Evaluation of a Menu Box Delivery Service to Improve Menu Compliance and Child Vegetable Intake in Australian Long Day Cares

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ABBREVIATIONS

ACECQA	Australian Children's Education and Care Quality Authority
AGHE	Australian Guide to Healthy Eating
AI	Adequate intake
AUD	Australian dollars
AUSNUT	Australian Food, Supplement and Nutrient Database
BIA	Budget impact analysis
BMI	Body Mass Index
CCA	Cost-consequence analysis
CHEERS	Consolidated Health Economic Evaluation Reporting Standards
CEA	Cost-effectiveness analysis
CI	Confidence interval
CPI	Consumer Price Index
CONSORT	Consolidated Standards of Reporting Trials
DALY	Disability-adjusted life years
EAR	Estimated average requirements
ECEC	Early childhood education and care
HRQoL	Health-related quality of life
ICER	Incremental cost-effectiveness ratio
IQR	Inter-quartile range
IRSAD	Index of Relative Socio-Economic Advantage and Disadvantage
ISPOR	International Society for Pharmacoeconomics and Outcomes Research (now known as The Professional Society for Health Economics and Outcomes Research)
kJ	Kilojoules
LDC	Long day care

LORI	Learning Object Review Instrument
MCAR	Missing completely at random
NQF	National Quality Framework
NQS	National Quality Standards
NRV	Nutrient Reference Value
OR	Odds ratio
QALY	Quality-adjusted life years
RCT	Randomised controlled trial
SD	Standard deviation
SEIFA	Socio-Economic Indexes for Areas
SES	Socio-economic status
TDF	Theoretical Domains Framework
TDFQ	Theoretical Domains Framework Questionnaire
UL	Upper limit
WHO	World Health Organization

GLOSSARY

Budget impact analysis	Estimates the expected financial consequences or changes in expenditure following the adoption of a new intervention over a given time horizon.
Centre	An individual childcare centre or service that provides care and supervision of children.
Centre director	The head of the individual childcare centre, responsible for its daily operations, including managing staff and budgets.
Centre cook	Childcare centres that serve meals on site typically employ a cook to prepare meals. Currently in Australia, cooks do not require any formal cookery training or experience.
Cost-effectiveness analysis	A form of economic analysis that compares costs and health outcomes of one or more interventions by estimating the costs to gain a unit of a health outcome.
Cost-consequence analysis	A form of economic analysis where a range of costs and a range of outcomes are presented in disaggregated form. There is no specific preference for one measure of cost or outcome; rather the analysis allows the decision maker to form their own opinion about the relative importance of all outcomes.
Early childhood education and care	Services that provide for children from birth to 8 years of age in a variety of settings.
Educator	An early childhood practitioner who works directly with children in early childhood settings.
Long day care	A centre-based service (often called a childcare centre) that provides education and care for children from birth to 6 years of age.

Meal kit subscription service	A food service business model that delivers pre-portioned ingredients and recipes to households, usually as a weekly subscription service.
National Quality Framework	A plan to which all Australian governments have agreed and that aims to raise quality in early childhood education and care (ECEC) services. It also aims to support services in continually improving what they do.
Menu compliance	When a menu meets prescribed types and quantities of foods outlined by a set of menu planning guidelines.
Menu planning	The activities undertaken, typically by a centre cook, to plan and prepare a centre menu.
Menu planning guidelines	Specification of the types and quantities of food from each core food group that meet children's requirements while in care. These may vary from state to territory.
National Quality Standards	The national benchmark for ECEC, and outside school hours' care services in Australia. This includes seven quality areas that are important outcomes for children.
Plate waste	A measure of food provision or waste that involves weighing the food served and the amount remaining on the plate. Consumption can be estimated by subtracting food waste from food provision.

SUMMARY

Background

Dietary patterns established in childhood continue into adulthood and, if healthy, contribute to the prevention of disease later in life. National Australian surveys demonstrate that on average, neither children nor adults are meeting the *Australian Dietary Guidelines*. In particular, vegetable consumption remains poor. Children spend a considerable amount of time in early childhood education and care settings. Long day care (LDC) centres that serve meals on site present an opportune setting to target children's eating behaviours at a stage of life where these behaviours are malleable. Analysis of Australian childcare centre menus shows that many are failing to meet menu planning guidelines for many food groups. Cooks report a number of key barriers to implementing menu planning guidelines, including lack of time, budget, knowledge and confidence. This warrants the exploration of an innovative food service model to support menu compliance and child dietary intake in these settings.

