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Development of text messages targeting healthy eating for children in the context of parenting partnerships

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Authorship declaration

LKC, CM, CEC, and TLB contributed to the methodological design of the study. LKC and CM developed the text messages which were reviewed and revised by CEC and TLB. LKC performed data analysis and prepared the manuscript. LKC, CM, CEC, and TLB contributed to the revision of the manuscript and tables. This study forms part of the PhD thesis of LKC at the University of Newcastle, Australia.

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Abstract

Aim: There has been an increase in the use of text messaging to deliver and support health interventions. The aim was to develop a bank of text messages targeting healthy eating for children in the context of parenting partnerships that could be used in a family intervention.

Methods: Text messages were developed using the Theoretical Domains Framework and Behaviour Change Wheel COM-B model by study investigators using a three phase approach; i) initial development of a message bank, ii) messages were reviewed and evaluated by experts and parents on their clarity, usefulness, and relevance using a 5-point Likert scale and open text spaces for additional feedback, and iii) refinement of messages content and finalised the message bank.

Results: Messages were reviewed for 'clarity', 'usefulness', and 'relevance' by 20 parents and 28 health experts, who were predominantly female (92%), parents of primary school age children (33%), of low to middle socioeconomic status (78%), with a mean age of 39 years ($SD\pm 9.87$). From an initial set of 97 messages developed, 48 messages were retained through consultation. Messages were designed to complement the intervention, while engaging both parents.

Conclusions: The three-phase development created a set of text messages acceptable to experts and parents that aim to support improvement in child eating behaviours. The process provides a template and practical guide for researchers and health providers looking to apply a systematic approach to text messages development. Future research

should investigate acceptability and impact of these messages as a component of family-based nutrition intervention.

Key words

Children; Healthy Diet; Parenting; Text Messaging

Introduction

Parents serve as the gate keepers and role models for a family's food intake and have a major influence on child eating habits.¹ Family-based behavioral lifestyle interventions that include parental involvement lead to better child health outcomes, including weight, Body Mass Index (BMI) and other measures of adiposity.²⁻⁵ However, in family-based interventions mothers and fathers are not usually represented equally.^{6, 7} A systematic review on family-based childhood obesity studies (n=667 studies) found that only 51% included both mothers and fathers.⁶ The evidence supporting the efficacy of mothers and fathers within dietary interventions on child health outcomes supports the rationale for increasing parental participation, as well as targeting both parents in childhood obesity interventions.⁸

Parenting partnership or 'co-parenting' is the term used to describe the relationship that both parents share in raising children.⁹ The quality of the parenting partnership has been shown to positively impact a child's social and emotional development, including impulse control,¹⁰⁻¹² which suggests that it might influence a child's lifestyle behaviour and weight status. However, a systematic review of 213 studies on childhood obesity interventions found no interventions that focused on the parenting partnership in relation to dietary intake or childhood obesity.⁷ Despite the importance and evidence for positive co-parenting the knowledge gap indicates that research targeting the parenting

partnership for optimising child and family outcomes in lifestyle interventions is warranted.

Existing research suggest the use of text messages in combination with additional behavioural interventions (e.g. in-person weekly group sessions) are effective in supporting parents with preschool children,¹³ as well as adolescents,¹⁴ who were overweight and obese in improving weight related behaviours. Evidence indicates that mothers and fathers engage with interventions delivered via text messages when they provide relationship focused information, encouragement, support, and links to supplementary resources.¹⁵ Text message technology has the potential to engage both parents by communicating corresponding health messages in family interventions and especially addresses barriers to paternal participation by taking intervention to fathers or the parent who may not be able to attend the intervention in a non-intrusive, temporal manner.¹⁶ Currently, there is a lack of reporting within intervention studies as to how text messages were developed and whether the development process was informed by theoretical behaviour change frameworks or included any formal evaluation with the intended recipients.¹⁷

