu and calculated servings of food groups per child based on the Australian Guide to Health Eating (AGHE) food groups
Incomplete outcome data (attrition bias) All outcomes	Low risk	At follow-up, 24/26 (92%) in the intervention and 20/28 (71%) in the control group provided their menu. Missing data were imputed.
Selective reporting (reporting bias)	Low risk	The outcomes reported in the paper were prespecified in the protocol paper.

Sharma 2018

Methods	**Study design:** non-randomised trial **Intervention duration:** 2 years **Length of follow-up from baseline:** 2 years **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** Preschool **Region:** Head Start centres in the intervention and comparison catchment areas in Houston and Austin, TX **Demographic/socioeconomic characteristics:** Ethnically diverse population; lower median household income; and lower home ownership rates **Inclusion/exclusion criteria:** Not reported **Number of centres randomised**: 25 centres **Numbers by trial group:** n (controls baseline) = 13 n (controls follow-up) = 13 n (interventions baseline) = 12 n (interventions follow-up) = 12 **Recruitment:** Not reported **Recruitment rate:** Not reported
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** - Implementation of classroom nutrition curriculum - Developmentally appropriate structured, indoor and outdoor physical activity - Distribution of health information to families **Implementation strategies:** Educational meetings: Annual 6-hour training of centre teaching staff, centre directors, Head Start organisation level staff including wellness manager and nutrition manager. Booster training conducted twice a year in year 1 preschool staff who trained over a 4- to 6-hour training period. At the start of year 2, another full training was conducted across the intervention centres for all teaching staff. Reminders: Programme staff conducted technical support in the form of, monthly messages, and email reminders. Academic detailing: In-person visits to the centres **Who delivered the intervention:** Project staff **Theoretical underpinning:** Social cognitive theory **Description of control:** Usual practice
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Implementation of nutrition and physical activity CATCH EC programme components:* **Data collection method:** Teacher and centre director surveys reporting implementation of various CATCH EC programme components **Validity of measures used:** not reported **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** *Child food intake frequency:* **Data collection method:** Parents completed surveys reporting child intake of various healthy and unhealthy foods, measuring child frequency of consumption of various foods including fruit, vegetables, French fries, sports drinks, water, and other sugar-sweetened beverages (e.g. sodas). **Validity of measures used:** Not reported *Child BMI:* **Data collection method**: Child height and weight were measured using stadiometers and digital scales. **Validity of measured used:** Not reported *Total child physical activity:*

	Data collection method: Parent-completed surveys reporting time spent in physical activity; parents were asked about their child's time spent in physical activity, including number of days per week they participated in more than 60 minutes of physical activity, and the number of days per week they played outside for 30 minutes. **Validity of measured used:** Not reported **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** not applicable
Notes	This research was supported by cooperative agreement RFA-DP-11-007 from the CDC. Additional support was provided by the Michael and Susan Dell Foundation through the Michael & Susan Dell Centre for Healthy Living, which has been funded, in part, with federal funds from the USDA/ARS under Cooperative Agreement number 58-6250-0-008.

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Non-randomised study: non-random allocation (no random sequence generated). Therefore, high risk of selection bias
Allocation concealment (selection bias)	High risk	Non-randomised study: non-random allocation (no allocation concealment). Therefore, high risk of selection bias
Blinding of participants and personnel (performance bias) All outcomes	High risk	CATCH EC implementation. There was no mention that the participants and personnel were blinded and therefore there was a high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	High risk	CATCH EC implementation. There was no mention of blinding and therefore there was a high risk of detection bias.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No sites dropped out.
Selective reporting (reporting bias)	Low risk	All measures aligned between the Sharma and Hoelscher papers.
Recruitment to cluster	Low risk	All parents/children were invited to participate
Baseline imbalance	Unclear risk	Significantly more parents in the intervention centres reported receiving SNAP benefits compared with those in the comparison centres across both years of measurement. For year 1, children in the comparison centres were slightly younger than those in the intervention centres.
Loss of clusters	Low risk	No loss of clusters
Incorrect analysis	Low risk	Adjustment for potential clustering in analysis
Compatibility with individually randomised RCTs		No evidence to make assessment
Potential confounding	Low risk	Various known confounders that were considered for inclusion into each of the regression models included: city (Houston and Austin), child race/ethnicity and gender, parental race, and education level.

Stookey 2017

Methods	**Study design:** Cluster-RCT **Intervention duration:** 6 months **Length of follow-up from baseline:** 12 months **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** ECEC centre **Region:** San Francisco, U.S.

	Demographic/socioeconomic characteristics: The CCHP provides centres to ECEC centres that primarily serve low-income children in San Francisco and do not have federal, state or school district funding. **Inclusion/exclusion criteria:** All ECEC centres that participated in CCHP nutrition screenings in 2011–2012 were eligible for the HAP pilot. ECEC centres that were closed in Autumn 2012 or declined CCHP centres for 2012–2013 before the randomisation were ineligible for the HAP pilot. ECEC centres with funding from Head Start, the San Francisco Unified School District, or Community College District were ineligible to receive CCHP screenings, and excluded from the HAP pilot. **Number of centres randomised:** 43 centres **Numbers by trial group:** n (controls baseline) = 24 n (controls follow-up) = 24 n (interventions baseline) = 19 n (interventions follow-up) = 19 **Recruitment:** Centre: 45 ECEC centres were invited to participate; of these, 43 centres participated. In summer 2012, the SFDPH epidemiologist randomised ECEC centres in two blocks, one block for each of two CCHP health workers responsible for BMI screenings. A list of the same length of random, unique, unsorted numbers was generated using randomizer.org. For each health worker, ECEC centres had an equal chance of being assigned to CCHP + HAP or CCHP + HAP Delayed. Enrolment in the ECEC centres ranged from 14 to 160 children. The mean (SE) enrolment in ECEC centres did not vary significantly by treatment assignment (48 (9) vs 37 (4)), and remained stable over time. Child: 902 participants completed data collection at baseline. Of these, 522 were allocated to the intervention arm and 380 participants to the delayed control arm. **Recruitment rate:** 96%
Interventions	**Number of experimental conditions:** 2 (intervention, delayed control) **Policies, practices or programmes targeted by the intervention:** -Use of physical activity curriculum -Staff involvement in active play -Visibility of pitchers of drinking water **Implementation strategies:** Educational materials: Invitation packet, which included information about the HAP, a self-assessment for ECEC providers, and information about the gift card incentive for completing the self-assessment Incentives: Gift card incentive for completing the self-assessment Educational meetings: The San Francisco Children's Council offered two workshops to address needs identified by the HAP participants. A nutrition workshop addressed ideas for seasonal menu planning, child nutrition education resources for parents, and policies for food for holidays or celebrations. A physical activity workshop addressed how to integrate age-appropriate physical activity and academic learning for preschoolers. Educational outreach or academic detailing: CCHP public health nurses or health workers introduced the HAP resources and process, in-person, to ECEC centre staff. They delivered the HAP invitation packet to the ECEC centre, and spent up to 16 h per ECEC centre, providing one-on- one support to each ECEC provider regarding the HAP self-assessment, goal setting, action plans to achieve the goal(s), Tip Sheets and online Technical Assistance resources. Tailored interventions: The HAP translated the nutrition and physical activity NAPSACC resources and process into a programme that coordinated self-assessment and practice improvement across ECEC providers. **Who delivered the intervention:** ECEC centre staff **Theoretical underpinning:** not reported **Description of control:** ECEC centres allocated to the CCHP + HAP Delayed group were also offered HAP resources, only after a delay, in 2014–2015. Throughout the evaluation period, routine CCHP centres were given to centres allocated to the CCHP + HAP Delayed group. These centres included public health nurse consultation, health education, and hearing, vision, dental, and nutrition screenings and referrals.

Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Exposure to the 3 nutrition and physical activity centre index practices:* **Data collection method:** The health workers gathered information about 3 practices which were relevant for tracking changes in response to HAP workshops that were offered in 2013. Data regarding the 3 index practices were combined into a score to track and compare cumulative changes in these practices in all CCHP + HAP and CCHP + HAP Delayed centres. **Validity of measures used:** not reported **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** *Change in child BMI percentile at the child level and ECEC centre level:* **Data collection method:** CCHP health workers visited all ECEC centres that requested bi-annual BMI screenings in the autumn and spring of each academic year. The health workers recorded child age and sex, and measured child weight and height using a standardised protocol and calibrated instruments. Measurements were taken after the child removed outer layers of clothing and shoes. The age and sex-specific BMI percentile and BMI z-score for each child was calculated relative to the CDC 2000 growth reference using Epi Info 7 software. The change in BMI percentile was calculated. Incident cases of overweight or obesity were identified. **Validity of measures used:** not reported **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Penetration:* **Data collection method:** Collected by the San Francisco Children's Council Healthy Apple Program Co-ordinator, including number of ECEC centres that completed the HAP self-assessment(s), set goals, received technical assistance materials, attended workshops, improved best practices, and received a HAP award. **Validity of measures used:** not reported
Notes	The HAP development in 2011–2012 was funded by a CDC Community Transformation Grant. Funding for the HAP pilot evaluation was provided by the Feeling Good Project, funded by USDA SNAP-Ed, an equal opportunity provider and employer (Laura Brainin-Rodriguez, Coordinator).

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	A list of random, unique, unsorted numbers was generated using randomizer.org
Allocation concealment (selection bias)	Low risk	Eligible ECEC centres were listed in alphabetical order and a list of random numbers generated.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Outcome: 3 index practices (use of physical activity curriculum; staff usually joining in physical active play with children; pitchers of drinking water visible in the classroom). The healthcare workers and ECEC providers were not blinded to treatment allocation, therefore, there was a high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome: 3 index practices (use of physical activity curriculum; staff usually joining in physical active play with children; pitchers of drinking water visible in the classroom). The healthcare workers and ECEC providers were not blinded to treatment allocation, therefore, there was a high risk of detection bias.
Incomplete outcome data (attrition bias) All outcomes	Low risk	At the 2-year follow-up, 9 (4 in intervention, 5 in comparison) of the 43 centres had missing data (21% attrition). Low risk of attrition bias
Selective reporting (reporting bias)	Unclear risk	There was no study protocol, therefore, it was unclear if there was selective outcome reporting.
Recruitment to cluster	Low risk	All parents/children were invited to participate.

Baseline imbalance	Unclear risk	Some baseline imbalances, but unknown whether these biased outcome. CCHP + HAP centres served significantly older children than CCHP + HAP Delayed centres in 2011–2012 and 2012–2013. The CCHP + HAP centres had a significantly smaller prevalence of overweight or obesity at autumn enrolment, compared to CCHP + HAP Delayed centres, in the baseline year (2011–2012). Intervention centres also had on average more children enrolled per centre than control centres (i.e. difference in size).
Loss of clusters	Low risk	Low risk of loss of clusters - similar % of centres lost across groups
Incorrect analysis	Low risk	The intracluster correlation coefficient (ICC), measure of within-ECEC centre variance relative to between-ECEC centre variance, was estimated to describe clustering in the outcome data in the follow-up year and implementation year 2.
Compatibility with individually randomised RCTs	Unclear risk	No evidence to make assessment

Ward 2008

Methods	**Study design:** RCT **Intervention duration:** 6 months **Length of follow-up from baseline:** 6 months **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** ECEC centres **Region:** North Carolina, U.S. **Demographic/socioeconomic characteristics:** not described **Inclusion/exclusion criteria:** inclusion criteria: current enrolment of 15 to 150 children. Exclusion criteria: centres with an open case of abuse or neglect or served only a special population Number of centres randomised: 84 (56 intervention, 26 control, 2 excluded following randomisation) **Numbers by trial group:** n (controls baseline) = 26 n (controls follow-up) = 26 n (interventions baseline) = 56 n (interventions follow-up) = 56 **Recruitment:** all ECEC health consultants working in North Carolina were invited to participate. A convenience sample was selected by recruiting the first 30 ECEC health consultants (only 1 per county) who indicated an interest in participation, worked with at least 3 ECEC centres meeting eligibility requirements, and had not participated in the previous pilot project. **Recruitment rate:** not reported
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** NAPSACC programme. Best practices for the promotion of proper nutrition and regular physical activity at ECEC. The programme focused on 15 nutrition and physical activity areas. Nutrition areas of focus included: fruits and vegetables; fried food and high-fat meats; beverages; menus and variety; meals and snacks; food items outside of regular meals and snacks; supporting healthful eating; nutrition education for children, parents and staff; and nutrition policy. Key physical activity areas of focus included: active play and inactive time; TV use and TV viewing; play

	environment; supporting physical activity; physical activity education for children, parents and staff; and physical activity policy. **Implementation strategies:** -Provision of educational materials -Self-assessment instrument completed by centre managers -Action planning to improve at least 3 target areas identified from the self-assessment -Education workshops on child being overweight, healthy eating and physical activity for children delivered by ECEC health consultants -Provision of technical assistance to centre staff via inperson visits and telephone contact -Re-assessment using the self-assessment tool **Who delivered the intervention:** trained ECEC health consultants **Theoretical underpinning:** social cognitive theory against a social-ecologic framework **Description of control:** delayed intervention control group
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *-Total nutrition score* *-Total physical activity score* **Data collection method:** EPAO tool including 1-day observation and a review of pertinent centre documents conducted by trained observers. 75 items were selected to evaluate the impact of the intervention. All 75-item responses were converted to a 3-point scale (0, 1 and 2), averaged within a given subscale, and multiplied by 10, with the average of all subscale scores representing total nutrition and physical activity scores. **Validity of measures used:** not established at time of study - additional work tests the reliability and validity of the NAPSACC self-assessment instrument in a sample of ECEC centres **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Penetration:* **Data collection method:** not reported **Validity of measures used:** not reported
Notes	This work was supported by a Potential Extramural Projects (PEP) grant from the CDC and a contract from the North Carolina Department of Health and Human Centres, Division of Public Health

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	No information provided on the method for generating random sequence for allocation of ECEC health consultants to treatment groups.
Allocation concealment (selection bias)	Unclear risk	No information provided on concealment of allocation of ECEC health consultants to groups.
Blinding of participants and personnel (performance bias) All outcomes	High risk	We assumed that, due to the nature of the intervention, ECEC centre staff and study personnel delivering the intervention were not blind to the study allocation and, therefore, there was a potential high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessors were blind to group allocation of centres and the tool used was observational.
Incomplete outcome data (attrition bias) All outcomes	Low risk	82 of 84 centres recruited were followed up - 2 centres were lost to follow-up due to closure.
Selective reporting (reporting bias)	Unclear risk	Authors stated that the outcome measures were determined a priori but unknown if these were listed in a study protocol or trial registry.