Thesis Aim

The aim of this study was to develop, implement and evaluate the impact of a menu box delivery service tailored to the LDC setting on the food provision and intake, including vegetable intake, of children aged 2–5 years.

Methods

An eight-week cluster randomised controlled trial was conducted across eight South Australian LDC centres. A menu box delivery service (intervention centres, $n = 4$) was compared with an Online Cook Training and Menu Assessment Tool (standard practice for comparison centres, $n = 4$). The trial outcomes included menu compliance and cook feedback, child dietary provision and consumption (measured via plate waste). A within-trial economic evaluation was also conducted. Centre menus were assessed against the menu planning guidelines and cook feedback was collected via interviewer-administered questionnaires. Feedback was coded into themes. Child dietary outcomes were measured via plate waste separated into food groups based on the menu planning guidelines. The economic evaluation analyses included a cost-effectiveness analysis, cost-consequence analysis and a budget impact analysis from the centre and service provider perspective.

Results

Comprehensive dietary data were collected from 224 children at follow up across four intervention ($n = 98$) and four comparison ($n = 126$) centres. At follow up, intervention centre menus exceeded menu planning guidelines for vegetables (2.0 ± 0.7 serves). No significant differences were found

in the median number of serves/day between intervention and comparison centres, for provision (intervention, 0.9 inter-quartile range [IQR] 0.7–1.2; comparison, 0.8 IQR 0.5–1.3) or consumption (intervention, 0.5 IQR 0.2–0.8; comparison, 0.5 IQR 0.3–0.9) of vegetables. Cooks and directors in the comparison group found the training and Menu Assessment Tool unrealistic to complete within time constraints. Intervention centre directors and cooks enjoyed the order and delivery process for the menu box delivery service. However, food preparation following the recipes was perceived to be time consuming and inappropriate for the setting. The total cost of the intervention menu ($4.62/child/day, 95% confidence interval [CI] $4.58, $4.67) over the eight-week study period was higher than the menu cost in comparison centres ($2.28/child/day, 95% CI $2.27, $2.30).

Conclusion

To the best of the PhD candidate's knowledge, there is no evidence in the literature regarding the use of a menu box delivery style food service model in a LDC centre. The innovative combination of sector guidelines and an emerging food model could support longer-term, sustainable improvements in centre menu compliance. Overall, the outcomes of this study show that although menu compliance can be improved via a menu delivery service, impacts of mealtime provision and consumption in children were similar for intervention and comparison groups. While cooks and directors were positive about the order and delivery process for the menu box delivery service, more work is required to ensure that recipes and costs are appropriate for LDC settings. This study provides a comprehensive evaluation of the novel food service model and highlights elements for improvement.

DECLARATION

I certify that this thesis:

1. Does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and

2. The research within will not be submitted for any other future degree or diploma without the permission of Flinders University; and

3. To the best of my knowledge and belief, does not contain any material previously published or written by another person except where due reference is made in the text

Shabnam Kashef

19th December 2022

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THESIS STRUCTURE

This thesis is structured as six chapters and reports on a large cluster randomised controlled trial (RCT). The chapters that make up this thesis are the introduction, methods, three results chapters and a discussion chapter. Each chapter begins with an introduction section that positions the reader to the purpose of the chapter. Concluding each chapter is a summary section that consolidates the chapter's purpose and navigates the reader to the next chapter.

Chapter 1 provides the context for this PhD project by presenting a broad overview of the literature regarding children's dietary consumption, the rationale for nutrition promotion targeting in the early childhood education and care setting and the current state of evidence in this area of research. It also serves to shape an argument about why vegetables are targeted in the context of a healthy diet in this thesis. Finally, it outlines the thesis aims and objectives.

Chapter 2 presents a description of the development of the menu box delivery service intervention and the cluster RCT methods to implement and evaluate the novel food service model.