Health behaviour change theories generally comprise social cognitive theories which primarily focus on intra-individual factors (i.e. reflective cognitive processes) as opposed to wider social and environmental factors (i.e. interpersonal influence between parent-child dyad, and interactions within family systems).¹⁸ The Theoretical Domains Framework (TDF) is an overarching holistic theoretical framework comprises of 14 key theoretical domains, such as 'Knowledge', 'Skills' and 'Emotion', constructed based on 33 behaviour change theories.¹⁹⁻²¹ The TDF domains can be further condensed and integrated into a behaviour change model which characterises individual behaviour

occurrences as the results of interactions between Capability, Opportunity and Motivation (the COM-B model).^{21, 22} The TDF and COM-B model have been used in existing research to develop a parent-targeted smartphone application (App) for childhood weight management.²³ However, the study focused on designing the App and not development of text messages. Moreover, the App content was underpinned with behaviour change techniques at intra-individual level (i.e. food portion sizes) as opposed to inter-individual variables (i.e. parenting partnership, family system). Therefore, the current study aimed to develop a bank of text messages targeting healthy eating within families that were specific to each parental context using the TDF and COM-B model.

Methods

The study was approved by the Hunter New England Human Research Ethics Committee (16/07/20/4.04) and the University of Newcastle Human Research Ethics Committee (H-2016-0329). The text messages development schema (Figure 1) was adapted from previous studies,^{24, 25} with adaptations made to incorporate behaviour change theories (i.e. TDF and COM-B model) in messages development, and a 5-point Likert scale in the reviewer evaluation survey, as detailed below.

Phase 1 involved design and development of messages. Text messages were designed to be delivered to both the father and mother, or caregiver where relevant. The intention was to engage both parenting partners in activities related to healthy eating in families, while encouraging them to be supportive of each other and to work together in resolving conflicts. Three of 14 TDF domains (i) knowledge, (ii) goals, and (iii) social influences, and four of nine intervention functions²² (i) education (provide information), (ii)

persuasion (prompt reflections/discussions), (iii) modelling (prompt actions), and (iv) enablement (prompt discussions/actions), were selected by two researchers experienced in family-based lifestyle intervention (LKC and CM) to underpin the messages development.

The content of each message corresponded one or more intervention functions (i.e. to provide information; prompt reflections; prompt discussions; and/or prompt actions) which dictated the message tone and language style. The specific message content was based on a previous survey of Australian parents of school aged children (n=75) which asked them about the program content they would like to receive if participating in a family lifestyle program.²⁶ Existing research studies in focus groups and interviews with parents²⁷ and adolescents²⁸ about text messages to address lifestyle behaviours, as well as other health behaviour studies in children^{13, 26} have suggested relevant topics for messages development within the current study. The most desired program content areas were “Knowledge about healthy food portion sizes for different ages”, “Healthy recipes”, “Specific information on nutrition topics” and “Education for my child about healthy eating”.²⁶ Messages were drafted to address this content, and some messages were added links to online evidence-based resources. These included factors related to eating habits, diet quality, food preparation, family mealtimes, and healthy snack ideas. By including links for additional resources, the messages also increase opportunity for parents to facilitate behaviour change. This pool of draft text messages (n=97) were developed by the research team and independently mapped to one of the three TDF domains and one of the four intervention functions by two researchers (LKC and CM). Conflicts were resolved between the two researchers through a consensus discussion which acknowledged that some messages were crossing multiple domains and a final

decision was made on the most appropriate single domain and/or function to be mapped to the draft messages. The messages were limited to 160 characters as the maximum length to be sent as a single text message. Messages were designed as passive one-way interaction so that there was no need for the recipient to reply. However, they can choose to act in response to the message prompts and click on the links to view resources.

In phase 2, the messages were reviewed by experts and parents for construct and content validation. Identified stakeholders from two distinct groups (i) parent, stepparent, or care giver of a child aged 18 and below; and (ii) experts in the field of family-based research, health behavioural research, or nutrition and dietetics were invited to review the content of draft messages. Experts were family health researchers, health researchers, dietitians, or nutrition academics. The expert reviewers were invited through mailing lists from academic and health institutions in the Hunter region, New South Wales, Australia, including universities, hospitals, and health services where staff would have knowledge and experience in developing and implementing family-based intervention, and/or clinical services related to healthy eating and weight management. A convenience sample of parents were recruited through the School of Health Sciences staff email of the University of Newcastle which comprises both academic and professional staff, and by snowballing and word of mouth within the local research network at the Priority Research Centre in Physical Activity and Nutrition, which has over 100 members.

