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Cluster randomised controlled trial of a menu box delivery service for Australian long day care services to improve menu guideline compliance: a study protocol

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ABSTRACT

Introduction Globally, children are not meeting the recommended serves of the five food group foods, particularly vegetables. Childcare is an opportune setting to improve children's diet quality. This study aims to assess the effectiveness of a menu box delivery service tailored to the long day care setting to improve menu compliance with recommendations and improve children's food intake while in care.

Methods and analysis This study will employ a cluster randomised controlled trial and will recruit eight long day care centres, randomly allocated to the intervention or comparison groups. The intervention group will trial the delivery of a weekly menu box service that includes all ingredients and recipes required to provide morning snack, lunch and afternoon snack. The menu boxes are underpinned by a 4-week menu developed by dietitians and meet menu planning guidelines. The comparison group will receive access to online menu planning training and a menu assessment tool for cooks. The primary outcomes are child dietary intake and menu guideline compliance. Secondary outcomes include within-trial cost-effectiveness and process evaluation measures including intervention acceptability, usability and fidelity. If effective, the menu box delivery will provide an easy strategy for childcare cooks to implement a centre menu that meets menu planning guidelines and improves child intake of five food group foods, including vegetables.

Ethics and dissemination This study was approved by the Flinders University Social and Behavioural Research Ethics Committee. Study outcomes will be disseminated in peer-reviewed publications, via local, national and international presentations. Non-traditional outputs including evidence summaries and development of a business case will be used to disseminate study findings to relevant stakeholder groups. Data will be used in a doctoral thesis.

Trial registration number Australian New Zealand Clinical Trials Registry (ACTRN12620000296932).

Strengths and limitations of this study

- To our knowledge, this is the first study to develop and evaluate a menu box delivery service to childcare services.
- The study employs a cluster randomised controlled trial design where centres will be randomly allocated to intervention or comparison groups.
- Effectiveness measures of this study include individual child dietary intake and menu provision.
- In addition to effectiveness, evaluation of the study includes a comprehensive economic evaluation paired with a process evaluation, informed by theory-based frameworks.
- This study is conducted in Adelaide metropolitan, South Australia, and would require replication nationally or internationally to establish generalisability.

INTRODUCTION

Childhood is a critical period where nutrition is essential for healthy development. Eating behaviours formed in this period track into adulthood.[1–3] As a modifiable risk factor for chronic disease, dietary intake can play a role in preventing the burden of disease later in life.[3–6] Dietary guidelines provide evidence-based advice about the amounts and types of foods needed for health and development.[6] However, in Australia and internationally, children are not meeting dietary guideline recommendations.[7–10] For example, only 6% of Australian children meet recommendations for vegetable intake.[9] Nutrition promotion interventions are needed to improve children's food intake in the range of settings where children eat and learn.

Centre-based early childhood education and care (ECEC) has been identified as an ideal setting to improve eating behaviours in young children.[11–13] Across Organisation for Economic Co-operation and Development countries, the enrolment rate of children in ECEC services or primary school is 87%.[14] In

Australia, over half of children under 5 years old attend ECEC services, with the most common setting for formal childcare being long day care (LDC).[15 16] In Australia, LDC centres operate for a minimum of 8 hours with children consuming at least half of their daily food intake while in care.[12 17] The most common LDC food service models are food provided on-site (70% of LDC centres in South Australia (Unpublished, Egan and Cox, 2015)), often by a cook, or food provided by parents from home. Given the average weekly attendance at LDC in Australia is 28 hours,[16] centres where food is prepared on-site may provide an ideal opportunity to improve children's diet quality.[11–13]

In centres where food is provided on-site, cooks are usually responsible for menu planning (MP), food purchasing and preparation. Typically, centre cooks require no formal nutrition training but are expected to provide a nourishing and healthy menu to children while in care.[18] Nutrition policy and MP guidelines, such as the Victorian Menu planning guidelines and the Caring for Children resource, are available and underpin a range of programmes to support cook's nutrition knowledge and skills to plan and provide appropriate meals, example of which includes the Healthy Eating Advisory Service and feedAustralia.[19–22] Specifically, guidelines outline the appropriate number of children's serves from each food group that should be provided to children over each eating occasion throughout the day. Each day in care should provide children with about half of their recommended daily intake from each of the five core food groups, including 1–1.5 serves of vegetables.[19] Similar policies internationally include the Voluntary Food and Drink Guidelines for Early Years Settings in England.[23 24]