Chapter 3 addresses Objective 1 of the thesis and presents the process evaluation results of the trial. Process evaluation measures are outlined as (1) feasibility and fidelity, and (2) acceptability. Feasibility and fidelity was assessed using measures of menu compliance, intervention participation and retention, while acceptability was measured via cook and director feedback from interviews.

Chapter 4 provides a summary of child dietary outcomes, and addresses Objective 2 of the thesis. This chapter presents child vegetable and total food intake, and provision and waste at mealtimes. It then explores various broader dietary outcomes including nutrient and energy provision and consumption.

Chapter 5 presents the outcomes of a within-trial economic evaluation via a CEA, CCA and budget impact analysis (BIA) from the centre perspective, comparing the menu box delivery service (intervention) with the menu planning group (comparison/comparator) following best practice guidelines.

Chapter 6 summarises the findings of the trial across all outcomes and presents an interpretation and overall triangulation of the trial results as a whole. The chapter also places the outcomes of the trial into the broader context of the literature. Strengths and limitations are discussed, and recommendations for future research and practice are summarised at the conclusion of the chapter.

KEY CONTRIBUTIONS TO KNOWLEDGE

The key original contribution to knowledge made by this thesis is the development, implementation of evaluation of a novel food service model for the LDC setting. The menu box delivery service is the first known commercial adaptation of a meal kit subscription service where menus and recipes are underpinned by evidence-based guidelines. Furthermore, findings of the economic evaluation reported in Chapter 5 will specifically contribute to filling the gap formed by the lack of economic evaluation of childcare nutrition interventions.

PUBLICATIONS AND CONFERENCE ABSTRACTS OVER CANDIDATURE

Publications relating to candidature

Kashef S, Zarnowiecki D, Brown V, Arguelles JC, Cox DN, Golley RK. Cluster randomised controlled trial of a menu box delivery service for Australian long day care services to improve menu guideline compliance: a study protocol. BMJ open. 2021 Apr 1;11(4):e045136.

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Other publications during candidature:

Zarnowiecki D, **Kashef S**, Poelman AA, Cochet-Broch MO, Arguelles JC, Cox DN, Golley RK. Protocol: Application of the multiphase optimisation strategy to develop, optimise and evaluate the effectiveness of a multicomponent initiative package to increase 2-to-5-year-old children's vegetable intake in long day care centres: a study protocol. BMJ Open. 2021;11(12).

Elford A, Gwee C, Veal M, Jani R, Sambell R, **Kashef S,** Love P. Identification and Evaluation of Tools Utilised for Measuring Food Provision in Childcare Centres and Primary Schools: A Systematic Review. International journal of environmental research and public health. 2022 Mar 30;19(7):4096.

Conference Abstracts and Presentations

Kashef S, Zarnowiecki D, Brown V, Kelaart A, Cox D, Golley R (2022), Impact of Menu Box Delivery Service in Australian long day care services to improve menu guideline compliance: cluster randomised controlled trial. (Presented Virtually) ISBNPA Annual Meeting in Phoenix, USA 18-21 May 2022

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CHAPTER 1 INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

Childhood is an important period of life where nutrition is essential for healthy growth and development.[1] Early childhood is particularly influential in shaping children's health behaviours and habits.[2-6] The habits formed in this period are often carried into adulthood. Poor diet is a known risk factor for chronic disease, one that can be modified in childhood to avoid the burden of disease later in life.[3, 7-12] Dietary guidelines in both Australia and worldwide provide evidence-based advice about the types and amounts of food needed for health, growth and child development at a population level.[13, 14] Both in Australia and globally neither children nor adults are currently meeting guidelines for most food groups.[15] In particular, they are not meeting recommendations for vegetable consumption, and are consuming an excess of discretionary items.[15] There is a recognised need for and importance of interventions to improve children's food intake in the range of settings in which children eat and learn.[16, 17]

This chapter starts by highlighting the importance of establishing healthy eating behaviours in early childhood, and the childcare setting as influential in shaping these behaviours. Next, there is a narrative review of menu planning guideline interventions for childcare centres that prepare and serve meals on site. The review explores the characteristics of these interventions and the learnings, gaps and recommendations identified from the current evidence base. The barriers that childcare centre staff and cooks may experience when faced with menu planning and preparation to meet guidelines are also contextualised. This chapter provides the context and background to support the development of a novel food service model for the long day care (LDC) setting.