Both groups were asked to provide feedback via an online reviewer evaluation survey administered using an online survey platform (www.qualtrics.com). At the start of the survey, reviewers were asked to indicate one or more of the following roles that may

apply to them: family-based researcher, health behaviour researcher, dietitian, parent or caregiver of a child. Researchers and/or dietitians who were also parents were classified as experts. Participants were then asked demographic information (8 items: gender, age, aboriginal status, education, occupation, postcode, number and age of children).

Postcodes were matched to Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) for Postal Areas ranking to ascertain socioeconomic statuses (SES; i.e. low, middle, high). Each reviewer of the same role (i.e. expert or parent) was randomly assigned to review either 50 messages (set A) or 47 messages (set B). For the purposes of construct and content validation, reviewers were asked to evaluate each message on three feedback categories: (i) clarity, (ii) usefulness, and (iii) relevance to parents of overweight children and respond on a 5-point Likert scale ranging from “1” (strongly disagree) to “5” (strongly agree). Open text spaces were provided for additional feedback or suggestions to improve message content. As an incentive for participation, all parent reviewers were offered the option to enter a prize draw to win one of two \$50 gift vouchers upon survey completion.

Phase 3 involved refinement of messages content and final selection of messages. For each message in Phase 2, a mean score was created for each feedback category (i.e. *clarity, usefulness, relevance*), with a total combined score for each message ranging from three (minimum) to 15 (maximum). Messages were discarded if they scored below three for *usefulness*, and retained without change if scored four or above for all individual categories. The remaining messages were refined based on reviewers' feedback.

Once the key messages were identified, the qualitative comments from the reviewers were checked by two researchers (LKC and CM), in addition to rewording and grammar, to ensure that the message content and structure were optimal. The research team then reassessed all remaining messages to create an even distribution across TDF domains, complementary message content, and intervention functions. A final set of text messages was selected for distribution over 12-weeks to targeted end users (i.e. mothers and fathers), across 4-weekly rotations of decreasing frequency (i.e. 5, 4, 3, then 2 text messages per week), based on previous evidence on the importance of varying the frequency of message delivery.¹⁷ The condensed set of messages was re-circulated to the research team for consideration in terms of overall appropriateness. Readability was checked on the final set of messages using an online tool (<https://www.webpagefx.com/tools/read-able/>) to ensure the messages are comprehensible for parents with low literacy. All reviewers were then asked to review the final messages and provide feedback which was used to derive the final message set. A list of the final text messages are presented in Supplementary Table 1.

All analyses were undertaken using Stata version 12 software (StataCorp, College Station, TX, U.S.). Results were considered statistically significant with p-values <0.05. Descriptive statistics were conducted to describe demographic characteristics by reviewer roles. Messages scores were expressed in mean and standard deviation (SD) by reviewer roles and message sets (i.e. set A or B).

Results

A total of 51 reviewers completed the survey and all reviewed the final message set. Of these, 20 were parents and 28 were health experts. Three identified themselves as

neither parents nor experts, thus, were excluded from the analysis. The demographic characteristics of parents and expert reviewers were presented in Table 1. Overall, the parent and expert reviewers (n=48) were predominantly female (92%), non-indigenous (100%), parents of primary school age children (33%), between low and middle SES class (73%), reporting having a university degree (48%), and the group mean age were 39 years (SD±10). The 20 parent reviewers were predominantly mothers (n=19; 95%). The parents reported having one or more children who were aged below five years (n=9; 45%), and/or primary school age 5-12 years (n=10; 50%), and/or secondary school age 12-18 years (n=4; 20%). Of the 28 experts who completed the survey in phase 2, seven were researchers of family-based studies, 12 were health researchers, and nine were dietitians. There were 12 experts who had expertise in two or more areas: family research, health research, nutrition. Of the experts, 50% were also parents and 39% had young children aged below 12 years at the time of participation. (Table 1)

Median scores by category can be found in Table 2. Overall, the 97 messages had a median [interquartile range] group score (max=15) of 13 [1.5], with sub scores (max=5) of 4 [1] for each individual category: clarity, usefulness, and relevance. The overall total scores were not significantly different between parents and experts in either message set. While family and health researchers did not differ significantly in their message scores, dietitians rated the messages significantly lower for all categories compared to family (p<0.001) and health researchers (p<0.001).