Despite the availability of such resources, analysis of childcare menus both in Australia and internationally shows that centres typically do not meet nutrition guidelines, particularly for vegetables.[24–27] Furthermore, interviews with LDC staff indicate that they rely on personal knowledge or online research to determine the nutritional adequacy of foods provided to children in care, rather than using evidence-based resources.[28] A Cochrane Review into interventions for in increasing fruit and vegetable intake in children aged 5 years old and under identified few randomised controlled trials in the ECEC setting.[29] Most interventions did not increase vegetable intake in comparison to control group.[30–33]

Previous studies have reported numerous barriers that impede implementation of guidelines in the childcare setting. These include insufficient MP tools and resources, lack of time or nutrition knowledge, awareness of dietary guidelines and lack of confidence.[34 35] These are further exacerbated when paired with beliefs around the perception that healthy foods such as vegetables will cost more and may not be liked by children, resulting in food waste.[36] Furthermore, costs associated with upskilling kitchen staff have been identified as an additional barrier.[34]

Interventions to improve food provision, including vegetables, in the childcare setting by promoting alignment with MP guidelines are typically comprehensive and require a great deal of time and resources to implement and maintain.[37] Training and upskilling staff involve both cost and time. This highlights the need for innovative or complementary approaches to tackle these obstacles that are sustainable in such settings.

A meal kit-style delivery service for LDC could be an innovative food service model that could support LDC to align with policy and guidelines and overcome common barriers to healthy food provision. Domestic models of meal kit delivery services provide a convenient option for families or individuals who like to cook at home while omitting the need to go grocery shopping or deciding what to eat.[38] Previous studies with Danish families suggested that meal delivery kits in the home are well received due to the convenience they provide while maintaining the socially acceptable standard of a home-cooked meal.[39] A novel food service model for LDC can pair the food supply to the centre menu to provide a menu box delivery (MBD) service compliant with LDC sector menu guidelines.[19]

By underpinning the MBD service with a menu that complies with MP guidelines, this model can overcome barriers of staff knowledge and training and cost of time and labour associated with a childcare menu. Furthermore, this model can introduce a purchasing power that may overcome costs associated with procuring raw ingredients, such as vegetables, for childcares. This may lead to increased accessibility and exposure to such foods in young children while offering a service that guarantees a healthy and compliant centre menu in a cost-effective and time-effective manner.

Study aim

The aim of this study is to evaluate the impact of an MBD service tailored for the LDC setting on the dietary intake, including vegetable intake, of preschool children while in care through direct observation. A secondary aim is to evaluate the effectiveness, including cost-effectiveness, of the MBD service to align childcare menu provision (including vegetable provision) with sector MP guidelines. The feasibility and acceptability of an MBD service will also be evaluated.

METHODS AND ANALYSIS

Study design

A cluster randomised controlled trial with LDC centres randomly allocated to one of two study groups. The intervention group will receive an MBD service that provides a menu plan and all the ingredients and recipes required to provide a menu compliant with MP guidelines for LDC. The comparison group, reflective of current nutrition promotion practice in LDC, will use an online MP tool and online training module to support cooks to develop and deliver a menu compliant with MP guidelines.

Setting and eligible population

The study will take place in privately owned South Australian LDC centres in the Adelaide metropolitan region. In Australia, LDC is a centre-based form of ECEC service that provides full-time or part-time care to children not yet attending school. LDC centres typically cater for children aged 6 weeks old to 6 years old, for a minimum of 8 hours a day, and generally include an education element to prepare children for school. South Australia has 40 860 children aged 0–5 years old enrolled in 384 LDC centres.[40]

Sample and recruitment

Sample

To be eligible for study participation, LDC centres must operate for at least 8 hours per day (Monday to Friday), serve one main meal and two mid-meal snacks each day and have a minimum enrolment of twenty children aged 2–5 years old. Centres that do not prepare meals or make MP decisions on-site by cooks, where food is brought from home (such as lunch box centres), will be excluded. Within centres, children enrolled in the centre between the ages of 2 and 5 years old and present on data collection days will be eligible to participate in data collection. Children with dietary requirements and allergies that prevent them from receiving the standard or vegetarian centre menu will be excluded.