Ward 2017

Methods	**Study design:** Cluster-RCT **Intervention duration:** 4 months **Length of follow-up from baseline:** 7 months **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** ECEC centre **Region:** Three local ECE technical assistance organisations serving six counties in North Carolina agreed to assist with recruitment and Go NAPSACC implementation. **Demographic/socioeconomic characteristics:** Largely rural and low-income areas, where resources are often limited **Inclusion/exclusion criteria:** Eligible centres had to have children currently enrolled who were between 3 and 5 years and a quality rating of at least 2 stars (out of 5) or be faith-based (exempt from rating). Rating considers factors like teacher education, in-centre training, teacher to-child ratios, and the ECEC environment. Centres that had participated in NAPSACC during the past 6 months were excluded. **Number of centres randomised:** 33 centres **Numbers by trial group:** n (controls baseline) = 15 n (controls follow-up) = 14 n (interventions baseline) = 18 n (interventions follow-up) = 17 **Recruitment:** Centre: 48 centres were invited to participate; of these 33 participated. Centres were randomly assigned (1:1) to receive either immediate access (intervention arm) or delayed access (control arm) to Go NAPSACC. Prior to randomisation, centres were stratified by county to ensure that each local agency would have half of its centres getting immediate access to the programme and half getting delayed access. Stratification by county also helped control for any potential differences between these geographic areas and their technical assistance staff that might influence implementation. A list of enrolled centres was provided to the study statistician, who then randomised participating centres into either intervention or control using a permutated block approach (block size of two to ensure equity between arms). **Recruitment rate:** 69%
Interventions	**Number of experimental conditions:** 2 (intervention, delayed control) Policies, practices or programmes targeted by the intervention: - ECEC centre menus, food and beverages provided - ECEC centre feeding environment - ECEC centre feeding practices - Staff education and professional development - ECEC centre nutrition policy **Implementation strategies:** Audit and feedback: The self-assessment tool is an audit with feedback, allowing ECE programme administrators to evaluate their current performance. The action planning tool guides ECE programs to develop a formal implementation blueprint that will allow them to accomplish the goals they have set. Educational materials: The tips and materials tool enables the distribution of educational materials that help ECE programme administrators as they implement their action plan and address any identified needs to provide education to teachers, parents, and children. Tailored intervention: Presentation of results and goals are based on data supplied in the self-assessment to help the ECE programme administrator see where he/she is doing well and where there is room for improvement. Potential goals are also presented to the ECE programme administrator so he/ she can choose to work toward goals requiring small or large changes. Educational outreach or academic detailing: One in-person meeting with the centre director to orient them to the Go NAPSACC tools (e.g. how to register for an account, complete a self-assessment, review results, set goals, create and customise action plans, navigate tips and materials). Following this orientation, TA providers conducted

	brief monthly check-ins by telephone or email (e.g. inquire about progress, assess need for additional assistance, remind about project timeline). **Who delivered the intervention:** ECEC centre directors **Theoretical underpinning:** Social cognitive theory **Description of control:** delayed access to Go-NAPSACC
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Change in centres' nutrition environment:* **Data collection method:** Self-report version of the Environment and Policy Assessment and Observation (EPAO-SR) (SR = Self report) The EPAO-SR components include a Centre Director Questionnaire, Teacher Questionnaires, and a Policy Document Review **Validity of measures used:** Reliability testing demonstrated day-to-day variation in things like foods and beverages served and teacher feeding practices (with ICCs of 0.06 to 0.60); however, reliability improved with multiple days of data capture (increasing ICCs to 0.20 to 0.86). Validity testing demonstrated generally good agreement between self-report and observation for foods and beverages served and nutrition policy (with correlations of 0.25 to 0.85), but lower agreement with teacher practices (correlations of 0.004 to 0.46). **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status: not** applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Acceptability:* **Data collection method:** A sample of centre directors from the intervention arm (n = 6), completed a semi-structured interview. **Validity of measures used:** not reported *Penetration:* **Data collection method:** Each local provider was asked to keep a log of their Go NAPSACC implementation activities. **Validity of measures used:** not reported
Notes	Funding for this project was provided by a Healthy Eating Research grant from the Robert Wood Johnson Foundation and the Blue Cross Blue Shield of North Carolina Foundation. Additional support for this project came from the National Institutes of Health, National Institute of Nursing Research (T32N- R007091). This project was conducted out of the Centre for Health Promotion and Disease Prevention at the University of North Carolina at Chapel Hill, which is a Prevention Research Centre funded through a Cooperative Agreement with the Centres for Disease Control and Prevention (U48- DP005017).

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	A list of enrolled centres was provided to the study statistician who then randomised participating centres into either intervention or control.
Allocation concealment (selection bias)	Low risk	Results of randomisation were shared with the study coordinator who then informed participating centres.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Outcome: Self-report version of the Environment and Policy Assessment and Observation (EPAO-SR) & EPAO-SR policy document review (completed by research staff). There was no mention that the participants and personnel were blinded and, therefore, there was a high risk of performance bias.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome: Self-report version of the Environment and Policy Assessment and Observation (EPAO-SR) & EPAO-SR policy document review (completed by research staff). There was no mention that the participants and personnel were

		blinded and, therefore, there was a high risk of detection bias.
Incomplete outcome data (attrition bias) All outcomes	Low risk	2 (1 intervention, 1 control) of the 33 centres (6% attrition) failed to provide data at follow-up.
Selective reporting (reporting bias)	Low risk	The outcomes reported in the paper aligned with those listed in the trial registration.

Williams 2002

Methods	**Study design:** non-randomised trial **Intervention duration:** 3 years **Length of follow-up from baseline:** 6 months, 18 months **Differences in baseline characteristics:** not reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre (child diet and weight status was assessed at the level of the individual)
Participants	**Centre type:** Head Start Centres - preschools **Region:** Upstate New York, U.S. **Demographic/socioeconomic characteristics:** low-income, predominantly minority preschool children **Inclusion/exclusion criteria:** not reported **Number of centres randomised:** 9 (3 intervention: food centre modification plus classroom education with nutrition modules, 3 intervention: food centre modification plus classroom safety education, 3 control) **Numbers by trial group:** n (controls baseline) = 3 n (controls follow-up) = 3 n (interventions: food centre modification plus classroom education baseline) = 3 n (interventions: food centre modification plus classroom education follow-up) = 3 n (interventions: food centre modification plus classroom safety education baseline) = 3 n (interventions: food centre modification plus classroom safety education follow-up) = 3 **Recruitment:** not reported **Recruitment rate:** not reported
Interventions	**Number of experimental conditions:** 3 (intervention: food centre modification plus classroom education with nutrition modules, intervention: food centre modification plus classroom safety education, control) **Policies, practices or programmes targeted by the intervention:** Food centre modification: -Achieving a 5-day a week meal/snack plan that provided no more than 30% energy from total fat and no more than 10% energy from saturated fat -Increased offering of fruit, vegetables, breads and grains in meals, decreased total and saturated fat content of foods purchased for the centre and decreased total and saturated fat due to alterations in food preparation techniques **Implementation strategies:** **Intervention:** food centre modification plus classroom education with nutrition modules: -Healthy Start Comprehensive Preschool Health Education Curriculum - core curriculum plus nutrition-related units -1-day training programme for cooks, which covered the major food centre intervention areas: menu planning, recipe development, food purchasing and food preparation -A list of objectives developed together with the cooks -Ongoing support from registered dietitian -Manual, newsletters and incentives **Intervention:** food centre modification plus classroom safety education:

	-Healthy Start Comprehensive Preschool Health Education Curriculum - core curriculum plus safety-related unit -1-day training programme for cooks, which covered the major food centre intervention areas: menu planning, recipe development, food purchasing and food preparation -A list of objectives developed together with the cooks -Ongoing support from registered dietitian -Manual, newsletters and incentives **Who delivered the intervention:** registered dietitians **Theoretical underpinning:** not reported **Description of control:** Healthy Start Comprehensive Preschool Health Education Curriculum - core curriculum plus safety-related units
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Change in centre menu:* -kcal -Total fat -Saturated fat -% kcal from total fat -% kcal from saturated fat **Data collection method:** centre menus were analysed for nutrient content by obtaining menus, recipes and food labels for 5 days at each data collection time point **Validity of measures used:** unclear **Outcome relating to cost:** not applicable **Outcome relating to adverse consequences:** not applicable **Outcome relating to child diet, physical activity or weight status:** *Change in child school meal dietary intake:* -Energy (kcal) -Total fat -Saturated fat -% kcal from total fat -% kcal from saturated fat **Data collection method:** direct observation of children during attendance at the centre with plate waste measurement to determine amounts of foods and beverages consumed **Validity of measures used:** the complete dietary intake assessment protocol was adapted from existing protocols proven to be reliable and valid *Child weight status:* **Data collection method:** measurements of child weight (using digital scale) and height (using telescopic measuring rod) obtained by trained staff. Weight to height ratio calculated at baseline and at 6 months **Validity of measures used:** unclear – appeared to be an objective measure **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** not applicable
Notes	For the analysis, all centres assigned to the food centre intervention arm of the study were grouped together, as were the centres assigned to the control condition. This research was funded by the National Heart Lung and Blood Institute, NIH, HL50321

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	No random allocation to control and intervention conditions (random allocation to 1 of 2 intervention conditions)
Allocation concealment (selection bias)	High risk	Unclear as to whether concealment of allocation occurred
Blinding of participants and personnel (performance bias) All outcomes	High risk	We assumed that, due to the nature of the intervention, ECEC centre staff and study personnel delivering the intervention were not blind to the study allocation and, therefore, there was a potential high risk of performance bias.

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information was provided on whether research personnel undertaking menu assessment and other data collection were blind to group allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Implementation data collected on all intervention (n = 6) and control centres (n = 3) pre- and post-intervention
Selective reporting (reporting bias)	Low risk	Methodology paper also listed physiological measures - these were published elsewhere.
Potential confounding	Unclear risk	No information provided

Yoong 2016

Methods	**Study design:** parallel-group RCT **Intervention duration:** 6 – 8 weeks **Length of follow-up from baseline:** no baseline data collection **Differences in baseline characteristics:** reported **Unit of allocation:** ECEC centre **Unit of analysis:** ECEC centre
Participants	**Centre type:** Long daycare centres **Region:** NSW, Australia **Demographic/socioeconomic characteristics:** Not stated **Inclusion/exclusion criteria:** Long daycare centres (centre-based centres typically open ≥ 8 hours/ day) located within NSW, Australia, served as the sampling frame. Centres were excluded if they did not undertake menu planning on site or where cooks did not understand English sufficiently to complete the survey. **Number of centres randomised:** 77 centres **Numbers by trial group:** n (controls baseline) = n/a n (controls follow-up) = 39 n (interventions baseline) = n/a n (interventions follow-up) = 38 **Recruitment:** Centre: 220 centres were invited to participate; of these 106 were ineligible to participate, 34 declined to participate and a further 14 could not be contacted. Seventy-seven consented to participate and were randomly allocated to either the intervention or control condition by a blinded research assistant using a random number function in Microsoft Excel in a 1:1 ratio. **Recruitment rate:** 68%
Interventions	**Number of experimental conditions:** 2 (intervention, control) **Policies, practices or programmes targeted by the intervention:** - Provision of fruit and vegetables on centre menu **Implementation strategies:** Educational materials: Intervention cooks were mailed a two-page education resource and the menu planning checklist from the Caring for Children resource. **Who delivered the intervention:** Printed resources were developed by a local health promotion team consisting of dietitians, behavioural scientists and health promotion practitioners. **Theoretical underpinning:** The content of the material was guided by the theory of planned behaviour (TPB). **Description of control:** The control group received usual care. All centres could access the Caring for Children resource online and may have been offered support from their local health promotion staff.
Outcomes	**Outcome relating to the implementation of ECEC centre policies, practices or programmes:** *Provision of fruit and vegetables:* **Data collection method:** A one-item question was used to assess the provision of fruit and vegetables on menus. **Validity of measures used:** This measure was not validated and is likely to result in an overestimation of effect. **Outcome relating to cost:** not applicable

	Outcome relating to adverse consequences: not applicable **Outcome relating to child diet, physical activity or weight status:** not applicable **Outcome relating to implementation strategy acceptability, adoption, penetration, sustainability and appropriateness:** *Penetration:* **Data collection method:** A telephone interview where participants were asked whether they recalled receiving the educational material and, if so, how long ago they received it **Validity of measures used:** not reported
Notes	The authors acknowledge the funding support of Hunter New England Population Health and Hunter Medical Research Institute.

Risk of bias		
Bias	**Authors judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	A random number function in Microsoft Excel was used to generate the random sequence.
Allocation concealment (selection bias)	Low risk	Microsoft Excel was used to generate a list of random numbers and could foresee assignment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Primary outcome of review: Number of fruit and vegetables provided on menu in last week. There was no blinding to group allocation of participants described and this was likely to influence performance.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Primary outcome: Although CATI interviewers were blinded to group allocation, participant self-report was used. There was no mention that participants were blinded to group allocation and, therefore, the risk of detection bias was high.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Table 2 outlines that there was missing data for two centres (2/77 = 3%) and therefore there was a low risk of attrition bias.
Selective reporting (reporting bias)	Low risk	The measures reported in the trial registration aligned with those reported in the outcome paper.

