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Two year follow-up of schools in randomised trial to assess the sustainability of an intervention to improve the implementation of a school-based nutrition policy.

Short title: Follow-up of a school nutrition intervention

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Two year follow-up of schools in randomised trial to assess the sustainability of an intervention to improve the implementation of a school-based nutrition policy.

ABSTRACT

Issue addressed: School-based nutrition policies can have a positive effect on the school food environment. The primary aim of this study was to assess primary school adherence to a mandatory state-wide healthy canteen policy 12-months after an effective multi-strategic implementation intervention concluded.

Methods: Primary schools were randomised to i) a 12-14 month multi-strategic intervention or ii) no-intervention (control). The intervention aimed to improve implementation of a state-wide canteen policy by encouraging schools to remove unhealthy food and beverages (classified as 'red' or 'banned') from canteen menus and replace with healthy items (classified as 'green'). No implementation support was provided to either group by the research team between the 12 and 24 month data collection period.

Results: Seventy schools participated, of which 56 schools were assessed at 24-months follow-up. Intervention schools were less likely to have a menu which contained 'red/banned' items at 24-months follow-up (RR=2.28; 95% CI: 1.18-4.40; p=0.01). Intervention schools, however were no more likely than controls to have a menu which contained >50% 'green' items at 24-months follow-up (RR=1.29; 95% CI: 0.98-1.70; p=0.10). Intervention schools were more likely to adhere to both policy components (no red/banned items and >50% green items on the menu) than control schools

(RR=2.61; 95% CI: 1.29-5.29; p=0.006). Among intervention schools that were fully adherent to the policy following implementation support (12-month post baseline), all were also adherent at the 24-month follow-up.

Conclusions: The intervention was effective in achieving long term school adherence to a state-wide canteen policy at 24-months follow-up.

So what? The findings suggests that sustained improvements in implementation of school nutrition policies is possible following a period (12 month) of comprehensive implementation support.

Summary: This study assessed implementation of a mandatory canteen policy 12-months after an effective multi-strategic intervention that supported schools to remove unhealthy items ('red/banned') from canteen menus and replace with healthy items ('green'). Intervention schools were less likely to have a menu which contained 'red/banned' items, and more likely to adhere to both policy components (no red/banned items, >50% green items) at 24 months.

Trial Registration: The study was prospectively registered with Australian New Zealand Clinical Trials Register (ACTRN12613000311752; <https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?ACTRN=12613000311752/>; registered 20th March 2013; first participant enrolled 16th July 2013).

Key words: schools, food, beverages, policy, environment.

BACKGROUND

Poor nutrition is a major contributing factor to the development of chronic diseases including cardiovascular disease, cancer and type 2 diabetes.^{1, 2} Global mortality figures show that modifiable dietary behaviours, such as diets low in fruits, vegetables and wholegrains as well as diets high in sodium, attributed to approximately 11.3 million deaths in 2013.³ Children in high income countries such as the United States (U.S.), United Kingdom (U.K.) and Australia, have diets low in fruit and vegetables and high in foods with low nutritional value.⁴⁻⁷ As childhood dietary behaviours track into adulthood⁸, the current poor dietary habits of children are likely to contribute to the chronic disease burden of disease in the future in the absence of intervention.

Outside of the home, children spend more time in school than in any other environment.⁹ Schools have been recognised as a key setting to improve dietary behaviours in children.⁹ School-based nutrition interventions can have a positive effect on the food and nutrition environment within schools, and consequently the dietary behaviours of students.¹⁰⁻¹² Nutrition policies that regulate the availability of unhealthy foods and beverages sold to students in schools have been recommended for implementation by leading health organisations, such as the World Health Organization¹³ (WHO) and the U.S. Institute of Medicine.¹⁴ Internationally, many countries have mandated policies which aim to improve the food environment in schools.¹⁵⁻¹⁷

In Australia, every state and territory has implemented mandatory policies or guidelines which specify the foods and beverages that can be sold in school canteens.¹⁸ Until recently, with a change in policy in NSW, all healthy canteen guidelines utilised a traffic light system of food classification, the nutritional criteria of which was similar across jurisdictions. However, evidence suggests that the implementation of these policies is inadequate. A survey of 263 Australian schools found that 5-35% of schools in all but one state (Western Australia) were implementing their state-specific mandatory healthy canteen policy.¹⁸ Despite the importance and potential public health benefit that the implementation of such school canteen policies offer, few trials have investigated the effectiveness of strategies to support their implementation.¹⁹