Based on the message review protocol adapted from previous studies,^{24, 25} 65 messages were retained without changes (score ≥4 for all three categories); 14 messages were retained and reworded to improve clarity; 18 messages were reassessed for potential inclusion, resulting in agreement (LKC and CM) to discard 12 messages. The revisions

involved minimal corrections including spelling, grammar, and minor wordings. A final set of 48 messages was selected as a set for use within an intervention targeting parents to improve dietary behaviours of their children. The set consisted 36 messages targeting both parents, six messages targeting fathers and six messages targeting mothers. The set contained a combination of messages which aim to provide information about healthy eating, prompt reflections and discussions related to healthy eating goals, and promote healthy eating behaviour. Messages with a focus to improve knowledge (n=14; 29%) were mainly giving information to impart knowledge. Messages that focused on goals (n=15; 31%) to prompt actions related to goal settings and action planning. Messages to address social influences (n=19; 40%) prompted reflection to inform discussion and subsequent actions. The overarching form of action was to achieve discussions between parents about child health behaviours. The literacy level of the final set of messages was on average grade 6 level for readability (i.e. readily understood by most 11 to 12-year olds).

Discussion

The aim of the current study was to develop a set of text messages that targeted healthy eating behaviours within families and to leverage the important role that parents and the parenting partnership plays in determining child and family health outcomes. The current study employed a review process involving a range of experts and researchers in family and health behaviour research, nutrition academics, dietitian, and parents as message recipients who reviewed and provided suggestions to improve message content and clarity. The three phases of the message development provide a practical guide for researchers and health providers looking to apply a systematic approach to text messages development in the future.

Evidence suggests that children can achieve improved behavioural outcomes (e.g. stronger impulse control) when their parents report stronger parenting partnerships.¹⁰⁻¹² However, there are limited studies utilising parenting partnerships to address child eating behaviours, hence the current approach is novel. The messages were designed to be implemented in combination with additional behavioural interventions (e.g. website, face-to-face group sessions) to prompt parents on healthy eating within the family while simultaneously leveraging the influence of parenting partnerships to support lifestyle change. The inclusion of maternal and paternal specific text messages was to help engage both parents in the behaviour change, and to potentially overcome only one parent being responsible for change.^{6, 7}

Reporting of methods used to develop text message content is currently lacking in the literature. It is commonly unclear whether the text messages were developed in an ad hoc way, informed by behaviour change theoretical frameworks, reviewed by health experts, or co-developed with feedback from the intended recipients. The current paper outlines details of the application of the TDF²¹ and COM-B model²² for development of text messages underpinned by relevant theory and informed by the evidence on efficacious child weight management strategies within the context of the parenting partnership. The current study contributes to the literature gap by presenting a systematic process for the development of text messages.^{20, 21} The text messages developed in the current study were also grounded in theory and evidence concerning the importance of the relationship that parents share in the raising of children, the parenting partnership.

Limitations of the current study include the small sample of reviewers evaluating the messages who were predominantly female (92%). Despite open recruitment strategies

were used to be inclusive of both mothers and fathers, parent participants who responded to invitation to participate were primarily mothers and well-educated. A systematic review on 667 family-based childhood obesity studies found that only 17% of the total parent participants were fathers.⁶ Future research involving usability testing with parents and evaluation of the effects of the text messages on child eating behaviour should actively recruit both parents/caregivers especially fathers. Lastly, the final set of text messages was developed specifically for a parent population with school aged children in the context of improving children's eating habits. Further research is warranted to apply the developed methodology for other population groups and health contexts to expand the literature on text messages in specific areas of family intervention.

Conclusion

The text messages development process, which incorporated messages underpinned with the TDF and COM-B models of behaviour change, created a set of text messages acceptable to experts and parents (primarily mothers) that aim to support improvement in child eating behaviours. The consultation process provided assurance that the text messages were likely to be comprehensible, useful, and relevant to parents seeking to improve their children's dietary intake.

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