ABC: Activity Begins in Childhood
AGHE: Australian Guide to Healthy Eating
BMI: Body Mass Index
CATCH EC: Coordinated Approach to Child Health Early Childhood
CATI: Computer Assisted Telephone Interview
CCHP: Child Care Health Program
CDC: Centres for Disease Control
CHILE: Child Initiative for Lifelong Eating and Exercise
CHPHSPC: Californian Childcare Health Programme Health and Safety Checklist
CSPlan: Complex Samples Plan
DOCC: Diet Observation in Child Care
DVD: Digital Versatile Disc
ECE: Early Care and Education
EPAO: Environment and Policy Assessment and Observation
EPAO-SR: Environment and Policy Assessment and Observation Self Report
HAP: Healthy Apple Program
HS: Head Start
IOM: Institute of Medicine
ICC: Intraclass Correlation CoeBicient
MPL!: Move, Play, Learn!
NAPSACC: Nutrition and Physical Activity Self-Assessment for Child Care
NC: North Carolina
OSRAP: Observation System for Recording Activity in Preschools
PA: Physical Activity
RCT: Randomised Controlled Trial
SE: Standard Error
SFDPH: San Francisco Department of Public Health
SNAP: Supplementation Nutrition Assistance Program

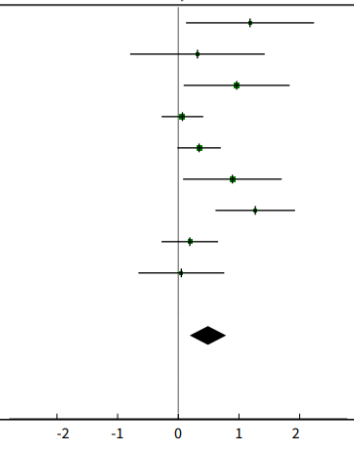
SOPLAY: System for Observing Play and Leisure in Youth
TA: Technical Assistant
TBP:Theory of Planned Behaviour
TDF: theoretical domains framework
vs: Versus
ZBMI: z Body Mass Index

Analysis 1.1: Comparison 1 Implementation strategy versus usual care or waitlist control, Outcome 1 Implementation Score.

Study or subgroup	Implementation support N	Implementation support Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
Alkon 2014	9	6.3 (4.9)	8	1.6 (1.9)		6.02%	1.18[0.13,2.24]
Benjamin 2007	15	118.2 (6)	4	116.3 (4.3)		5.58%	0.32[-0.79,1.42]
Esquivel 2016	11	15.7 (1.1)	12	14.6 (1.1)		7.86%	0.96[0.09,1.84]
Finch 2019	68	4 (1.5)	63	3.9 (1.5)		17.99%	0.07[-0.27,0.41]
Jones 2015	62	6.2 (0.9)	60	5.8 (1.4)		17.63%	0.34[-0.01,0.7]
Mazzucca 2017	13	4.6 (0.7)	13	4 (0.6)		8.63%	0.89[0.08,1.7]
Seward 2017	24	2 (1.6)	20	0.4 (0.7)		11.09%	1.27[0.61,1.92]
Ward 2008	56	10.2 (1.8)	26	9.8 (1.5)		15%	0.19[-0.28,0.66]
Ward 2017	17	10.2 (1.8)	14	10.1 (2.1)		10.19%	0.05[-0.66,0.76]
Total ***	**275**		**220**			**100%**	**0.49[0.19,0.79]**

Heterogeneity: Tau²=0.1; Chi²=17.23, df=8(P=0.03); I²=53.56%

Test for overall effect: Z=3.19(P=0)

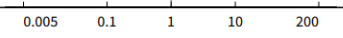


Analysis 1.2: Comparison 1 Implementation strategy versus usual care or waitlist control, Outcome 2 Per cent of staff or centres implementing a policy or practice.

Study or subgroup	Implementation support N	Control N	log[Odds Ratio] (SE)	Odds Ratio IV, Random, 95% CI	Weight	Odds Ratio IV, Random, 95% CI
Alkon 2014	0	0	2.5 (1.604)		5.45%	12.09[0.52,280.42]
Finch 2014	0	0	-0.4 (0.945)		11.76%	0.64[0.1,4.1]
Finch 2019	0	0	-0.7 (0.592)		18.8%	0.51[0.16,1.63]
Hardy 2010	0	0	0.5 (0.792)		14.39%	1.67[0.35,7.87]
Jones 2015	0	0	0.3 (0.373)		24.48%	1.33[0.64,2.76]
Seward 2017	0	0	2.1 (0.884)		12.74%	8.37[1.48,47.34]
Stookey 2017	0	0	1.9 (0.906)		12.37%	6.5[1.1,38.41]
Total (95% CI)					**100%**	**1.83[0.81,4.11]**

Heterogeneity: Tau²=0.56; Chi²=12.34, df=6(P=0.05); I²=51.39%

Test for overall effect: Z=1.46(P=0.14)



Alkon 2014

Domain	Risk of bias	Support for judgement
Random sequence generation *(selection bias)*	Unclear risk	Authors indicate that the centres were randomly assigned to treatment groups, but sequence generation procedure was not described. One control group centre that was not able to adequately complete baseline data collection was replaced by a matched centre (unclear if this was randomly chosen)
Allocation concealment *(selection bias)*	Unclear risk	Method of concealment not described.
Blinding of participants and personnel *(performance bias)*	High risk	Physical Activity and Weight: Assume through nature of the intervention that centre staff and study personnel delivering the intervention not blind to the study allocation and therefore potential high risk of performance bias
Blinding of outcome assessment *(detection bias)*	Low risk	Physical Activity and Weight: Outcome assessment undertaken by blinded research personnel and therefore risk of detection bias considered to be low.
Incomplete outcome data *(attrition bias)*	Low risk	Complete data collected for all centres (8 control and 9 intervention), with no centres excluded from the analysis - therefore risk of attrition bias considered to be low
Selective outcome reporting *(reporting bias)*	Unclear risk	Unaware if any other planned outcomes were not reported - for instance, no protocol found.
Other bias	Low risk	Selection of participants from each centre for measurement of nutrition, physical activity and BMI outcomes was random, so risk of bias through selection to cluster is considered to be low.

Finch 2014

Domain	Risk of bias	Support for judgement
Random sequence generation *(selection bias)*	Low risk	Computerised random number function in Microsoft Excel used to generate random number sequence.
Allocation concealment *(selection bias)*	Low risk	Statistician not involved in the project allocated the centres to groups using a computerised program
Blinding of participants and personnel *(performance bias)*	High risk	Assume through nature of the intervention that centre staff and study personnel delivering the intervention not blind to the study allocation and therefore potential high risk of performance bias
Blinding of outcome assessment *(detection bias)*	Low risk	Child physical activity: Measured using pedometers with research staff blind to group allocation.
	High risk	Adverse effects: centre manager self-report via interview
Incomplete outcome data *(attrition bias)*	Low risk	Child physical activity: Although there was 48% and 44% loss to follow-up in intervention and control groups respectively, sensitivity analysis imputing missing data showed no difference in outcome analysis.
Selective outcome reporting *(reporting bias)*	Unclear risk	There are no unreported outcomes according to those planned in published protocol.
Recruitment bias	Low risk	For the physical activity measure, children were recruited by supervisors at the centre selecting a day of the week for measurement to occur. Allocation was not revealed to centres until after baseline data collection.

Jones 2015

Domain	Risk of bias	Support for judgement

Random sequence generation *(selection bias)*	Low risk	A random number function was used to generate the random sequence.
Allocation concealment *(selection bias)*	Low risk	Random number function was used to randomly allocated each centre so allocation concealment assumed.
Blinding of participants and personnel *(performance bias)*	Unclear risk	Child dietary intake and physical activity levels: Centres were not blind to study allocation however observers were blind to allocation at the level of the child and so the impact of performance bias is unclear.
	High risk	Acceptability and Adverse Effects: Centres were not blind to study allocation and therefore high risk to performance bias.
Blinding of outcome assessment *(detection bias)*	Low risk	Child dietary intake and physical activity levels: Observers were blind to centre group allocation.
	High risk	Acceptability and Adverse Effects: Centres were not blind to study allocation and therefore high risk to detection bias.
Incomplete outcome data *(attrition bias)*	Low risk	120/128 centres (95%) provided follow-up data.
Selective outcome reporting *(reporting bias)*	Unclear risk	The primary outcome is reported as pre-specified, however the secondary outcomes of child dietary intake and physical activity levels and adverse effects have not been pre-specified in the protocol paper.
Recruitment bias	Low risk	The children were randomly selected by asking the room leader at each centre to identify the three children with the most recent birthdays.
Baseline imbalance	Low risk	No baseline imbalances in centre characteristics. No baseline measures of secondary outcomes taken.
Loss of clusters	Unclear risk	Only follow up data collected from random sample of centres that had remained in trial at follow up.
Incorrect analysis	Low risk	The analysis appeared appropriate. Clustering effects adjusted for.
Compatibility with individually randomised RCTs (cluster RCTs):	Unclear risk	No evidence to make assessment.

Mazzucca 2017

Domain	**Risk of bias**	**Support for judgement**
Random sequence generation *(selection bias)*	Unclear risk	The random sequence generation procedure is not described.
Allocation concealment *(selection bias)*	Unclear risk	There is no information provided about allocation concealment and therefore it is unclear if allocation was concealed.
Blinding of participants and personnel *(performance bias)*	Unclear risk	Child and teacher physical activity (accelerometer-measured): There is no mention that the teachers and children were blinded. However physical activity was objectively measured and so it is unclear if there was a risk on performance bias.
Blinding of outcome assessment *(detection bias)*	Unclear risk	Child and teacher physical activity (accelerometer-measured): Child and teacher physical activity was measured using accelerometers however outcome assessors were not blinded to allocation and so unclear risk of detection bias.
Incomplete outcome data *(attrition bias)*	Low risk	All 13 centres provided post-intervention data. Seven children (4 intervention, 3 control) of the 182 children did not provide post-intervention data (4% attrition).
Selective outcome reporting *(reporting bias)*	Low risk	The outcomes reported align with those outlined in the trial registration.
Recruitment bias	Low risk	All children within participating centres/classes invited to participate.
Baseline imbalance	Low risk	No baseline imbalances in centre characteristics or outcomes.

Loss of clusters	Low risk	No loss of sites.
Incorrect analysis	Low risk	Adjustment for potential clustering in analysis.
Compatibility with individually randomised RCTs *(cluster RCTs):*	Unclear risk	No evidence to make assessment.

Seward 2017

Domain	**Risk of bias**	**Support for judgement**
Random sequence generation *(selection bias)*	Low risk	A random number function in Microsoft Excel was used to generate the random sequence.
Allocation concealment *(selection bias)*	Low risk	Consenting ECEC centres were immediately randomly allocated using a random number function in the statistical software package SAS.
Blinding of participants and personnel *(performance bias)*	Unclear risk	Child food group consumption (centre level): ECEC centres were aware of their group allocation however it is unclear how this impacted on the risk of performance bias for this outcome.
	High risk	Adverse effects reported by centre cooks: ECEC centre staff were aware of their group allocation.
	Unclear risk	Adverse effects reported by children/parents: It is unclear if adverse effects reported by children/parents were influenced by performance bias.
Blinding of outcome assessment *(detection bias)*	Low risk	Child food group consumption (centre level): All trial outcome data collectors were blinded.
	High risk	Adverse effects reported by centre cooks: ECEC centre staff were aware of their group allocation and therefore there is a high risk of detection bias.
	Unclear risk	Adverse effects reported by children/parents: It is unclear if adverse effects reported by children/parents were influenced by detection bias.
Incomplete outcome data *(attrition bias)*	Low risk	At follow-up 24/26 (92%) in the intervention and 20/28 (71%) in the control provided their menu. Missing data was imputed.
Selective outcome reporting *(reporting bias)*	High risk	There was a secondary outcome related to usual food intake questionnaire specified in the protocol but not reported in the outcome paper and the centre-level child food group servings consumption was reported using a different measure then was specified in the protocol.

Sharma 2018

Domain	**Risk of bias**	**Support for judgement**
Random sequence generation *(selection bias)*	High risk	Quasi-experimental study- non-random allocation (no random sequence generated). Therefore high risk of selection bias.
Allocation concealment *(selection bias)*	High risk	Quasi-experimental study- non-random allocation (no allocation concealment). Therefore high risk of selection bias.
Blinding of participants and personnel *(performance bias)*	High risk	Obesity (BMI): There was no mention that the participants and personnel were blinded and therefore there is a high risk of performance bias.
	High risk	Child diet: There was no mention that the participants and personnel were blinded and therefore there is a high risk of performance bias.
	High risk	Child physical activity: There was no mention that the participants and personnel were blinded and therefore there is a high risk of performance bias.
Blinding of outcome assessment *(detection bias)*	Low risk	Obesity (BMI): Child height and weight were measured using stadiometers and digital scales.
	High risk	Child diet (parent surveys): There was no mention that the participants were blinded and therefore there is a high risk of detection bias.

	High risk	Physical activity (parent surveys): There was no mention that the participants were blinded and therefore there is a high risk of detection bias.
Incomplete outcome data *(attrition bias)*	Low risk	No sites dropped out.
Selective outcome reporting *(reporting bias)*	Low risk	All measures align between the Sharma and Hoelscher papers.
Potential confounding	Low risk	Various known confounders that were considered for inclusion into each of the regression models included city (Houston and Austin), child race/ethnicity and gender, parental race, and education level.
Recruitment Bias	Low risk	All parents/children were invited to participate.
Baseline imbalance:	Unclear risk	Significantly more parents in the intervention centres reported receiving SNAP benefits compared with those in the comparison centres across both years of measurement. For year 1, children in the comparison centres were slightly younger than those in the intervention.
Loss of clusters:	Low risk	No loss of clusters.
Incorrect analysis:	Low risk	Adjustment for potential clustering in analysis.
Compatibility with individually randomised RCTs *(cluster RCTs):*	Unclear risk	No evidence to make assessment.

Stookey 2017

Domain	**Risk of bias**	**Support for judgement**
Random sequence generation *(selection bias)*	Low risk	A list of random, unique, unsorted numbers was generated using randomizer.org.
Allocation concealment *(selection bias)*	Low risk	Eligible child care centres were listed in alphabetical order and a list of random numbers generated.
Blinding of participants and personnel *(performance bias)*	Unclear risk	Child BMI: The health care workers and ECEC providers were not blinded to treatment allocation and there is no mention if children were blinded. However the impact this would have on child BMI is unclear.
Blinding of outcome assessment *(detection bias)*	Low risk	Child BMI: Child weight and height was measured using a digital scale and stadiometer, therefore low risk of detection bias.
Incomplete outcome data *(attrition bias)*	Low risk	At the 2 year follow-up 9 (4 in intervention, 5 in comparison) of the 43 centres had missing data (21% attrition). Low risk of attrition bias.
Selective outcome reporting *(reporting bias)*	Unclear risk	There is no study protocol therefore it is unclear if there was selective outcome reporting.
Recruitment bias:	Low risk	All parents/children were invited to participate.
Baseline imbalance:	Unclear risk	Some baseline imbalances, but unknown whether these biased outcome. CCHP + HAP centres served significantly older children than CCHP + HAP Delayed centres in 2011–2012 and 2012–2013. The CCHP + HAP centres had a significantly smaller prevalence of overweight or obesity at Autumn enrolment, compared to CCHP + HAP Delayed centres, in the Baseline Year (2011–2012). Intervention centres also had on average more children enrolled per centre than control centres (i.e. difference in size)
Loss of clusters:	Low risk	Low risk of loss of clusters - similar % of centres lost across groups.
Incorrect analysis:	Low risk	The intracluster correlation coefficient (ICC), measure of within-child care centre variance relative to between-child care centre variance, was

		estimated to describe clustering in the outcome data in the Follow-up year and Implementation year 2.
Compatibility with individually randomised RCTs *(cluster RCTs):*	Unclear risk	No evidence to make assessment.