Recruitment

Eligible centres will be recruited in partnership with a local childcare service provider where sites make MP decision. A list of centres provided by head office will be used to identify eligible LDC centres in the metropolitan region of Adelaide. These centres will be stratified by socioeconomic status using Socio-Economic Indexes for Areas (SEIFA) quartiles.[41] From this list, 16 centres from low, middle and high SEIFA quartiles will be randomly sampled using a random number generator.

Centres will be invited to participate until the required sample size of eight centres, to achieve a sample size of 180 children, is attained (see sample size calculation below). Directors will be emailed study information, followed by a phone call from the research team within a week to confirm eligibility. A face-to-face meeting with interested centre directors and cooks will provide study information and obtain centre consent. Within centres, study participants will include centre directors, cooks, educators/teachers, coeducators/floor staff and children. Parents of children enrolled at recruited centres will be informed of the study, and their child will be exposed to the intervention through the centre's primary parent communication method. Parent consent will follow an opt-out protocol for those who do not want their child involved in data collection (see online supplemental file 1).

Group allocation

Centres will be randomly allocated to either the MBD or MP groups. Following baseline data collection, participating centres will be stratified into two groups, matched for centre size and centre socioeconomic status using SEIFA. The two groups of centres will then be randomly assigned to the intervention group using a random number generator. Staff in each centre, along with research staff delivering the intervention, will be aware of group allocation after baseline data collection.

Intervention

The intervention will target the LDC menu and food service system, with a focus on supporting the childcare cook. The study will use the Victorian Menu planning guidelines for LDC; as South Australia does not provide standardised guidelines for ECEC settings, these guidelines are the closest to those previously used in South Australia.[19 26 42–44]

Data collection time points

The intervention will be conducted across the centre's winter menu, commencing September 2020. The intervention period will be 12 weeks, which comprises a 4-week MP period (MP group only) and 8-week menu implementation period (both groups). During the MP period, centres in the MP group will complete the online cook's training and plan their new menu using the MP tool. During the 8-week intervention period, the MP group will implement their revised menu, while the intervention group will start receiving the MBD. After the 8-week intervention period, the MBD service will cease, and centres in the intervention group will return to usual centre menu and practices. Centres in the comparison group will continue using their revised menu as per usual practice (see figure 1).

Intervention group: MBD

The MBD group will receive the active intervention for 8 weeks (ie, two 4-week menu cycles). Centres allocated to this group will receive a weekly MBD that includes all ingredients and recipes required for morning snack, lunch and afternoon snack for the week, designed in collaboration with dietitians from an expert nutrition service provider experienced in working with Australian LDC services and a local industry partner to provide all fresh and pantry produce. Centres will receive packs that provide information about the boxes, delivery and recipes and will also receive continued support from the research team throughout the duration of the study. If recruited centres offer a breakfast or late snack service, foods for these meals will be able to be ordered with the MBD. Recipes will be nut-free, the meat will be halal and vegetarian options will be provided. Allergens will be identified on foods provided in the menu boxes as per regulated Australian labelling requirements, and centres will be asked to apply usual practices and policies to manage preferences or dietary requirements.

Comparison group: MP training and assessment tool

Centres in the comparison group will use an online MP training and assessment for LDC cooks to support