1.2 A Review of the Literature: Nutrition in the Early Years and the Role of the Long Day Care Environment

1.2.1 Importance of Optimal Nutrition in Childhood

A nutritious diet throughout life plays a major role in an individual's overall health, growth and development. The early years in particular are a period in which an individual experiences some of the most crucial physiological growth and development.[18] It is important that food offered to children during this time of development is adequate and conducive to healthy growth.[10] Poor nutrition throughout this time is associated with an increased risk of both short- and long-term complications. Short-term consequences include an increased risk of illness, whereas long-term consequences can manifest as impacts on development and child health, and increased risk of chronic disease later in life.[3, 19]

Key findings from the *Australian National Health Survey 2020–21* reported that half of Australians (46.6%) had one or more chronic conditions.[20] The contribution of diet to the prevention of chronic diseases such as cardiovascular disease, diabetes (type 2) and some types of cancer, has been well documented.[9, 10, 21-23] The *Australian Burden of Disease Study* identified dietary risks responsible for 5.4% of burden of disease in Australia.[24] A key strategy for managing the development of chronic disease focusses on prevention. As a key modifiable risk factor, a healthy diet can play a valuable role in preventing the burden of disease later in life.[23, 25-27] Dietary factors include diets low in legumes, wholegrains (and high fibre cereal foods) and diets high in sodium and red meat. Furthermore, diets low in nuts, seeds, fruit and vegetables contribute to a large proportion of the burden. Eating patterns established in childhood continue into adulthood and contribute to the prevention of disease later in life.[10, 25, 27, 28] This makes adequate nutrition at this stage of life crucial for establishing a foundation for lifelong health and development.

Many of an individual's dietary patterns and behaviours have been established by the time they start school as children.[5, 29] Healthy behaviours developed in early childhood often carry through to adolescence and adulthood.[8] Longitudinal data collected in China over six years, for 984 children aged 6–13 years demonstrated correlations between dietary intake across time points.[8] Furthermore, this association was not exclusive to a particular type of dietary pattern. Correlations were observed for children who initially consumed a diet high in fats, carbohydrates, vegetables, fruit or meat, regardless of intake at later timepoints. Mikkilä et al. (2005) tracked dietary patterns over 21 years for 1,037 individuals aged 3–18 years at baseline.[28] Correlations between dietary patterns in childhood and adulthood were evident in this cohort. However, because of the long study period (21 years) correlations recorded in the study were weaker than in previous studies of a similar nature. Tracking of dietary patterns from childhood to adulthood is difficult given the complexities and logistical considerations involved in collecting data over such an expansive study period.[28, 30] Targeting healthy eating behaviours during childhood is important to increase the likelihood of these behaviours being sustained into adulthood. Greater retention of healthy dietary behaviours may prevent the onset of chronic disease and obesity later in life.[3, 9, 10, 21, 22]

Early intervention is key to developing healthy behaviours.[31, 32] The early years are considered an effective period for behavioural change characterised by 'rapid transitions' and 'high plasticity'. The transition from drinking milk to eating a solid food diet, where children are offered meals and start to gain more independence is when a vast range of learning about food and dietary behaviours occurs.[33] Children begin to establish food preferences learned by associative conditioning, observing behaviours modelled by the adults around them and becoming familiar with a range of food.[29, 33] As children grow older and become more independent, their food preferences are more established than those in younger children.[33] Younger children are more likely to accept new foods as they have less established food preferences and less independence in their choices.[33] Caton and colleagues (2014) found that younger children were more likely to accept novel vegetables

than were their older counterparts.[34] They recommended that intervening before a child reaches school should be a priority as this is where parents have greater influence, and children have more plasticity.[31-33]

Clear evidence of dietary pattern trajectories from childhood to adolescence, and similar trends from childhood to adulthood indicates long-term stability in dietary patterns over time.[28] However, early childhood is an opportune life stage to target health behaviours. Particularly as younger children are more likely to accept new, healthier, foods than their older counterparts.[2, 29, 31, 33-35] Nutrition promotion interventions are needed to improve children's food consumptions from an early age.[5, 6, 36, 37] Recommendations to target eating behaviours from early childhood have remained consistent over recent decades.[2, 3, 5, 38, 39]