Williams 2002

Domain	**Risk of bias**	**Support for judgement**
Random sequence generation *(selection bias)*	High risk	No random allocation to control and intervention conditions (random allocation to 1 or 2 intervention conditions).
Allocation concealment *(selection bias)*	High risk	As above
Blinding of participants and personnel *(performance bias)*	High risk	Child diet and weight status: Due to nature of the intervention, centres and study personnel delivering the intervention would not have been blind to the study allocation and therefore potential high risk of performance bias
Blinding of outcome assessment *(detection bias)*	Unclear risk	Child diet and weight status: No information provided on whether research personnel undertaking menu assessment and other data collection were blind to group allocation.
Incomplete outcome data *(attrition bias)*	Low risk	Child diet and weight status: Practice level outcome of the review - menu data collected on all intervention (n=6) and control centres (n=3) pre and post intervention. No information provided on difference in groups in regards to characteristics of parents/children lost to follow-up.
Selective outcome reporting *(reporting bias)*	Low risk	Methodology paper also lists physiologic measures - appears that these have been published elsewhere
Recruitment bias	Unclear risk	Unclear how parents/children from centres selected - whether all invited or selection process undertaken and therefore where bias in selection of participants to clusters.
Potential confounding	Unclear risk	Non randomised design - adjustment for confounding factors: no information provided.

Protocol section	Appraisal points	Appraisal points
Background and research question	Review and update background section, including supporting references to take account of any changes that may have occurred. This should include updating any new information and current policy debates on the topic.	The review update will not involve a change in research question or aim. The primary aim of the review is to examine the effectiveness of strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within ECEC centres. The background section of the review will be updated to include current statistics regarding the condition (obesity) and the intervention.
Inclusion criteria	• Review current PICO(s) and amend in light of new knowledge. • Identify any changes in usual care standards. • Check for standardised core outcomes sets, such as those developed in collaboration with the core outcome measures in effectiveness trials (COMET) initiative (www.comet-initiative.org) or by guideline groups since the original review. • Check for any relevant patient reported outcomes to include subsequent to the original review. • Consider any new studies with less risk of bias that might warrant a stricter study design inclusion criteria (where the older version, when there was a dearth of evidence, included observational or quasi-randomised comparisons).	The PICO developed for the original review will be closely replicated for the review update. There will be no changes to the type of population group, interventions or comparison groups previously included in the original review. However, two adjustments will be made to the secondary outcomes measured. The original review included a secondary outcome describing the impact of strategies on ECEC centre staff skills, knowledge and attitude. This will be removed from the review update. The updated review will include a secondary outcome examining implementation acceptability, adoption, penetration, sustainability and appropriateness. As outlined by Proctor in the study, *Outcomes for Implementation Research: Conceptual Distinctions, Measurement Challenges, and Research Agenda*, it is recommended that all implementation trials assess these implementation outcomes. For the review, these implementation outcomes will be operationally defined as follows: - Acceptability: Defined as the perception among implementation stakeholders that a given treatment centre, practice or innovation is agreeable, palatable or satisfactory. Measures of acceptability assessed at the individual or organisational level will be included such a surveys of staff or managers of ECEC centres regarding their experience of features of the intervention. - Adoption: any measure of uptake, including intention, initial decision, or action to try and implement potentially effective interventions, programs or centres. These could include decisions by managers of ECEC centres to take up a potentially effective centre, or individual staff interventions to deliver potentially effective centres. - Penetration: integration of a practice within a centre setting or its sub settings. Include any measure of penetration at the individual or organisational level. For example, proportion of eligible individuals (or ECEC centres) that receive an intervention (or implement an intervention) of the total number eligible to do so. These could include the proportion of all ECEC centres eligible for an intervention that actually receive it. - Sustainability: defined as the extent to which a newly implemented intervention, program or centre is maintained. Measures of sustainability must require successful implementation in part or in full, of an intervention, program or centre. Include any measure of ongoing sustainability of implementation of intervention elements assessed at least 6 months following a measure of successful implementation. This could include the proportion of ECEC centres maintaining implementation of all elements of a program 12 months following the provision of implementation support. - Appropriateness: defined as the perceived fit, relevance of compatibility of an innovation of evidence based practice for a given setting, provider or consumer, and/or perceived fit of the innovation

		to address a particular problem. Measures of appropriateness assessed at the individual of organisational level will be included, such as surveys of staff or managers of ECEC centres regarding their perception of the consistency of the implementation of a new intervention with their skill set or work expectations. The study design inclusion criteria will remain the same for the review update. Any study (randomised, including cluster-randomised, or non-randomised) with a parallel control group that compares an implementation strategy with no intervention or 'usual' practice; or two or more alternative strategies to improve implementation, will be considered and screened for eligibility.
Methods	• Appraise and update the methods pending relevant methodological advancements or developments. For example, if there are new tools for assessing the risk of bias of individual studies or appraising the quality of a body of evidence (e.g. GRADE). • Update or include a 'Summary of findings' table, which is recommended for all systematic reviews, because it improves the clarity, understanding, and interpretation of the findings of a systematic review, and rapidly reduces the amount of time readers require to find key information. • Any new subanalysis needed. • Any substantive change in the review structure.	The updated review will include a minor refinement of the search strategy for electronic databases used in the previous review. This refinement aligns with feedback received from the Cochrane Editorial team regarding the search strategy used in another review by the same lead author. Due to the inclusion of an additional secondary outcome in the review update, studies included in the original review will be re-examined to assess the new secondary outcome. Any data from studies in the original review that assessed the new secondary outcome will be extracted and included in the review update. Despite the addition of a new secondary outcome, the amended search will only be applied to the review update date range (27th June 2016 – present). As per the original review, the primary outcome of the review update is the implementation of policies, practices or programmes in centre-based ECEC centres to promote healthy eating, physical activity or obesity prevention. Therefore, any eligible studies that assess the primary outcome will be included in the review. These studies will then be further examined to determine if any secondary outcomes were also evaluated, with relevant data then extracted. As per the original review, studies that do not assess the primary outcome despite potentially assessing secondary outcomes, will be excluded from the review update. As per the original review, the review update will appraise the quality of evidence using the GRADE method and include a 'Summary of findings' table to increase clarity and understanding for the reader. We will however, report a SOF table for RCTs separate from non RCTs in line with GRADE recommendations. The updated review will also include methodological analysis advancements utilised in the Cochrane review titled *Audit and Feedback: effects on professional practice and healthcare outcomes* (http://cochranelibrary-wiley.com/doi/10.1002/14651858.CD000259.pub3/full). Authors of the review update intend to formally pool the trial using an adjusted median effect and conduct analyses in STATA, as described in the Audit and Feedback review. No substantive change in the review structure will occur in the update

Barriers and Enablers to Adoption of Digital Health Interventions to Support the Implementation of Dietary Guidelines in Early Childhood Education and Care: Cross-Sectional Study

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ABSTRACT

Background: Few Australian childcare centers provide foods consistent with sector dietary guidelines. Digital health technologies are a promising medium to improve the implementation of evidence-based guidelines in the setting. Despite being widely accessible, the population-level impact of such technologies has been limited due to the lack of adoption by end users.

Objective: This study aimed to assess in a national sample of Australian childcare centers (1) intentions to adopt digital health interventions to support the implementation of dietary guidelines, (2) reported barriers and enablers to the adoption of digital health interventions in the setting, and (3) barriers and enablers associated with high intentions to adopt digital health interventions.

Methods: A cross-sectional telephone or online survey was undertaken with 407 childcare centers randomly sampled from a publicly available national register in 2018. Center intentions to adopt new digital health interventions to support dietary guideline implementation in the sector were assessed, in addition to perceived individual, organizational, and contextual factors that may influence adoption based on seven subdomains within the nonadoption, abandonment, scale-up, spread, and sustainability (NASSS) of health and care technologies framework. A multiple-variable linear model was used to identify factors associated with high intentions to adopt digital health interventions.

Results: Findings indicate that 58.9% (229/389) of childcare centers have high intentions to adopt a digital health intervention to support guideline implementation. The changes needed in team interactions

subdomain scored lowest, which is indicative of a potential barrier (mean 3.52, SD 1.30), with organization's capacity to innovate scoring highest, which is indicative of a potential enabler (mean 5.25, SD 1.00). The two NASSS subdomains of ease of the adoption decision (P<.001) and identifying work and individuals involved in implementation (P=.001) were significantly associated with high intentions to adopt digital health interventions.

Conclusions: A substantial proportion of Australian childcare centers have high intentions to adopt new digital health interventions to support dietary guideline implementation. Given evidence of the effectiveness of digital health interventions, these findings suggest that such an intervention may make an important contribution to improving public health nutrition in early childhood.

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KEYWORDS

early childhood education and care; digital health technologies; adoption; dissemination; guidelines

INTRODUCTION

Poor diet is a modifiable risk factor and leading cause of burden of disease globally [1], with 11 million deaths and 255 million disability-adjusted life years in 2017 attributable to dietary risk factors [2]. Early childhood is a critical period to instill healthy eating habits to reduce diet-related burden of disease, as dietary behaviors developed in childhood track into adulthood [3]. Within Australia, population surveys indicate preschool-aged children are not consuming the recommended servings of fruits and vegetables, and consume more than recommended amounts of discretionary foods (ie, foods high in sodium, saturated fat, and added sugar) [4-6]. As a strategy to reduce the burden from poor diet, the implementation of dietary guidelines in the early childhood education and care (ECEC) setting is recommended [7,8]. Despite such recommendations, Australian childcare centers do not provide foods consistent with sector dietary guidelines [9-11]. For example, a 2017 audit of menus in 70 childcare centers across New South Wales (NSW) determined none of the menus were fully compliant with sector-specific dietary guidelines, particularly for vegetables [9].

Digital health interventions (eg, web-based programs, apps, etc) are advocated by the World Health Organization [12] and offer the opportunity to deliver support at scale and at low cost to improve the nutrition-related practices of food service organizations, such as childcare centers [13]. Evidence from randomized controlled trials [11,14-16] suggests that digital health interventions in education settings can improve the purchasing, provision, and consumption of healthier foods. Despite the clear potential of technology-based approaches, such interventions to improve health outcomes are often not adopted by end users, that is, the individual or organization for which the digital health intervention was developed (eg, ECEC centers, schools, and parents within educational settings). For example, it has been estimated that 80% of health technologies fail [17] due to uncertainty (ie, doubt about the technology's value or

dependability), abandonment (ie, ceasing use of the technology), and lack of organizational willingness to adopt the technology [18] when disseminated in real-world contexts.

Broadly, systematic reviews, guidelines, and previous literature suggest that factors across a number of levels are important for the adoption and implementation of digital health interventions. These include factors related to the individual user (eg, knowledge, skills, beliefs, and attitudes) [19-21], the organization (eg, compatibility or fit with the organization, access to appropriate infrastructure and equipment, and leadership engagement) [12,19-21], the wider setting (eg, external policies and incentives) [12,19,21], the process of implementation (eg, lack of considered planning, engagement, and evaluation) [21], and the technology-based intervention itself (eg, complexity, costs, adaptability, and ability of the intervention to meet user needs) [12,19-21].

Within ECEC settings, a 2015 systematic review examining the barriers to integration of information technology more broadly, including computers, tablets, and touchscreen whiteboards, identified a scarcity of empirical studies examining barriers and enablers within the setting, none of which focused on improving guideline implementation or child health outcomes [19]. The lack of research examining the factors that may enable or impede the adoption of digital health interventions to improve dietary guideline implementation is problematic, as such evidence is necessary to inform future strategies to maximize the adoption and, therefore, impact of evidence-based technologies in the setting.

As such, by employing the nonadoption, abandonment, scale-up, spread, and sustainability (NASSS) of health and care technologies framework [17], this study aimed to describe the following in a randomly selected national sample of Australian childcare centers: (1) intentions to adopt digital health interventions to support childcare center implementation of dietary guidelines, (2) reported individual, organizational, and contextual barriers and enablers to the adoption of digital health interventions in the setting, and (3) barriers and enablers associated with high intentions to adopt digital health interventions.

METHODS

Study Design, Ethics Approval, and Consent to Participate

This study employed a cross-sectional design. Ethical approval was obtained by the Human Research Ethics Committees of Hunter New England (16/02/17/4.05) and the University of Newcastle (H-2016-0111). All subjects in this research study provided consent to participate.

Sample

The Australian Children's Education and Care Quality Authority's (ACECQA) national register [22] was used to obtain a sampling frame of potentially eligible center-based childcare centers, including long day cares (ie, centers that provide care for children aged 0-6 years for >8 hours per day) and preschools (ie, centers that provide care for children aged 3-6 years for 6-8 hours per day) [5], from each state within

Australia (N=10,631). A sample of 1500 childcare centers (14.11%) were randomly selected from the sampling frame of potentially eligible centers, stratified by state and center area socioeconomic classification by an independent statistician.

Childcare center eligibility was assessed via online or telephone survey items. Centers were deemed ineligible if they did not provide meals to children or make menu planning decisions onsite, as this survey was assessing technology to support nutrition guideline implementation on menus; had staff with insufficient English to complete the survey; were a Department of Education and Communities center, as ethical approval was not obtained from the relevant government department; were located in the Hunter New England region of NSW or were select centers across NSW, due to concurrent nutrition and physical activity research trials being undertaken by the research team; were identified as out-of-school hours, vacation care, or family day care; or catered solely to children with special needs.

Recruitment and Procedures

An email with an information statement and link to an online survey was sent to the nominated supervisor (ie, the center manager) of all sampled childcare centers (N=1500) inviting them to assess eligibility and participate in the study. Nominated supervisors were able to select an alternate staff member (eg, center director) to complete the survey on their behalf. Centers that did not complete the survey within 4 weeks were sent a reminder email to participate (1466/1500, 97.73%), followed by a phone call from a member of the research team (1455/1500, 97.00%) to assess eligibility and gain verbal consent to complete the telephone version of the survey. A final reminder email was sent to centers that indicated a preference to complete the online version of the survey (846/1500, 56.40%) and those who were noncontactable via phone. Centers that were yet to complete the survey following the final reminder email received a final telephone call to gain consent and complete a telephone version of the survey (744/1500, 49.60%). Centers were not offered any incentives to complete the survey. Data to assess study outcomes were collected between January and August 2018.