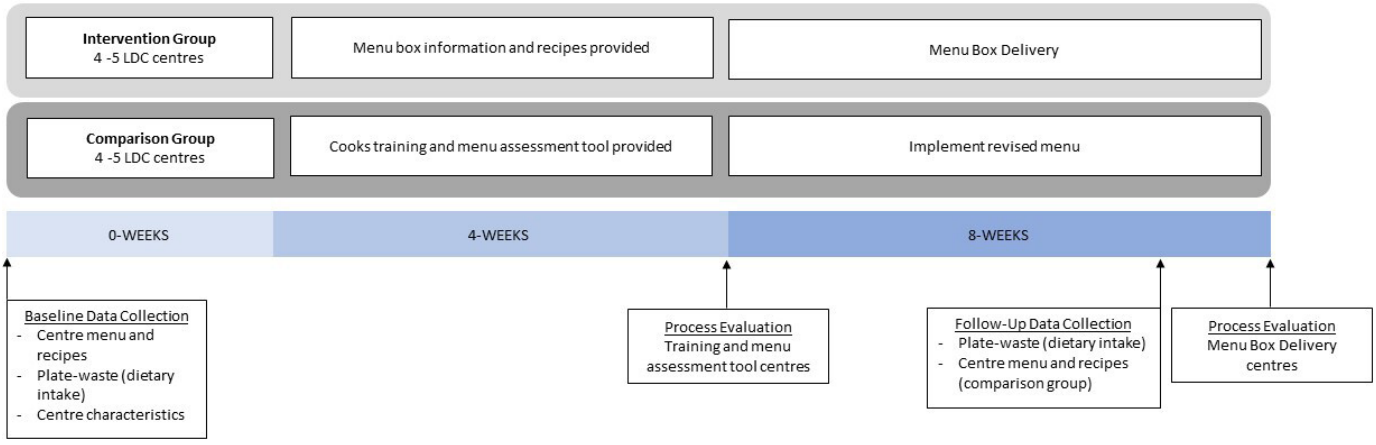

Figure 1 Intervention flow and data collection points. LDC, long day care.

implementation of a centre menu that meets MP guidelines. The training takes approximately 45 min to complete and includes modules on MP, implementing healthy eating guidelines and strategies to overcome common challenges.

The training is complemented by an automated menu assessment tool, which is a free online tool that assesses menus and recipes against MP guidelines. The tool provides feedback on areas for improvement to meet guidelines and allows users to create and save recipes, assess current menus and create new menus. After completing the training, cooks will order and implement as per their standard protocol; however, it is anticipated that this will be using the menu assessment tool, which will support cooks to meet the Victorian Menu planning guidelines for LDC.

Outcomes

Food provision and dietary intake (primary outcomes)

The primary study outcomes are menu compliance with MP guidelines and children's dietary intake of vegetables. Centre food provision will be assessed against compliance with MP guidelines. Dietary intake will be measured as intake of vegetables within the context of a healthy diet using the five food groups defined by the Australian Dietary Guidelines, which include (1) vegetables and legumes/beans; (2) fruit; (3) grain (cereal) foods; (4) lean meats and alternatives; (5) milk, yoghurt cheese and/or alternatives; and (6) discretionary choices, foods and drinks that do not fit in the five food groups as they are nutrient-poor and typically higher in kilojoules, saturated fat, added sugars and/or added salt.[10]

Secondary outcomes

Process evaluation

Process evaluation will occur on two levels: (1) acceptability and usability of the intervention materials and resources provided and (2) intervention implementation and fidelity. This is the first study to test a menu box food provision approach in LDC centres; therefore, evaluation of feasibility, acceptability and usability will provide crucial information to inform future use of this approach within the sector.

Covariates

Centre operational data

Operational data for the centres will be collected at baseline. Data collected will include number of enrolments and average attendance, operating hours, meals and snacks served, menu cycle length and current or previous menu guidelines or policies used at the centre. At follow-up, centres will be asked to report the implementation of any other nutrition policies or programmes during the intervention period.

Staff and child characteristics

Staff characteristics will include number of staff employed as cooks and kitchen assistants, hours worked per week, age, gender, years in current position as well as years employed in ECEC sector and qualifications relevant to role. Age and gender of children participating will be collected at each data collection stage along with any dietary requirements and allergies, which may affect food intake.

Economic evaluation

The cost-effectiveness of the MBD intervention will be estimated, compared with MP (ie, usual practice). Within-trial cost-effectiveness will be estimated from the centre perspective in 2020 Australian dollars following recommended guidelines, and budget impact analysis will be undertaken.[45]

Study procedures and data collection

As described earlier, collection will be conducted at baseline, immediately prior to the start of the intervention, and at follow-up, which will align with the last few weeks of the menu box menu cycle.

Primary outcomes

Menu assessment

Compliance of the centre menu with Victorian Menu planning guidelines will be assessed at baseline and follow-up.

Assessment of the centre menu will be completed by an accredited practising dietitian using the menu assessment tool.[20] Centre cooks will be asked to provide (1) a copy of their full centre menu, (2) recipes for each meal and (3) number of children provided for. If recipes are not available, standardised recipes for the closest matching meal from the Australian Food, Supplement and Nutrient Database 2011–2013 database will be used.[46] This information will then be entered into the online menu assessment tool, which will provide an assessment of the menu reflecting adherence of each food group to the Victorian Menu planning guidelines.