To bridge this evidence-practice gap, a randomised controlled trial (RCT)^{20, 21} was conducted in one region of New South Wales (NSW), Australia. The trial aimed to increase the implementation of the mandatory state canteen policy Fresh Tastes @ School NSW Healthy School Canteen Strategy (hereafter referred to as Fresh Tastes @ School). At intervention completion (12 months post baseline), schools receiving implementation support were significantly more likely to adhere to the policy.²⁰ Although the findings are encouraging, the benefits of implementation support strategies are maximised if their effects are maintained in the long-term. As such, the aim of this study was to assess whether improvements in primary school implementation of a mandatory state-wide healthy canteen policy were sustained longer-term (24-month post-baseline follow-up).

METHODS

Detailed methods of the trial have been previously reported²¹.

The reporting of the trial adhered to the Consolidated Standards of Reporting Trials (CONSORT) Guidelines (Additional File 1).²²

Policy context

Introduced in 2005, Fresh Tastes @ School was mandated by the NSW Government for implementation in all primary and secondary Government schools and strongly encouraged in Catholic and Independent schools. The strategy was based on the principles of the Australian Dietary Guidelines and employs a 'traffic light' system, classifying foods and beverages as 'green', 'amber' or 'red' (Figure 1).¹⁷ To be compliant, schools must not have 'red' foods available for regular sale (e.g. > 2 days a term) and the canteen menu must contain >50% 'green' items. Furthermore, in 2007 a ban was introduced on all sugar-sweetened drinks (>300 kJ and/or have >100mg of sodium/serve), prohibiting them from being sold in schools.²

Sample and recruitment

All Government primary schools with an operational canteen in the Hunter region of New South Wales, Australia, who were not currently adhering to the Fresh Tastes @ School policy served as the sampling frame. Schools were randomly selected, approached to participate, and enrolled in the study between July and September 2013.

Random allocation and blinding

Seventy participating primary schools were randomised in a 1:1 ratio to receive a 12-14 month multi-strategic intervention or to a 'no-intervention' control group using a computerised stratified block randomisation procedure (generated by a statistician) following baseline data collection. Data collection staff were blind to group allocation. Participants were enrolled and assigned to intervention and control groups by research and health staff.

Intervention group

The strategies to support canteen policy implementation included i) allocation of a support officer to support schools, ii) engagement of school principals and parent committees, iii) consensus processes with canteen managers, iv) training, v) provision of tools and resources, vi) academic detailing, vii) performance feedback, viii) recognition and marketing initiatives. This support was provided to schools from baseline to the 12 month post-baseline follow-up data collection period. No implementation support was offered to schools by the research team between the 12 and 24 month post-baseline follow-up.

Control group

No policy implementation support was provided to schools allocated to the control group between baseline and the 24 month post baseline follow-up periods.

Data collection and measures

School characteristics

Data regarding number of students and the postcode of the locality of the school were obtained from the Australian Governments 'My School' website.²³

Data collection and measures

Primary outcome

The trial sought to improve adherence of schools with the Fresh Tastes @ School nutrition policy. Two measures of adherence were the primary trial outcomes. Specifically, (i) the proportion of

schools with a canteen menu that did not contain foods or beverages restricted for sale ('red' and 'banned') under the policy and (ii) the proportion of schools where healthy canteen items ('green items') represented more than 50% of listed menu items. In this study the primary endpoint was the 24-month follow-up (November, 2015 to April, 2016). In addition to the primary trial outcomes, we also assessed the proportion of schools that were fully adherent, that is, adhered to both the criteria specified by both the primary outcomes. This measure of full adherence was not prospectively registered but was included to provide a more comprehensive description of the long-term effect of the implementation strategy.

To assess the primary trial outcomes, a comprehensive menu assessment was performed at baseline (April to September 2013). At 24 month follow-up, a quick menu audit tool was used for outcome assessment. Both procedures are described in detail elsewhere.²⁴ The quick menu audit tool was developed to minimise canteen manager burden and decrease costs associated with comprehensive menu assessments and has been shown to have high agreement (84%, $k=0.68$) with gold standard menu assessments, in the primary outcome assessment.²⁴ At the 24 month follow-up, to assess menus, schools' administration was contacted and requested to send a copy of their current canteen menu to the project team. Trained dietitians, blinded to group allocation, assessed the menus using the quick menu audit tool to classify menu items as 'green', 'amber', or 'red/banned'. The tool used a list of assumptions to classify foods as red, amber or green according to the policy. For foods that could not be classified using the assumptions, the canteen manager was contacted to provide additional product information to enable classification.