Data Collection and Measures

Center and Responder Characteristics

Childcare centers were asked to report on the type of center (ie, preschool or long day care), number of full-time equivalent staff members, center opening and closing hours, number of children enrolled, and the number of children enrolled identifying as of Aboriginal and/or Torres Strait Islander background. Childcare center staff completing the survey were asked to report their main role at the center and the total number of years working in the childcare setting. Survey items assessing center characteristics were sourced from previous Australian childcare center surveys conducted by the research team [11,23,24].

Center geographical information, including state and postcode, were obtained via the ACECQA national register to determine location and the center area socioeconomic classification.

Intentions to Adopt Digital Health Interventions

To aid comprehension and standardization of digital health interventions and their capabilities, participants were first given a brief example of the potential modality (eg, web-based or online) and key features (eg, feedback and tips) that could be provided within a digital health intervention to support guideline implementation in the setting. Three survey items derived from the Technology Acceptance Model [25] were then used to assess childcare centers' intentions to adopt digital health interventions in the setting. The Technology Acceptance Model is an information systems theory that models how end users come to accept and use a new technology [25]. The Technology Acceptance Model has been shown to have high internal consistency (Cronbach α>.80) [26]. Respondents were asked to rate on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree), how much they agreed with the following statements, assuming they had access to a digital health intervention to support the implementation of dietary guidelines in their center: "I intend to use it," "I predict that I would use it," and "I would plan to use it." These items have been used in previous research by the team in the ECEC setting [27].

Barriers and Enablers to Adoption of Digital Health Interventions

A purpose-built measure based on the NASSS framework by Greenhalgh [18] was used to assess individual, organizational, and contextual factors that may influence adoption of digital health technologies to improve the implementation of dietary guidelines in the childcare setting. The NASSS framework is an evidence-based, theory-informed, and pragmatic framework designed to help predict and evaluate the success of a technology-supported health care program [18]. The NASSS consists of seven domains: the illness or condition, the technology, the value proposition, the individuals intended to adopt the technology, the organizations, the wider system, and how all these domains interact over time [28]. The NASSS framework can be used to generate insight into the multiple influences on the success or failure of a complex technology-based intervention; to identify simple, complicated, and complex components of the intervention; and to consider how individuals and organizations may be supported to handle complex components of the intervention [18].

An expert advisory group, including health promotion practitioners, implementation scientists, and dietitians, was involved in the development of the measure. Based on expert advisory group consensus, only three of the seven NASSS domains were deemed relevant to the end users for the scale of dissemination of digital health interventions under examination and were, therefore, assessed. At the time of survey development, no validated measure for the NASSS framework existed. As such, a search was conducted for validated measures that had corresponding domains to the NASSS framework. Where possible, such validated measures were employed and adapted to fit the ECEC context, including the e-Health Readiness Measure [29], which was utilized for two of the subdomains: the organization's capacity to innovate and readiness of the organization for technology-supported change. The e-Health Readiness Measure [30] has been shown to have high internal consistency (Cronbach α>.80). Items for the remaining

five subdomains were developed by the advisory group and pilot-tested among a group of health promotion practitioners and trained telephone interviewers for comprehension and face validity. The final measure consisted of 24 items, 10 of which were adapted items from the e-Health Readiness Measure, across three domains and seven subdomains of the NASSS framework, rated on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Table 1 lists the domains, subdomains, number of survey items, and an example survey item relevant to the setting.

Table 1. Nonadoption, abandonment, scale-up, spread, and sustainability framework application to the early childhood education and care setting

Domain and subdomain (No. of items)	Example survey item
The adopter system	
Changes in staff roles, practices, and identities (3 items)	Using an online program is consistent with the usual practices of my cook and menu planner.
The organization	
Organization's capacity to innovate (6 items)	Overall, I think our service has a champion or leader for using new technology.
Readiness of the organization for technology-supported change (4 items)	Overall, I think our service has access to experts in use of new technology.
Ease of the adoption and funding decision (1 item)	It would be easy to adopt new technology to support menu planning in my service.
Changes needed in team interactions and routines (2 items)	My service would need to change the way it currently plans menus if we decided to adopt new technology.
Identifying work and individuals involved in implementation (2 items)	We already have the existing personnel available to support the adoption of new technology.
The wider context	
Political, economic, regulatory, professional (eg, medicolegal), and sociocultural context for program rollout (6 items)	I would be more likely to adopt new technology in my service if it was promoted by relevant government agencies (ie, Department of Education or Department of Health).

ANALYSIS

Overview

All analyses were performed in SAS, version 9.3 (SAS Institute) [31]. Descriptive statistics including means, frequencies, and proportions were used to describe center demographic characteristics and survey responses. Childcare center postcodes ranked in the top 50% of NSW, according to the Socio-Economic Indexes for Areas, were classified as higher socioeconomic status [32]. A chi-square analysis (ie, test of independence) was used to compare center area socioeconomic classification among consenters and nonconsenters.

Intentions to Adopt Digital Health Interventions

An intention-to-adopt score for each responder was calculated by averaging scores for the three intention items. This score was also used to dichotomize responders into having low intentions to adopt (score <6) or

high intentions to adopt (score<6). This cut point corresponds to those who agree or strongly agree with each item. Such an approach has been used previously within ECEC centers [27].

Barriers and Enablers to Adoption of Digital Health Interventions

Similar to previous studies assessing barriers and enablers using theoretical frameworks [9,33-35], average scores for each NASSS construct were calculated by summing all scores for all items within the subdomain, ranging from 1 (stronglydisagree) to 7 (strongly agree), and dividing by the total number of responses within the domain. Six survey items were negatively worded and were, therefore, reverse scored. Mean values were used to describe the domains as potential barriers and enablers [33]. A lower mean (≤4) suggested that the particular domain may be a barrier, and a higher mean (>4) suggested a perceived enabler to adoption of digital health interventions. In consultation with the expert advisory group (ie, health promotion practitioners, implementation scientists, and dieticians), this cutoff was employed as a pragmatic approach to categorizing mean scores (ie, ≤4 [responses strongly disagree to neither agree nor disagree] and >4 [responses slightly agree to strongly agree]) and was chosen to limit reporting of any potential social desirability bias in the identification of enablers.

Barriers and Enablers Associated With Intentions toAdopt Digital Health Interventions

All seven NASSS subdomains were entered as independent variables into a multiple-variable logistic regression model, to assess which NASSS constructs were significantly associated with high intentions to adopt digital health interventions (ie, dependent variable) after adjusting for each other. The significance value was set at .05.

RESULTS

Characteristics of Participants

Of the 1500 centers invited to participate in the study, 72 (4.80%) were noncontactable, 53 (3.53%) were contacted but did not respond, and 378 (25.20%) declined to participate prior to eligibility being assessed. A total of 997 out of 1500 (66.47%)centers consented to the study and were assessed for eligibility,with 590 of these 997 (59.2%) centers deemed ineligible, most commonly due to the center not providing meals and/or snacks to children and being a Department of Education and Community center. This resulted in a total of 407 centers taking part in the survey. There were no statistically significant differences in center socioeconomic area between consenters and nonconsenters.

The large majority of participating centers were long day carecenters (391/407, 96.1%) (see Table 2). The majority of responders held the position of nominated supervisor (183/399,45.9%) or director (179/399, 44.9%), with more than 10 years' experience working in the childcare setting (278/397, 70.0%).

Table 2. Childcare center and responder characteristics

Characteristics	Value, n (%) or mean (SD)
Center characteristics (N=407)	
Type of center, n (%)	
Preschool	16 (3.9)
Long day care center	391 (96.1)
Number of children enrolled (n=406), mean (SD)	96.33 (56.79)
Number of full-time equivalent primary contact teaching staff (n=404), mean (SD)	12.78 (7.93)
Number of children of Aboriginal and/or Torres Strait Islander background enrolled at center (n=406), n (%)	214 (52.7)
Center area socioeconomic status , n (%)	
High	231 (56.8)
Low	176 (43.2)
Center geographic location , n (%)	
Urban (major cities)	307 (75.4)
Rural (inner regional, outer regional, or remote)	100 (24.6)
Center state, n (%)	
New South Wales	165 (40.5)
Victoria	94 (23.1)
Queensland	62 (15.2)
Australian Capital Territory	7 (1.7)
Tasmania	7 (1.7)
Western Australia	40 (9.8)
South Australia	25 (6.1)
Northern Territory	7 (1.7)
Responder characteristics (n=399), n (%)	
Role at the center	
Nominated supervisor	183 (45.9)
Director	179 (44.9)
Cook	12 (3.0)
Other	28 (7.0)
Number of years working in the childcare setting (n=397), n (%)	
≤5	36 (9.1)
6-10	83 (20.9)
>10	278 (70.0)

Intentions to Adopt Digital Health Interventions

The mean intention score was 5.52 (SD 1.07), with a median of 6.00 (IQR 5.00-6.00). Of 389 responders, 229 (58.9%) centers had high intentions to adopt digital health interventions to support the implementation of dietary guidelines.

Reported Barriers and Enablers to Adoption of Digital Health Interventions

A mean score of 4 or lower (ie, barriers) was found for four of the seven NASSS domains (see Table 3). For three of the seven NASSS constructs—organization's capacity to innovate, ease of the adoption and funding decision, and political context—responders had mean scores of more than 4 (ie, enablers).

Table 3. Mean and median scores for the nonadoption, abandonment, scale-up, spread, and sustainability subdomain barriers and enablers, as reported by responders

Barrier or enabler	Score[a]	
	Mean (SD)[b]	Median (IQR)
The adopter system (n=390)		
Changes in staff roles, practices, and identities	4.32 (1.25)	4.33 (3.33-5.00)
The organization		
Organization's capacity to innovate (n=382)	5.25 (1.00)	5.50 (4.67-6.00)
Readiness of the organization for technology-supported change (n=386)	4.88 (1.03)	5.00 (4.25-5.75)
Ease of the adoption and funding decision (n=387)	5.22 (1.31)	6.00 (4.00-6.00)
Changes needed in team interactions and routines (n=389)	3.52 (1.30)	3.50 (2.50-4.00)
Identifying work and individuals involved in implementation (n=389)	4.35 (1.19)	4.00 (4.00-5.00)
The wider context (n=389)		
Political, economic, regulatory, professional (eg, medicolegal), and sociocultural context for program rollout	5.07 (1.08)	5.33 (4.50-6.00)

Barriers and Enablers Associated With Adoption of Digital Health Interventions

Multiple-variable logistic regression analyses revealed a significant association between two of the NASSS subdomains and high intentions to adopt digital health interventions (see Table 4). For every 1-point increase in the ease of the adoption and funding decision subdomain, centers were 1.75 times more likely to have high intentions of adopting digital health interventions (95% CI 1.40-2.18; P<.001). For every 1-point increase in the identifying work and individuals involved in implementation subdomain, centers had 1.46 times the odds of having high intentions to adopt digital health interventions (95% CI 1.61-1.84; P=.001).

Table 4. Nonadoption, abandonment, scale-up, spread, and sustainability subdomains associated with high intentions to adopt digital health interventions in early childhood education and care centers.

Barrier or enabler	Odds ratio	95% CI	*P* value
The adopter system			
Changes in staff roles, practices, and identities	0.88	0.71-1.10	.27
The organization			
Organization's capacity to innovate	1.26	0.91-1.75	.17
Readiness of the organization for technology-supported change	1.15	0.83-1.59	.41
Ease of the adoption and funding decision	1.75	1.40-2.18	<.001
Changes needed in team interactions and routines	0.92	0.75-1.13	.42
Identifying work and individuals involved in implementation	1.46	1.16-1.84	.001
The wider context			
Political, economic, regulatory, professional (eg, medicolegal), and sociocultural context for program rollout	1.03	0.82-1.29	.81

DISCUSSION

Principal findings

This novel study applied a technology-specific framework to conduct a theoretical assessment of childcare center barriers and enablers to the adoption of digital health interventions to improve dietary guideline implementation, nationally. Application of the NASSS framework resulted in the identification of a number of reported barriers and enablers. The main barrier identified was changes needed in team interactions and routines, with the main enablers identified as being ease of the adoption decision, identifying work and individuals involved in implementation, and organization's capacity to innovate. Centers that reported higher scores in the ease of the adoption decision and the identifying work and individuals involved in implementation subdomains were significantly more likely to have high intentions of adopting digital health interventions.

The study found that over half (229/389, 58.9%) of responders had high intentions to adopt digital health interventions in the setting. Few studies of technology-based health interventions within the ECEC setting report adoption rates, with variable findings. A 2015 cross-sectional study assessing intentions to adopt a web-based program to support healthy eating andphysical activity policies and practices in the ECEC setting reported that 72% of respondents had high intentions to adopt such a program [27]. In our earlier study assessing the impact of implementation support on actual adoption of a web-based menu planning program, 58% of the control group, who did not receive support, had adopted the program [36]. Combined, these findings are indicative of the relatively high intentions to adopt digital health technologies in the ECEC setting.

When examining the potential barriers and enablers to adoption of digital health interventions, scores of 4 or higher were found for only three of the subdomains assessed (ie, enablers), two of which fall within the organizational construct of the NASSS framework. The highest levels of agreement were found for the *organization's capacity to innovate* (mean 5.25, SD 1.00), the *ease of the adoption decision* (mean 5.22, SD 1.31), and *political context* (mean 5.07, SD 1.08). This suggests these subdomains may be potential enablers of the adoption of digital health interventions for end users. Responders reported the lowest level of agreement for *changes needed in team interactions* (mean 3.52, SD 1.30) within the organizational construct, which suggests this subdomain may be a potential barrier to adoption.Such findings suggest that in order to facilitate the adoption of new technology, strategies that generate a high level of organizational support (eg, informing opinion leaders, involving executive boards, and mandating change) and those that overcome any operational challenges and changes in practice (eg, educational outreach visits, changing equipment, and local technical assistance) should be considered [37]. This finding is consistent with previous research demonstrating that implementation support strategies, including face-to-face training, ongoing telephone support, and provision of resources and infrastructure, in addition to obtaining managerial support, improved the adoption of a web-based program in the setting [36].