Plate waste

Children's dietary intake at morning snack, lunch and afternoon snack will be measured using weighed plate waste, a method that has been extensively used to measure food intake in the childcare setting.[26 47] Data collection in each centre will occur on 2 days each at baseline and at follow-up. To measure plate waste, prior to each eating occasion, each meal component will be weighed and photographed, before being served. Once each child is finished with their meal, their plate will be weighed again to measure how much food is remaining; each component of the meal will be weighed similar to when serving. Each plated serving and leftovers will be weighed using calibrated electronic kitchen scales to the nearest 1 g. The amount of food consumed will be measured by subtracting the mass of the food waste leftover from the initial mass served. Food provision and consumption are measured in grams and therefore will be converted to equivalent servings based on the Australian Guide to Healthy Eating and Victorian Menu planning guidelines for LDC.[19]

Secondary outcomes

Process evaluation

Intervention delivery and fidelity

Fidelity in the menu box group will be determined from MBD courier records and use of the menu and recipes by centre cooks using a weekly over-the-phone check-in, described in more detail below. In the MP group, website metrics will be used to monitor use and number of logins on the cook's training module and menu assessment tool.

Feasibility

Feasibility will be evaluated through childcare and staff recruitment and retention rates, time taken to complete training modules, menu assessments and cost of intervention components to the centre. Information about time taken to complete the training, menu assessment and menu box orders will be collected by inclusion of two questions in the interviewer-administered questionnaires described below

Satisfaction with menu boxes

Centres receiving the MBD will complete a weekly over-the-phone check. Specifically, the purpose-designed 10-minute 13-item checklist will assess ingredient quality, overall satisfaction and whether any meals needed to be modified or additional ingredients were required.

Acceptability

Feedback from cooks will be collected through a structured interview format using interviewer-administered questionnaire that evaluates cook's acceptability of intervention components and feedback on training material at follow-up. Cooks will respond to multiple-choice questions including items such as time taken, quality of materials, effectiveness and readiness to implement it, with the opportunity to comment further on responses. Process evaluation questionnaires will be administered for both study groups. Centres in the intervention group will complete a 23-item interviewer-administered questionnaire on completion of the 8-week MBD, while cooks in the MP group will complete a 32-item interviewer-administered questionnaire following the cook's training and menu revision phase.

The purpose-designed questionnaires will include items from the Learning Object Review Instrument (LORI) and Theoretical Domains Framework (TDF). The LORI framework will be used to evaluate the acceptability and usability of learning resources providing insights on content quality, staff motivation, interaction usability and presentation.[48] Perceived barriers and enablers of implementing the MP guidelines will be evaluated using the Theoretical Domains Framework Questionnaire for cooks developed by Seward (Comparative Fit Index of 0.78) including domains such as staff knowledge, environmental context and resource and social influences to understand factors that may affect implementation of the interventions.[49 50]

Economic evaluation

To measure cost-effectiveness, centres will be asked for their budget for food provision and any budget allocation to menu assessment or cook training. To estimate intervention cost, cooks in both groups will collect all food invoices and receipts over the 8-week intervention period. Menu box costs, including produce and delivery fees, will be collected from supplier invoices, and cost of the menu pack resource will be available from study records. In the 8 weeks of the intervention period, weekly over-the-phone check will be conducted, in which cooks will be asked to report estimated time spent planning, ordering or shopping for the week's menu using a structured interview. These data will be used to compare differences in cook time between the two groups, using published salary rates. The incremental difference in costs will be combined with the primary and process outcomes to produce a range of incremental cost-effectiveness ratios.

Sample size and power calculations

Sample size calculations were conducted using G*Power software V.40 based on an α-value of 0.05 and power of 0.80. Cohen's d of 0.65 was calculated based on a similar study in the Australian LDC setting that calculated

a change in consumption of 0.4 serves of vegetables from 0.9 (0.8) serves at baseline to 1.3 (0.9) serves at follow-up.[51] Using an intraclass correlation coefficient of 0.1, to account for clustering by centre, the required sample size for this study is approximately 180 children. As the average place allocation per centre is around 60 children,[52] with majority of ages being between 2 and 5 years old, it is expected that eight, with a minimum of twenty children recruited per centre, will be required to meet this.