Sustainability of initial improvements in menu adherence

To assess if improvements in adherence of schools to the policy achieved post intervention (12 month follow-up) were sustained at 2 year follow-up we report the proportion of intervention schools that were adherent to the policy at 12 months, as defined by the criteria of each primary outcome measure, that were also adherent at on that measure at the 24 month follow-up.

Statistical Analyses

All analyses were performed in SAS 9.3 (SAS Institute Inc., Cary, NC). Descriptive statistics were used to describe school characteristics. The primary trial outcomes were analyzed under an intention-to-treat framework using all available data. Between group differences in the primary outcomes at 24 month follow-up were assessed using Fishers exact test and presented as relative risks (with approximate 95% CI). Sensitivity analyses were then performed using last observation carried forward to test the robustness of the findings to any bias introduced by missing data. All statistical tests were two tailed with an alpha of 0.05.

RESULTS

The baseline characteristics of participating schools in intervention and control groups are shown in Table 1. Seventy schools were enrolled in the study and were assessed at baseline, and 56 schools provided menus for assessment at 24-months follow-up (Figure 2). Descriptive data showing changes in the percentage of menu items that were green and red for both intervention and control groups at baseline, 12- and 24 months are shown in Additional File 3. There were no significant differences in baseline characteristics between participating and non-participating schools at 24-month follow-up for days of operation ($p=0.24$), mean number of students ($p=0.87$), socioeconomic region ($p=0.76$), type of manager ($p=0.94$), time as manager ($p=0.91$), or staffing of the canteen ($p=0.86$). There was also no significant difference in the proportion of canteens at baseline not selling red food items ($p=1.0$), or the proportion of menus at baseline with $> 50\%$ green menu items ($p=1.0$) between participating and non-participating schools at 24-month.

Primary trial outcome

Intervention schools were significantly more likely to have a menu which did not contain 'red/banned' foods and beverages at 24 months follow-up ($RR=2.28$; 95% CI: 1.18-4.40; $p=0.01$) (Table 2), however intervention schools were no more likely than controls to have a menu which contained $>50\%$ 'green' items ($RR=1.29$; 95% CI: 0.98-1.70; $p=0.10$). Intervention schools were more likely to be 'fully' adherent to the policy (no red/banned items and $>50\%$ green items on the menu) than control schools ($RR=2.61$; 95% CI: 1.29-5.29; $p=0.006$) at 24 months follow-up. The sensitivity analysis identified similar relative risks to the main analysis when last observation was carried forward for the 14 schools without menu data at 2 year follow-up - indicating the robustness of the findings (Additional File 4).

Sustainability of initial improvements in menu adherence

All intervention schools that had a menu which contained $>50\%$ 'green' items at 12-months follow-up also had a menu that contained $>50\%$ 'green' items at the 24 months follow-up (Table 3). However, only 14 of the 19 intervention schools that had a menu which did not contain 'red/banned' foods and beverages at 12-months follow-up also had a menu that did not contain 'red/banned' foods and beverages at 24-months follow-up. Additionally, all intervention schools with a menu that was full adherent at 12-months follow-up remained fully adherent at 24 months.

DISCUSSION

This first study investigated the long term effects of a strategy in improving adherence to a school nutrition policy. The study found that the intervention strategy was effective in improving long-term

policy adherence (no 'red items and >50% of menu items classified as 'green') at 24-month follow-up. The findings indicate that, with comprehensive implementation support, long-term adherence to such policies is possible and provides policy makers and practitioners with one method of ensuring that the potential benefits of school nutrition policies materialise. Programs that are not effective in the long-term diminish the public health effect achieved during program implementation, and may not represent an efficient use of scarce public health resources.^{25, 26}

Interestingly, substantial improvements in policy adherence were reported in the comparison group in the period between the 12- and 24-month post-baseline follow-up. This reduced the relative size of the intervention effect at 24-months compared to that reported at 12-month follow-up. Such changes were surprising given evidence suggesting the policy implementation had been largely stable prior to study commencement.²⁷ Implementation improvements within control schools may indicate potential contamination after the initial intervention ceased through sharing of resources, or learnings by intervention with control group schools. Additionally, ^{28, 29} during the study period NSW government funded initiatives continued to provide opportunities for schools to attend professional development workshops, advice and support from Local Health District staff and canteen resources and guides to support canteen policy implementation. Increased access and utilisation of such support may explain improvements in control group policy implementation overtime. If this did occur, the sustainability benefits of the implementation strategy reported at 24 months may represent an under-estimate. Alternatively, the changes may reflect greater interest in the sector to address this health issue or changes in measurement methods of policy adherence at the 24-month follow-up. Nonetheless, the effects sizes reported in this study are comparable to other studies (45³⁰ – 80³¹ %) which have examined longer-term implementation of policies, practices or programs in the school setting.