Study results revealed a discrepancy in the reported barriers and enablers to adoption of digital health interventions and the factors associated with adoption. Multiple-variable logistic regression analyses determined that the *ease of the adoption decision* and the *identifying work and individuals involved in implementation* subdomains were the only factors to have a statistically significant association with high intentions to adopt. Responders scoring higher, that is, those with greater agreement,on these two factors were 1.75 and 1.46 times more likely to report high intentions to adopt digital health interventions, respectively. Although previous studies have not specifically assessed such theoretical constructs in this setting, incongruity in the perceived versus the actual experiences of barriers to the adoption of technology-based interventions [19] and evidence-based guidelines [9] within the ECEC setting has beenreported previously. There are opportunities to target this identified incongruence. In-depth examination of the factors by way of supplementation with qualitative methods among all intended end users is warranted. This may provide greater insights into the complexities to adoption of technology-based health interventions and the interaction between each domain of the NASSS.

While recent studies have employed the NASSS framework retrospectively to categorize various constructs [38,39], this study is novel in its prospective application of the NASSS as a measure to conduct a theory-based assessment. Future research could further examine use of the NASSS as a tool to identify barriers and enablers to the adoption of digital health interventions to inform intervention development and evaluation. In addition, embedding measures of the NASSS into the evaluation of dissemination interventions to improve adoption of digital health interventions would allow for an examination of mechanisms and provide a better understanding of how individual, organizational, and contextual factors impact adoption.

Limitations

The intention to adopt digital health interventions, rather than actual adoption, was assessed. While there is evidence of a relationship between intentions and actual adoption [40], and while our findings align with prior research in the setting [36], rates of actual adoption may differ to those reported. While drawing on validated measures used in other settings, this study employed a nonvalidated self-reported measure to assess barriers and enablers to the adoption of digital health interventions, which may be subject to social desirability bias [41]. Three of the subdomains—*changes needed in team interaction, identifying work and individuals involved in implementation,* and *ease of funding decision*—contained less than three items and, as such,should be interpreted with caution. This study also did not assess additional contextual factors that are theorized to influence adoption according to the NASSS framework, such as the condition, the technology, the value proposition, and embedding and adapting over time [18]. Future studies should consider undertaking an assessment of such factors to assist in providing a more comprehensive understanding of the broader factors that may impact adoption of digital health technologies in the childcare setting. Finally, as Department of Education and Community centers were not eligible to participate, study findings may not be representative of these centers. However, as the geographic distribution of participating centers is similar

to that of the sampling frame—all center-based childcare within the ACECQA national register (differences between the responders in each state vs state population ranged from 0.32%to 7.05%)—the sample may be considered nationally representative.

Conclusions

This study provides novel insights into the perceived and actual factors that may facilitate or impede the adoption of digital health interventions at scale from the perspective of end users.A substantial proportion of Australian childcare centers reported high intentions to adopt digital health interventions. Given evidence of the effectiveness of such technologies, these interventions have the potential to make an important contribution to improving public health nutrition in early childhood. Nonetheless, future efforts to disseminate digital health prevention programs at scale should consider targeting factors within the *ease of the adoption decision* and *identifying work and individuals involved in implementation* subdomains in order for adoption to be ubiquitous in the setting.

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Authors' Contributions

All authors contributed to conception or design of the work, data acquisition, and analysis or interpretation of data, and took part in revising the manuscript. All authors give their final approval of this version to be published and agree to be accountable for all aspects of the work. AG, SY, and LW conceived the study and secured funding. AG and SY designed the evaluation procedures.AG and CB lead the acquisition of data. CL conducted the data analysis. AG led the drafting of the manuscript.

Conflicts of Interest

None declared.

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Effectiveness of a Web-Based Menu-Planning Intervention to Improve Childcare Service Compliance With Dietary Guidelines:Randomized Controlled Trial

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ABSTRACT

Background: Foods provided in childcare services are not consistent with dietary guideline recommendations. Web-based systems offer unique opportunities to support the implementation of such guidelines.

Objective: This study aimed to assess the effectiveness of a Web-based menu planning intervention in increasing the mean number of food groups on childcare service menus that comply with dietary guidelines. Secondary aims were to assess the impact of the intervention on the proportion of service menus compliant with recommendations for (1) all food groups; (2) individual food groups; and (3) mean servings of individual food groups. Childcare service use and acceptability of the Web-based programwere also assessed.

Methods: A single-blind, parallel-group randomized controlled trial was undertaken with 54 childcare services in New South Wales, Australia. Services were randomized to a 12-month intervention or usual care control. Intervention services received access to a Web-based menu planning program linked to their usual childcare management software system. Childcare service compliance with dietary guidelines and servings of food groups were assessed at baseline, 3-month follow-up, and 12-month follow-up.

Results: No significant differences in the mean number of food groups compliant with dietary guidelines and the proportion of service menus compliant with recommendations for all food groups, or for individual food groups, were found at 3- or 12-month follow-up between the intervention and control groups. Intervention service menus provided significantly more servings of fruit(P<.001), vegetables (P=.03), dairy (P=.03), and meat (P=.003), and reduced their servings of discretionary foods (P=.02) compared with control group at 3 months. This difference was maintained for fruit (P=.03) and discretionary foods (P=.003) at 12 months. Intervention childcare service staff logged into the Web-based program an average of 40.4 (SD 31.8) times and rated the program as highly acceptable.

Conclusions: Although improvements in childcare service overall menu and individual food group compliance with dietary guidelines were not statistically significant, findings indicate that a Web-based menu planning intervention can improve the servings for some healthy food groups and reduce the provision of discretionary foods. Future research exploring the effectiveness of differing strategies in improving the implementation of dietary guidelines in childcare services is warranted.

Trial Registration: Australian New Zealand Clinical Trial Registry (ANZCTR): 16000974404; http://www.anzctr.org.au/ACTRN12616000974404.aspx

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KEYWORDS

child care; child, preschool; online systems; menu planning; nutrition policy; randomized controlled trial; internet-based intervention

INTRODUCTION

Background

Poor diet is a modifiable risk factor for the development of noncommunicable diseases including stroke, diabetes, and heart disease, accounting for 19% mortality and 10% of morbidity, globally [1]. Population surveys in Australia and internationally indicate that both adults and young children are not consuming the recommended servings of fruit and vegetables and consume more than recommended amounts of discretionary (energy-denseand nutrient-poor) foods [2-5]. As dietary behaviors established in early childhood track into adulthood [6,7], the World Health Organization recommends that population health approaches be undertaken to improve healthy eating behaviors in young children [8,9].

As approximately 662,000 children aged 0 to 5 years attend formal care in Australia [10], childcare services represent an opportune environment in which to intervene to establish healthy eating behaviors. Systematic review evidence, leading health authorities, and governments internationally recommend that childcare services provide foods in line with dietary guidelines[2,8,11-14]. In the state of New South Wales (NSW), Australia, the Caring for Children [15] resource outlines best practice dietary guidelines for the childcare sector. However, research internationally and in Australia suggests that such dietary guidelines are poorly implemented, with childcare services frequently providing foods and drinks inconsistent with guideline recommendations [16-19].

Childcare staff have reported a number of barriers to the implementation of dietary guidelines. Findings from a recent systematic review indicated such barriers to childcare service staff implementation of guidelines related to knowledge, skills, social influences, environmental context, and a lack of resources[20]. These barriers center around the lack of staff training and support to undertake menu planning consistent with guidelines and regulatory standards (eg, child allergies) and challenges associated with self-assessment of a menu to determine the nutritional adequacy [18,21-24] and its compliance with guidelines.

To improve the implementation of dietary guidelines in childcare, strategies that target known barriers to implementation are required. To our knowledge, only 4 controlled trials have been conducted with the aim of improving the provision of foods and beverages to children in childcare in accordance withdietary guidelines [17,19,25,26]. All 4 trials assessed the impact of multistrategy interventions consisting of a combination of educational materials, face-to-face meetings, or audit and feedback; and when compared with control groups, none found significant improvements in the implementation of the targeted dietary guidelines. The implementation support strategies utilized in these previous trials, therefore, appear insufficient to address knowledge and skill barriers to the implementation of dietary guidelines in this setting.

Web-based interventions offer an opportunity to provide implementation support that has the potential to be effective inenhancing childcare service implementation of dietary guidelines. First, childcare services have existing infrastructure (computer and internet access) to support a Web-based intervention [27]; and staff are willing to use such an intervention to support their implementation of healthy eating policies and practices [27]. Second, specific programming within Web-based systems [28] has the potential to integrate active behavior change strategies [29] to target primary barriers to guideline implementation, including resources, audit, and feedback for menus, and automated calculation of menu compliance with guidelines, eliminating the need for manual calculations by service staff. Third, Web-based interventions can be tailored to a particular service's needs, delivered with high fidelity, at low end-user cost, and are able to address equityissues related to access to dietetic support, particularly for childcare services in rural and remote areas [30,31]. Finally, Web-based systems have the potential to minimize the need for ongoing investment in implementation support (eg, the provision of training and resources) for practice improvements to be sustained.

Objectives

Despite this potential, the effectiveness of a Web-based intervention to improve childcare service implementation of dietary guidelines has not yet been evaluated [32]. As such, the primary aim of the study was to assess, compared with usual care, the effectiveness of a Web-based menu planning intervention in increasing the mean number of food groups on childcare service menus that comply with dietary guidelines. Secondary aims include assessment of the impact of the intervention on the proportion of service menus compliant with (1) all food groups; (2) individual food groups; and (3) the mean servings of individual food groups. Childcare service use and acceptability of the Web-based program were also assessed.

METHODS

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Hunter New England (approval no: 16/02/17/4.05) and the University of Newcastle (approval H-2016-0111) Human Research Ethics Committees.The trial was prospectively registered with the Australian NewZealand Clinical Trials Registry (ACTRN12616000974404). Other registered secondary outcomes will be reported elsewhere. The reporting of this study adheres to the Consolidated Standards of Reporting Trials guidelines [33]. All subjects in this research study provided consent to participate.

Design and Setting

As previously described in the study protocol [34], a parallel-group randomized controlled trial (RCT) was undertaken with 54 long day care services in NSW, Australia. The 252 potentially eligible childcare services in NSW that were current clients of a single specific childcare management software (CCMS) provider, and that provided foods to children,served as the study sampling frame. In order for families to receive financial reimbursement from the Australian government to assist with the costs of childcare [35], services are mandated by Federal legislation to use a government-approved CCMS. The Web-based intervention, titled *feedAustralia*, was developed by Hubcare Innovation, for Healthy Australia and in collaboration with HubHello, and was linked to one such software package used by approximately 20% of childcare services in NSW [36].

Participants

Eligible childcare services were required to (1) be open for ≥8hours each weekday; (2) prepare and provide at least 1 main meal and 2 snacks to children onsite each weekday; (3) have service staff make menu planning decisions; and (4) have a menu planner with sufficient English to engage with the intervention. Services that outsourced menu planning, did not cater for children aged 3-6 years, catered exclusively for

specialneeds children, or were run by the NSW Department of Education were excluded because of differing administrative characteristics.

Recruitment

All services in the sampling frame were posted an invitation letter and information statements about the study in random order, approximately 2 weeks before receiving a call from a research assistant to assess eligibility and obtain service consent to participate (August-December 2016). Recruitment of services was conducted in random order as a subsample of services also participated in a nested evaluation [34]. The CCMS provider also displayed an invitation for services to participate in the trial via their Web access portal. Following provision of consent, nominated supervisors and menu planners were contacted to complete a computer-assisted telephone interview (CATI) to assess baseline service and menu planner characteristics and were asked to provide a 1-week-long menu from their current menu cycle for assessment.

Randomization and Allocation

Following the completion of baseline data collection, services were allocated to the intervention or control group in a 1:1 ratio,stratified by service area socioeconomic status (as determinedby service postcode) [37] by an independent statistician using a random number function in Microsoft Excel 2010. All outcome data assessors were blind to group allocation; however, owing to the nature of the trial, childcare staff and health promotion officers delivering the intervention were aware of group allocation.

Intervention

Services received a 12-month implementation interventionconsisting of access to a Web-based menu planning program (*feedAustralia*), in addition to training and support to use the program (Multimedia Appendix 1 [15,28,34,38-44]). The menu planning program was not embedded within the CCMS platform already used by the childcare services as originally planned because of changes in national regulatory requirements for CCMS. Rather, the menu planning program was developed asa stand-alone program, allowing childcare services to access the program outside of CCMS. The program was linked to theWeb-based CCMS platform to allow communication between the 2 systems. The intervention was codeveloped and overseen by an experienced multidisciplinary expert advisory groupconsisting of health promotion practitioners, implementation and behavioral scientists, policy makers, and public health nutritionists with experience working in the setting. To ensure uptake and to enhance use of the Web-based program, the menu planning program was developed using the Technology Acceptance Model [45], with implementation support strategies identified through a barriers assessment using the Theoretical Domains Framework [46]. Further details regarding the theoretical underpinnings and development of the interventionare reported elsewhere [34].

Control Group

Services randomly allocated to the control group did not receive access to the Web-based menu planning program or other implementation support strategies.

Data Collection Procedures and Measures

Baseline data were collected during October 2016 to April 2017, with the 12-month follow-up conducted during October 2017 to March 2018.

Primary Outcome: Mean Number of Food GroupsCompliant With Dietary Guidelines

As a summary indicator of childcare service menu compliance, the primary outcome was the mean number of food groups on the menu that were compliant with dietary guidelines for the sector [15] at the 12-month follow-up. The majority of childcare services in NSW typically plan their menus in cycles of 2 to 6 weeks [18]. As such, at baseline, 3-month follow-up, and 12-month follow-up, a dietitian or nutritionist blinded to service allocation randomly selected 1 week of each services' current menu cycle for review to eliminate selection bias, using the random number function in Microsoft Excel 2010. Menus were assessed using best practice protocols [47] to calculate the number of servings of each food group that the menu provided per child, per day.

Dietary guidelines for the setting [15] recommend that services provide the following servings at a minimum, of each of the following Australian Guide to Healthy Eating (AGHE) [14] foodgroups on a daily basis for children in care for 8 hours: (1) vegetables and legumes/beans (2 servings); (2) fruit (1 serving); (3) wholegrain (cereal) foods and breads (2 servings); (4) lean meat and poultry, fish, eggs, tofu, seeds, and legumes (3/4 serving); (5) milk, yoghurt, cheese, and alternatives (1 serving);and (6) no *discretionary* foods that are high in energy and low in nutrients (0 servings). A food group was only considered compliant when the minimum recommended number of servings, and no discretionary foods, were provided for every child, every day over a 1-week period. A menu was only considered compliant when the minimum recommended number of servings of all food groups, and no discretionary foods, were provided for every child, every day over a 1-week period.