Statistical analysis

All statistical analysis will be performed with SPSS V.24.0 statistical software. All statistical tests will be two tailed with an α-value of 0.05. χ^2 and t-test will be used to check for differences between groups. Centre characteristics will be presented using descriptive statistics. Group differences in food group provision and change in child dietary intake will be assessed using a linear regression model, controlling for clustering. Feedback from staff will be grouped and presented descriptively.

Patient and public involvement

The menu box intervention was developed by researchers and dietitians with experience in the LDC sector and food provision in education settings. The menu was developed by dietitians at a public health not-for-profit organisation, which provides MP support for LDC centres. The menu incorporates feedback from centres about suitability of recipes and the menu. The supply chain for the menu boxes was established with the menu box supplier, a wholesaler with experience of food distribution to LDC centres. The acceptability and feasibility of the intervention in terms of time investment, barriers and participant burden will be assessed as part of the process evaluation. A summary of study results will be disseminated to participating centres via email.

ETHICS AND DISSEMINATION

This study was approved by the Flinders University Social and Behavioural Research Ethics Committee (Approval 8566). Study outcomes will be disseminated in peer-reviewed publications, via local, national and international presentations. Non-traditional outputs including evidence summaries and development of a business case will be used to disseminate study findings to relevant stakeholder groups. Data will be used in a doctoral thesis.

DISCUSSION

The aim of this cluster randomised controlled trial is to evaluate a new food service model to support LDC cooks to implement nutrition guidelines in the day care setting. There is evidence that nutrition promotion interventions to improve adoption and implementation of nutrition policy and MP guidelines are effective in enhancing children's diet while in LDC. However, barriers to adoption and implementation of such changes at scale may not be sustainable in long term as previously highlighted.[37] Few randomised controlled trials have been identified in this setting that effectively improve both healthy eating and vegetable intake.[17 26 53]

Service-level changes to the centre menu have the capacity to effectively improve child intake; however, strategies that tackle barriers such as perceptions of food waste and cost warrant further exploration. For example, by overcoming cost barriers, vegetables can be provided on the menu more frequently, therefore increasing exposure and the potential for greater acceptance in childcare-aged children.[36 54 55] Given the potential effectiveness that a service-level change may have on child intake, it is worthwhile exploring strategies to improve guideline implementation that can be easily adopted and executed consistently across LDC centres.

Strengths and limitations of menu box intervention

To our knowledge, this is the first study to develop and evaluate an MBD service of this kind. The strengths of this study include its randomised design, use of a standard practice comparison group and comprehensive process and economic evaluation. There is limited evidence of research targeting the implementation of menu guidelines in the childcare settings; of these, many lack a comprehensive economic analysis. This trial will address this gap by conducting a rigorous economic evaluation paired with a comprehensive process evaluation, informed by frameworks (TDF and LORI), to provide strong evidence to inform potential for scalability and implementation in the sector. A comprehensive process evaluation will provide insight to understanding feasibility, acceptability and contextual factors (TDF) that affect successful implementation.[48 49 56]

Additionally, the 4-week menu for the menu boxeswas developed by dietitians with experience within the early care and education sector and contains recipes that have been designed and tested specifically for the childcare setting while meeting MP guidelines, strengthening suitability of menu box in the childcare sector. However, this strength could also pose a limitation by reducing the input of cooks and centres into the centre menu, potentially limiting opportunities for creativity and adapting menus to child preferences. This study will be conducted in metropolitan and private South Australian childcare centres and will need to be replicated to support generalisability of findings. Finally, the short follow-up and intervention period may limit the findings, as results may be affected by the impact of centres adapting to new food service model rather than the effects of the menu box itself.

The food service model described in this study integrates the centre menu and food supply with the MP guidelines. By streamlining these two components of the centre menu, an MBD service can support centres to provide a centre menu that meets MP guidelines and increase provision and exposure of vegetables in young

children in a time-effective and cost-effective manner. Findings of this study are likely to inform the application of a novel food service model in the LDC setting and contribute to a growing body of evidence to support implementation of MP guidelines in the childcare setting. This trial will be the first of its kind to evaluate an MBD service in the LDC setting and, if effective, may provide a contemporary strategy to improve vegetable provision and child dietary intake.

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Contributors DC and RG conceived the study. SK led the manuscript drafting. SK, DZ and RG led the intervention design. VB developed the economic evaluation design. JCA contributed to the design and preparation of the intervention components. All authors contributed to the study design and development of the intervention and evaluation procedures and the final manuscript and approved the final version.

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