Examination of schools within the intervention group that were adherent immediately following the provision of implementation support (12-month post-intervention) found that such schools were able to sustain policy adherence over time. Such findings suggest that the intervention was effective in building the capacity of schools to adhere to the nutrition policy in the absence of external support, at least for a period of 12 months. The sustainability of implementation over longer-periods warrants further investigation. Nonetheless, for policy makers and practitioners, the findings suggest that allocation of resources may be better placed supporting schools that are not adherent rather than the provision of ongoing support for adherent schools to remain so. Further, the provision of a monitoring system of canteen policy implementation, as undertaken successfully in Western Australia¹⁸, may provide an effective means of sustaining implementation long-term once it has been achieved.

The findings should be considered in the context of the study methods. The primary limitation of the study was the difference in assessment method used to examine menu adherence between the 24-month follow-up and early trial phases. These changes influence the absolute effect size reported in

this paper, however, is unlikely to have introduced any between group bias. There is also the potential that schools in the comparison group received component of the implementation support strategies tested in the trial during the follow-up period. The extent to which this occurred, however, was not assessed in this trial. While this is possible, it was not assessed in this study. The trial also sampled schools from one study region in Australia. The generalisability of the study findings to other countries and school systems is unknown.

CONCLUSION

The findings of this trial suggest that, with comprehensive implementation support, achieving long-term improvement in adherence to school nutrition policies is possible. The study, therefore, serves as one model of improving healthy food availability in schools as a means of improving public health nutrition.

ABBREVIATIONS

95% CI – 95% confidence intervals

RR – relative risk

U.S. – United States

U.K. – United Kingdom

WHO – World Health Organization

RCT – Randomised Controlled Trial

NSW – New South Wales

HNELHD – Hunter New England Local Health District

DEC – Department of Education and Communities

CONSORT – Consolidated Standards of Reporting Trials

SD – Standard deviation

SEIFA – Socioeconomic Index for Area

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Table 1. Characteristics of participating schools by group

	Intervention baseline N=35	Intervention 24m follow-up N=27	Control baseline N=35	Control 24m follow-up N=29
Mean (SD) number of students †	256 (147)	246 (157)	253 (173)	267 (159)
Socioeconomic Region (SEIFA 2006) †				
Least advantaged	17 (42.9%)	13 (48.2%)	16 (45.7%)	13 (44.8%)
Most advantaged	18 (57.1%)	14 (51.8%)	19 (54.3%)	16 (55.2%)
Type of Manager				
Paid manager	16 (45.7%)	13 (48.2%)	16 (45.7%)	14 (48.3%)
Volunteer manager	14 (40.0%)	10 (37.0%)	15 (42.9%)	13 (44.8%)
Other	5 (14.3%)	4 (14.8%)	4 (11.4%)	2 (6.9%)
Mean (SD) time as manager (in months)	51 (56)	55 (62)	57 (57)	53 (55)
Days of operation ‡				
5 days a week	15 (44.1%)	10 (37.0%)	20 (57.1%)	16 (55.2%)
3-4 days a week	14 (41.2%)	12 (44.4%)	9 (25.7%)	9 (31.0%)
1-2 days a week	5 (14.7%)	4 (14.8%)	6 (17.1%)	4 (13.8%)
Staffing of canteen†				
All volunteer staff	19 (54.3%)	14 (54.3%)	17 (48.6%)	15 (51.7%)
Combination of volunteer and paid staff	15 (42.9%)	12 (42.9%)	15 (42.9%)	13 (44.8%)
Other	1 (2.9%)	1 (2.9%)	3 (8.6%)	1 (3.5%)

† Missing data from one control school; ‡ Missing data from one intervention school

Table 2. Proportions and relative risk of primary outcome variables at 24-months follow-up