Secondary Outcomes

The secondary outcomes were as follows:

- Compliance with dietary guidelines for all food groups: To identify absolute compliance with dietary guidelines, the proportion of services compliant for all of the 6 food groups was assessed via 1-week menu review at baseline, 3-monthfollow-up, and 12-month follow-up.
- Individual food group compliance with dietary guidelines: To identify variation in compliance with dietary guidelines for individual food groups, the proportion of services compliant with dietary guidelines for each of the 6 food groups individually was compared between the intervention and control groups as assessed via 1-week menu review at baseline, 3-month follow-up, and 12-month

follow-up.

- Mean servings of individual food groups: To identify any changes in the quantities or times an individual food group was provided on the menu, an additional exploratory outcome was included. This measure was not prospectively registered. The mean number of servings for each of the 5 food groups (vegetables, fruit, breads and cereals, meat anddairy) and the number of times discretionary foods were provided on the menu daily were compared between the intervention and control groups as assessed via 1-week menu review (resulting in 5 days of data per service) at baseline, 3-month follow-up, and 12-month follow-up.

Other Data

A range of other data were assessed as follows:

- Service and menu planner characteristics: Nominated supervisors and menu planners completed a CATI at baseline to obtain service postcode (to determine service area socioeconomic status and geographic location), whether any children of aboriginal and/or Torres Strait Islander background were enrolled, the number of children attending each day, service hours of operation, and menu planner age, qualifications and years working as a service cook. Items have been used previously by the research team in surveys conducted with childcare services [18,20].
- Use of the Web-based program: Google Analytics data [48] routinely collected by the CCMS provider were used to assess service engagement with the menu planning program at the 12-month follow-up. This included the frequency of access, number of times key features were accessed (menu, recipes, nutrition checklist, analytics, and guidelines), and the number of help desk queries made in relation to the program.
- Intervention delivery: Internal records maintained by the project team were used to monitor the delivery of the intervention support.
- Intervention acceptability: At the 12-month follow-up, nominated supervisors in the intervention arm reported via CATI the acceptability of the Web-based menu planning program on a 5-point Likert scale (1=strongly agree; 5=strongly disagree), using items developed by the research team. The proportion reporting 2 or lower (agree or stronglyagree) on each of these questions was calculated.

Sample Size and Power Calculations

On the basis of pilot data (unpublished) with a standard deviation of 1.23, a sample of 27 services in the intervention and 27 services in the control would enable detection of a 0.96 (approximately 1) change in the mean number of food groups compliant between intervention and control groups at the 12-month follow-up (primary outcome) with 80% power and a 2-sided alpha of .05. From a population health perspective, increasing compliance with just 1 food group may contribute to important improvements in public health nutrition. For example, based on current data regarding food provision by childcare services in Australia

[49], achieving compliance with guideline recommendations for vegetables would be equivalent to an increase of 60 grams (0.8 servings) per child, while compliance with discretionary foods would be equivalent to a decrease of 360 kilojoules (0.6 servings) per child [14]. Such improvements have been associated with important child health outcomes and reductions in disease risk [50,51].

Statistical Analysis

All statistical analysis was undertaken using SAS 9.3 (SAS Institute Inc) [52] by a statistician blinded to group allocation. All statistical analyses were 2-tailed with an alpha value of .05. Service postcodes ranked in the top 50% of NSW according to the 2016 Socioeconomic Indices for Areas were classified as higher socioeconomic status [37]. Geographical characteristics of service locality were classified as either urban or rural according to the Australian Statistical Geography Standard [53].Chi-square and *t* test analyses were used to compare characteristics of consenters and nonconsenters, and service and menu planner characteristics between intervention and control groups at baseline. The primary (mean number of food groups compliant with guidelines) and secondary menu outcomes (individual and all food group compliance with guidelines, and mean daily servings of individual food groups) were analyzed with generalized linear mixed models to account for repeated measures at the service level, as well as potential service level clustering effects for the mean daily servings of food groups analysis. All models included a random effect for service, as well as a group by time interaction to assess intervention effectiveness over the 3 time points (summarized as relative mean difference for the continuous measures and relative odds ratio [OR] for the categorical outcomes). All models assessed the relative difference in menu outcomes between the 2 groups from baseline to 3 months, as well as the relative difference from baseline to 12 months. For the primary and secondary outcomes, under an intention-to-treat framework, a complete case analysis was performed using all available data based on group allocation (without imputation), in addition to analysis using multiple imputation for missing data at follow-up undertaken using the MI procedure in SAS.

RESULTS

Baseline Characteristics of Study Participants

Of the 252 long day care services, who were current clients of a single specific CCMS provider in the study region, 54 services declined to participate in the study before eligibility assessment. A total of 198 services were assessed for eligibility, with 42.4%(84/198) deemed ineligible, most commonly because of the inability of service staff to make menu planning decisions (28/84, 33%), and not providing meals and snacks to children (24/84, 29%); (Figure 1). Of the remaining 114 eligible services,47.4% (54/114) provided consent to participate in the study. There were no significant differences in service area socioeconomic status or service geographic location between consenters and nonconsenters.

A total of 27 services were randomized to the intervention and 27 services to the control. Two intervention services withdrew from the study before the 12-month follow-up; 1 no longer prepared and provided meals and the other no longer wished to participate. Services in the control arm had a significantly higher proportion of menu planners with a university qualification (5/27, 19%) compared with services in the intervention (0/27, 0%; P=.02; Table 1).

Figure 1. Consolidated Standards of Reporting Trials diagram. CATI: computer-assisted telephone interview.

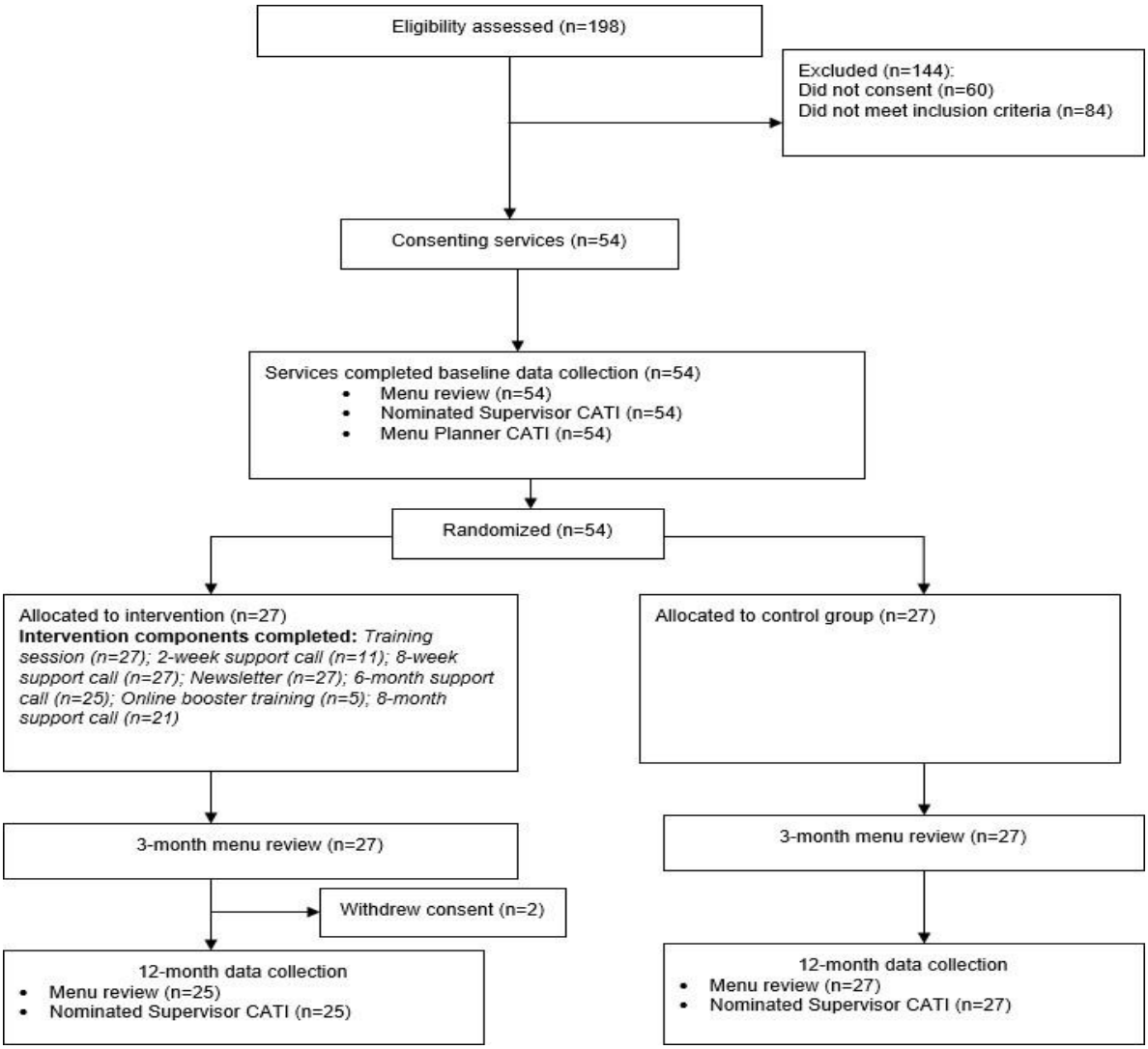

Table 1. Baseline demographic characteristics of participating childcare service, menu planner and children.

Characteristics	Intervention (n=27)	Control (n=27)
Service		
Area socioeconomic status (n=53), n (%)		
High socioeconomic status	17 (63)	15 (56)
Low socioeconomic status	10 (37)	11 (41)
Geographic location (n=53), n (%)		
Urban (major cities)	24 (89)	19 (73)
Rural (inner regional, outer regional, remote)	3 (11)	7 (27)
Services with children of aboriginal background, n (%)	14 (52)	18 (67)
Number of children attending each day, mean (SD)	49.8 (18.6)	45.0 (16.8)
Hours open per day, mean (SD)	10.6 (0.5)	10.8 (0.7)
Number of primary contact educators, mean (SD)	12.3 (9.8)	10.5 (4.5)
Menu planner		
Age (years), mean (SD)	48.4 (10.4)	44.9 (10.5)
Qualifications, n (%)		
University qualification	0 (0)	5 (19)
Technical and Further Education	8 (30)	14 (52)
Registered training organizational course	12 (44)	7 (26)
"On the job" training	7 (26)	8 (30)
Commercial cooking qualification	7 (26)	6 (22)
Years working as menu planner, mean (SD)	9.4 (8.6)	10.3 (8.9)

Primary Outcome

Mean Number of Food Groups Compliant With Dietary Guidelines

Although an increase in the mean number of food groups compliant with dietary guidelines from baseline to follow-up was found for both intervention and control services, no significant differences between the groups were found at the 3-month follow-up (mean difference 0.52; 95% CI −0.35 to 1.39; *P*=.24; Table 2) or the 12-month follow-up (mean difference 0.26; 95% CI −0.61 to 1.14; *P*=.55; Table 3).

Table 2. Baseline and 3-month primary and secondary outcome menu compliance with dietary guidelines: Results for participating childcare services.

Measure	Intervention		Control		Complete case analysis[a]: Baseline versus 3 months		
	Baseline (n=27)	3 months (n=27)	Baseline (n=27)	3 months (n=27)	Relative effect size		
					Mean difference (95% CI)	Odds ratio (95% CI)	*P* value
Number of food groups compliant (n=6), mean (SD)	1.19 (1.33)	2.15 (1.90)	0.96 (1.13)	1.41 (1.15)	0.52 (−0.35 to 1.39)	—	.24
Compliance for all food groups (n=6), n (%)	0 (0)	1 (4)	0 (0)	0 (0)	—	—[b]	—
Compliance with individual food groups, n (%)							
Vegetables	1 (4)	6 (22)	1 (4)	4 (15)	—	1.65 (0.07 to 40.33)	.76
Fruit	7 (26)	11 (41)	8 (30)	5 (19)	—	4.33 (0.69 to 27.29)	.12
Cereals and breads	10 (37)	15 (56)	7 (26)	9 (33)	—	1.55 (0.29 to 8.42)	.61
Meat and alternatives	3 (11)	9 (33)	2 (7)	5 (19)	—	1.48 (0.14 to 15.42)	.74
Dairy and alternatives	8 (30)	9 (33)	7 (26)	11 (41)	—	0.59 (0.11 to 3.19)	.54
Discretionary	3 (11)	8 (30)	1 (4)	4 (15)	—	0.75 (0.05 to 12.21)	.84

[a]Complete case analysis under an intention-to-treat framework—analysis using all available data for menu compliance for baseline and follow-ups in the group to which they were originally assigned.

[b]Statistical analysis could not be performed.

Table 3. Baseline and 12-month primary and secondary outcome menu compliance with dietary guidelines: Results for participating childcare services.

Measure	Intervention		Control		Complete case analysis[a]: Baseline vs 12 months			Overall *P* value
	Baseline (n=27)	12 months (n=25)	Baseline (n=27)	12 months (n=27)	Relative effect size			
					Mean difference (95% CI)	Odds ratio (95% CI)	*P* value	
Number of food groups compliant (n=6), mean (SD)	1.19 (1.33)	1.80 (1.55)	0.96 (1.13)	1.30 (1.10)	0.26 (−0.61 to 1.14)	—	.55	.5
Compliance for all food groups (n=6), n (%)	0 (0)	0 (0)	0 (0)	0 (0)	—	—[b]	—	—
Compliance with individual food groups, n (%)								
Vegetables	1 (4)	2 (8)	1 (4)	5 (19)	—	0.37 (0.01 to 10.82)	.56	.43
Fruit	7 (26)	11 (44)	8 (30)	8 (30)	—	2.46 (0.41 to 14.58)	.32	.28
Cereals and breads	10 (37)	8 (32)	7 (26)	5 (19)	—	1.21 (0.20 to 7.51)	.83	.87
Meat and alternatives	3 (11)	6 (24)	2 (7)	3 (11)	—	1.70 (0.14 to 20.56)	.68	.91
Dairy and alternatives	8 (30)	11 (44)	7 (26)	11 (41)	—	0.97 (0.18 to 5.18)	.97	.78
Discretionary	3 (11)	7 (28)	1 (4)	3 (11)	—	0.99 (0.06 to 17.29)	.99	.96

[a]Complete case analysis under an intention-to-treat framework—analysis using all available data for menu compliance for baseline and follow-ups in the group to which they were originally assigned.
[b]Statistical analysis could not be performed.