Policy criteria	Baseline		12-months follow-up		24-months follow-up		Intervention v Control at 24-months follow-up	
	Intervention	Control	Intervention	Control	Intervention	Control	Relative Risk	P-value
	(N=35), n (%)	(N=35), n (%)	(N=27), n (%)	(N=30), n (%)	(N=27), n (%)	(N=29) [†] , N (%)	(95% CI)	
Canteen Menu does not contain foods and beverages restricted for sale ('red' or 'banned')	4 (11.4%)	6 (17.1%)	19 (70.4%)	1 (3.3%)	17 (63.0%)	8 (27.6%)	2.28 (1.18 – 4.40)	.01
Healthy canteen items ('green') represent >50% of products listed on the canteen menu	5 (14.3%)	7 (20.0%)	22 (81.5%)	8 (26.7%)	24 (89.0%)	20 (69.0%)	1.29 (0.98 – 1.70)	.10
Fully adherent: No red or banned items and >50% green items on the menu	0 (0.0%)	0 (0.0%)	17 (63.0%)	1 (3.3%)	17 (63.0%)	7 (24.1%)	2.61 (1.29 – 5.29)	.006

[†]denotes one school refused to provide 24 month data

Table 3. Sustainability of initial improvements in menu adherence at 24-months follow-up

Variable	Intervention		Control	
	Compliant at 12-months n/N (%)		Compliant at 12-months n/N (%)	
	Yes	No	Yes	No
Canteen Menu does not contain foods and beverages restricted for sale ('red' or 'banned') at 24-months follow-up	14/19 (73.7%)	5/8 (62.5%)	1/1 (100%)	7/21 (25%)
Healthy canteen items ('green') represent >50% of products listed on the canteen menu at 24-months follow-up	22/22 (100%)	2/5 (40%)	8/8 (100%)	12/21 (57.1%)
Fully adherent: No red or banned items and >50% green items on the menu at 24-months follow-up	13/13 (100%)	0/2 (0%)	1/1 (100%)	3/11 (27.3%)

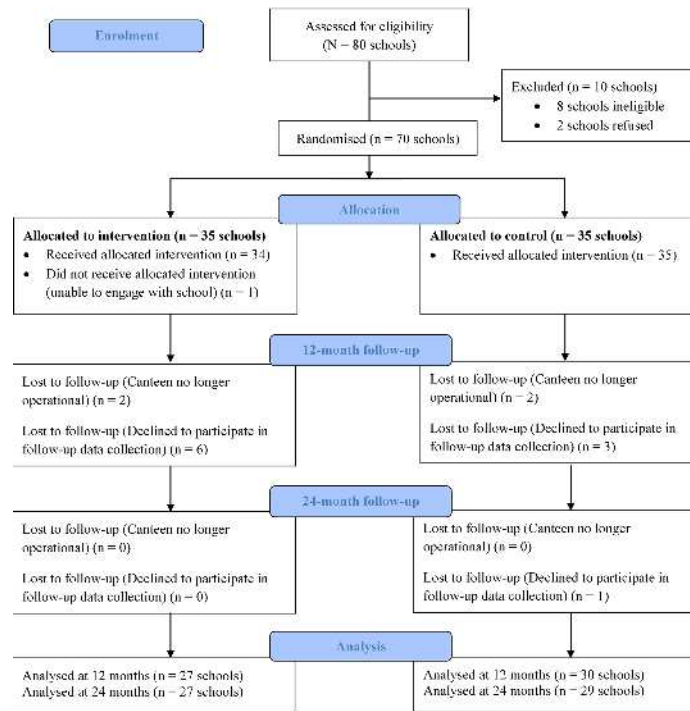
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Figure 1. Classification and examples of 'Red', 'Amber' and 'Green' food items based on "Fresh Tastes @ School".

Figure 2. CONSORT diagram outlining the flow of participants throughout the study.

‘RED’ foods ‘Red’ foods are nutrient poor, high-energy foods such as confectionary, deep fried foods and chocolate coated or premium ice creams.	‘AMBER’ foods ‘Amber’ foods are considered to have some nutritional value however if consumed in large amounts can contribute to excess energy intake such as full fat dairy products, processed meats, some snack food bars and biscuits, some savoury snack foods, some muffins and cakes, some ice creams and dairy desserts.	‘GREEN’ foods ‘Green’ foods are considered to provide good sources of nutrients such as fruit, vegetables, reduced fat dairy products, lean meat, fish and poultry and water.
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