Secondary Outcomes

Compliance With Dietary Guidelines for All Food Groups

At 3 months, only 1 (1/27, 4%) service in the intervention arm was compliant with dietary guideline recommendations for all 6 food groups (Table 2). At the 12-month follow-up, no services in either group were compliant with dietary guidelines for all 6 food groups (Table 3). Statistical analysis could not be performed, given the inadequate values in all cells.

Individual Food Group Compliance With DietaryGuidelines

An increase in the proportion of services compliant with individual food groups from baseline to follow-up was found for both intervention and control services, for the majority of food groups (4 out of 6). However, no significant differences between groups were found at the 3-month (Table 2) or 12-month (Table 3) follow-up for any individual food group.

Mean Servings of Individual Food Groups

Exploratory analyses revealed that at the 3-month follow-up, menus from services in the intervention group provided significantly more mean daily servings of fruit, vegetables, dairy, and meat, and significantly reduced the number of timesdiscretionary foods were provided compared with control (Table 4). At the 12-month follow-up, menus from intervention services provided significantly more mean daily servings of fruit and significantly less discretionary foods compared with control service menus (Table 5).

Table 4. Baseline and 3-month mean daily servings of individual food groups on the menu for participating childcare services.

Measure	Intervention[a]		Control[a]		Complete case analysis[b]: Baseline versus 3 months	
	Baseline (n=27), mean (SD)	3 months (n=27), mean (SD)	Baseline (n=27), mean (SD)	3 months (n=27), mean (SD)	Relative effect size	
					Mean difference (95% CI)	*P* value
Vegetables	1.72 (1.15)	2.23 (1.27)	1.96 (1.28)	2.05 (1.30)	0.41 (0.05 to 0.78)	.03
Fruit	1.09 (0.72)	1.28 (0.55)	1.30 (0.79)	1.02 (0.55)	0.47 (0.29 to 0.66)	<.001
Cereals and breads	2.75 (1.28)	3.00 (1.40)	2.75 (1.47)	2.70 (1.31)	0.30 (−0.10 to 0.71)	.14
Meat and alternatives	0.73 (0.46)	0.96 (0.55)	0.87 (0.58)	0.85 (0.50)	0.24 (0.09 to 0.40)	.003
Dairy and alternatives	1.17 (0.63)	1.26 (0.70)	1.31 (0.64)	1.18 (0.57)	0.21 (0.03 to 0.40)	.03
Discretionary (times)	0.62 (0.71)	0.33 (0.52)	0.70 (0.80)	0.64 (0.76)	−0.24 (−0.45 to −0.03)	.02

[a]Calculated from service mean daily servings data (5 days of data per service).

[b]Complete case analysis under an intention-to-treat framework—analysis using all available data for menu compliance for baseline and follow-up in the group to which they were originally assigned.

Table 5. Baseline and 12-month mean daily servings of individual food groups on the menu for participating childcare services.

Measure	Intervention[a]		Control[a]		Complete case analysis[b]: Baseline versus 12 months		Overall *P* value
	Baseline (n=27), mean (SD)	12 months (n=25), mean (SD)	Baseline (n=27), mean (SD)	12 months (n=27), mean (SD)	Relative effect size		
					Mean difference (95% CI)	*P* value	
Vegetables	1.72 (1.15)	2.04 (0.97)	1.96 (1.28)	2.12 (1.26)	0.14 (−0.23 to 0.51)	.45	.08
Fruit	1.09 (0.72)	1.30 (0.73)	1.30 (0.79)	1.27 (0.79)	0.21 (0.02 to 0.40)	.03	<.001
Cereals and breads	2.75 (1.28)	2.90 (1.42)	2.75 (1.47)	2.81 (1.59)	0.04 (−0.37 to 0.45)	.85	.28
Meat and alternatives	0.73 (0.46)	0.88 (0.39)	0.87 (0.58)	0.88 (0.63)	0.12 (−0.03 to 0.28)	.12	.01
Dairy and alternatives	1.17 (0.63)	1.21 (0.64)	1.31 (0.64)	1.24 (0.63)	0.10 (−0.09 to 0.29)	.29	.08
Discretionary (times)	0.62 (0.71)	0.23 (0.51)	0.70 (0.80)	0.63 (0.77)	−0.33 (−0.54 to −0.11)	.003	.008

[a]Calculated from service mean daily servings data (5 days of data per service).

[b]Complete case analysis under an intention-to-treat framework—analysis using all available data for menu compliance for baseline and follow-up in the group to which they were originally assigned.

No changes to the statistical significance of any outcomes were observed in the multiple imputation analyses, and as such these results are not reported.

Use of the Web-Based Menu Planning Program

At approximately 12-month follow-up, intervention services had logged into the Web-based menu planning program an average of 40.4 (SD 31.8) times, spending an average of 47.1 (SD 65.2) min in the program per login (Table 6).

Table 6. Use of the Web-based program among intervention services at the 12-month follow-up (N=25).

Measure	Mean (SD)	Median (IQR)
Number of times logged in	40.4 (31.8)	35.0 (16.0-52.0)
Number of times the menu was accessed	69.5 (54.7)	55.0 (31.0-107.0)
Number of times recipes were accessed	10.8 (11.3)	6.0 (4.0-13.0)
Number of recipes used	89.2 (119.2)	20.0 (1.0-140.0)
Number of times nutrition checklist was accessed	8.0 (14.2)	4.0 (2.0-6.0)
Number of times analytics was accessed	6.2 (6.1)	5.0 (2.0-6.0)
Time in program (hours)	38.8 (108.4)	13.3 (6.9-20.9)
Time per login (min)	47.1 (65.2)	34.9 (18.8-47.5)
Number of times helpdesk was contacted	0	__[a]

[a]Unable to be calculated.

Intervention Acceptability

Over 90% (23/25) of nominated supervisors reported the web-based menu planning program to be useful with planning menus to meet dietary guidelines and 88% (22/25) would recommend the program to other childcare services (Table 7).

Table 7. Acceptability of the Web-based program reported by nominated supervisors in the intervention at the 12-month follow-up.

Measure (score ≤2 [agree or strongly agree])	Value, n (%)
The Web-based menu planning program was useful in my service to help staff with planning menus to meet the dietary guidelines.	23 (92)
Using the Web-based menu planning program improved my services performance in planning menus to meet the dietary guidelines.	22 (88)
Using the Web-based menu planning program is an acceptable method for assessing our services menu compliance with the dietary guidelines.	22 (88)
The children benefited from our service's use of the Web-based menu planning program.	22 (88)
My service intends to continue to use the Web-based menu planning program to plan menus to meet the dietary guidelines.	21 (84)
I would recommend the Web-based menu planning program to other childcare services.	22 (88)

Delivery of Implementation Support

All 27 (27/27, 100%) intervention services were offered and completed a face-to-face training session in use of the Web-based menu planning program with a health promotion officer; 5 (5/27, 19%) services received a second training session because of technical issues (n=1); difficulties using the program (n=3), and staff returning from leave (n=1); 11 (11/27, 41%) menu planners received a brief support call 2 weeks following their training session (based on service needs) and 27 (27/27, 100%) received a support phone call at 8 weeks. All 27 services(27/27, 100%) were sent a study newsletter. A total of 25 (25/27,93%) nominated supervisors received a support phone call at 6 months and 9 (9/27, 33%) menu planners received an online booster training session at 6 months (offer of training based on service needs). Finally, 21 (21/27, 78%) menu planners received a final support call at 8 months.

DISCUSSION

Principal findings

This study is the first RCT measuring the effectiveness of a Web-based menu planning program, linked to a CCMS system,in improving childcare service compliance with dietary guidelines. The study found that, despite being considered acceptable by childcare service staff, the intervention did not significantly improve childcare service menu or food group compliance with dietary guidelines compared with the control. However, significant increases in the servings of fruit, vegetables, dairy, and meat on the menu, and a significant reduction in the number of times discretionary foods were provided were observed at 3 months. At 12 months, a significant increase in servings of fruit and a significant reduction in the provision of discretionary foods was found. Such findings suggest that despite increases in the quantity of some healthy foods and a decrease in unhealthy (discretionary) foods provided on the menu, the Web-based

intervention was not sufficiently effective to ensure children are provided with servings of foodgroups consistent with dietary guidelines for the setting. As foods provided in the home and other settings often fail to alignwith dietary guidelines [54], such findings are of concern.

The lack of a significant effect of the intervention on menu compliance with all food groups is similar to previous Australian studies in the childcare setting [17,19]. This suggests the achievement of a fully compliant menu in accordance with the current dietary guidelines for the setting is a sizeable challenge[55], and perhaps an unachievable goal for many childcare services at present. To be fully compliant with guidelines, services are required to provide adequate servings of each of the AGHE foods groups, and no discretionary foods, for every child in attendance on every single day. Reviews of public health program implementation more broadly suggest that implementation of more than 80% of recommended program elements is rarely achieved across a range of settings [56]. As such, continuous, incremental changes to practice may be more manageable, and over time may result in greater improvements in the provision of healthy food in childcare.

On measures of individual food group compliance, the ORs reported in this study at any time point (0.37-4.33) were generally smaller than those found in a previous randomized trial (1.19-17.83) which, using the same measure, found statistically significant improvements in compliance for fruit, meat, dairy, and discretionary foods [19]. In that 6-month face-to-face intervention, support for childcare service staff included securing executive support, 2 rounds of staff training and ongoing telephone support from an implementation support officer, provision of resources, and 2 rounds of audit and feedback from a dietitian. The findings may reflect a greater capacity of the more intensive face-to-face implementation support offered in the trial by Seward and colleagues to address a broader range of barriers to implementation (eg, environmental context). Such findings suggest the inclusion of additional implementation support strategies as an adjunct to the Web-based program, may be required in order for larger improvements in guideline implementation to be achieved. Future research testing this hypothesis is warranted.

Notwithstanding the lack of statistical significance between group effects on these measures, increases in compliance for all food groups and individual food groups for the control group were observed and were similar to those found in the intervention group. A possible explanation for this could be anincreased awareness of the importance of healthy food provision in childcare in the external environment, other secular trends, or changes to childcare service accreditation requirements during the study period [57]. Alternatively, this may be the evidence of measurement reactivity or Hawthorne effect [58], in that the act of evaluating childcare service menus by external dietitians on multiple occasions within a 12-month period may lead to an increase in menu compliance with guidelines. To reduce the impact of any research reactivity effects, future studies should investigate alternate methods of measuring guideline implementation.

The exploratory analysis identified a statistically significant increase in the mean daily servings of food groups, in particular fruit, and a reduction in discretionary foods at both 3 months and 12 months among

the intervention group, compared with the control. As the program focused on supporting services to make incremental changes to the quantities of healthy food groups provided on the menu via recipe substitution and modification, such improvements to servings are not surprising. In addition, the mean number of daily servings for some food groups (eg, fruit, breads and cereals, and dairy) was higher than the required minimum servings to be considered compliant with the guidelines, suggesting it is likely that services were compliant on some, but not all days of the week (as required for menu compliance). Assessments of any adverse impacts of the provision of foods above the recommended minimum on child-level outcomes or service outcomes (eg, increased waste) warrants investigation.

Among intervention services, there were high levels of acceptability and variable levels of use of the Web-based program (as evidenced by the large SDs and IQRs in program use data). Previous research has identified engagement with Web-based interventions to be associated with a range of healthbehaviors [59,60]. As such, research exploring perceived barriers and enablers to use of the program and identification of strategies to best support end-user engagement with the Web-based program is warranted.

Limitations

The study had notable strengths including the design (RCT), rigorous evaluation approaches, and inclusion of theory-driven and evidence-based intervention and implementation support strategies. Limitations, however, were also present. Similar to previous trials within childcare services [61], the study yielded a moderate consent rate (47.4%). Although there were no significant differences in service area socioeconomic status or geographic location for consenters and nonconsenters, given the study was conducted within 1 state in Australia (NSW) with few Indigenous services, it is unclear whether these findings are generalizable nationally or internationally. Furthermore, despite randomization, services in the control arm had a significantly higher proportion of menu planners with a university qualification compared with the intervention services. It is possible that this may account for the improvement in menu compliance observed in the control arm. The findings report the overall effects of the intervention, which may mask differences in outcomes at the subgroup level. Future exploratorystudies reporting findings from the trial will describe any differential effects by subgroups based on service locality (eg,service area socioeconomic status and geographic location), service characteristics (eg, size), or other contextual factors. Although the menu planning program was linked to a CCMS platform to increase uptake and integration into daily routines,the program was not viewable on the main child enrollments page that is accessed on a daily basis by childcare service staff. Integrating the Web-based menu planning program into the main CCMS platform of the software may reduce variability inservice use of the program. Finally, the outcome relating to servings of individual food groups provided on the menu was not prospectively registered and should be interpreted with caution.

Conclusions

The study is the first RCT measuring the effectiveness of a Web-based menu planning program to improve childcare service compliance with dietary guidelines in NSW, Australia. Findings indicate that the Web-based program was not effective in increasing the mean number of food groups compliant with dietary guidelines, nor the proportion of service menus compliant with dietary guidelines for all food groups and individual food groups. Despite this, significant improvements in the mean number of servings of healthy food groups and a reduction in the provision of discretionary foods provided on the menu were found. Future research should aim to reduce potential measurement reactivity or Hawthorne effects.

Exploration of differing strategies in supporting uniform use of the Web-based program, and the implementation of dietary guidelines, among childcare services is warranted to ensure potential public health benefits are achieved.

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Authors' Contributions

All authors contributed to conception or design of the work; data acquisition, analysis, or interpretation of data, and took part in revising the manuscript. All authors gave their final approval of this version to be published and agreed to be accountable for allaspects of the work. SY, LW, JW, VF, and CR conceived the study and secured funding. SY, LW, JW, VF, and CR designed the intervention and evaluation procedures. DS and ROR oversaw development of the Web-based program. AG, SY, and FS led the acquisition of data and implementation of the intervention. AG led the drafting of the manuscript. CL conducted statistical analysis.

Conflicts of Interest

ROR is the Chief Executive Officer of Healthy Australia Ltd and HubHello Pty Ltd. DS is the Head of Social Impact Program Development of Healthy Australia and HubHello Pty Ltd. There are no other conflicts of interest to declare.

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