Dietary Guidelines In Australia

Dietary guidelines provide evidence-based advice about the amounts and types of food needed for growth, health and development. In Australia, *Eat For Health* provides the current evidence-based public health nutrition guidelines and nutrition resources.[40] The scope of this program includes the *Infant Feeding Guidelines* (birth–24 months) and *Australian Dietary Guidelines* (7 months and above), which provide evidence-based advice about the amounts and types of food for health from birth to old age.[13, 41] The 2013 *Australian Dietary Guidelines* are currently under review and the revised guidelines are forecasted to be released in 2024.[42]

The *Infant Feeding Guidelines* provide suitable, evidence-based guidelines to support optimum infant nutrition, and are the Australian response to supporting the World Health Organization (WHO) *International Code of Marketing of Breast-milk Substitutes* (the WHO Code).[41, 43] The WHO Code was created to counteract the widespread promotion of infant formula, and to protect and promote the importance and practice of breastfeeding worldwide. The evidence-based Australian *Infant Feeding Guidelines* were designed to support nutrition in children from birth to 24 months of age, encompassing practices including breastfeeding, formula feeding and transition to solid foods.

The *Australian Dietary Guidelines* provide detailed information about the types and amounts of food required for health. These guidelines were developed rigorously with consideration of the evidence via a review of the literature; understanding of population diet using data from national surveys; and food modelling. Furthermore, the *Australian Dietary Guidelines* parallel the Nutrient Reference Values (NRVs),[44] an evidence-based set of recommendations for nutritional intake that assesses the dietary requirements of population groups and individuals.[44, 45] It would be expected that through meeting the *Australian Dietary Guidelines*, an individual would meet their nutrient needs. Moreover, the guidelines were designed to recommend a dietary pattern associated with the lowest risk of chronic disease aligning with the NRVs.[44] The five *Australian Dietary Guidelines* are summarised in Table 1.1. The guidelines take into consideration the complex relationships

between food, nutrients, food groups and dietary patterns that prevent deficiency and promote health, optimal growth and chronic disease prevention.

Table 1.1 Summary of the 2013 *Australian Dietary Guidelines* taken from the *Australian Dietary Guidelines Educator Guide*. Canberra: National Health and Medical Research Council, 2013.[13]

Guideline 1	To achieve and maintain a healthy weight, be physically active and choose amounts of nutritious food and drinks to meet your energy needs.
Guideline 2	Enjoy a wide variety of nutritious foods from these five groups every day: • Plenty of vegetables, including different types and colours, and legumes/beans • Fruit • Grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties, such as breads, cereals, rice, pasta, noodles, polenta, couscous, oats, quinoa and barley • Lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans • Milk, yoghurt, cheese and/or their alternatives, mostly reduced fat (reduced fat milks are not suitable for children under the age of 2 years). And drink plenty of water.
Guideline 3	Limit intake of foods containing saturated fat, added salt, added sugars and alcohol.
Guideline 4	Encourage, support, and promote breastfeeding.
Guideline 5	Care for your food; prepare and store it safely.

Guideline 1 promotes achieving and maintaining healthy growth by meeting energy requirements for physical activity through diet. Recommendations specific to children state that, 'Children and adolescents should eat sufficient nutritious foods to grow and develop normally. They should be physically active every day and their growth should be checked regularly'.[13] The 24-hour movement guidelines, and physical activity and sedentary behaviour guidelines provide specific activity guidelines for infants, children and adults.

Guideline 2 provides specific recommendations for diet.[13, 46, 47] To complement the *Australian Dietary Guidelines*, the *Australian Guide to Healthy Eating* (AGHE) is a population-level resource that provides a visual representation of the types and proportions of food from each food group.[13, 40] Guideline 2 provides specific recommendations on the amounts of food to consume from the five food groups: (1) vegetables, (2) fruit, (3) grain (cereal) foods, (4) lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans, and (5) milk, yoghurt, cheese or their alternatives. Adequate water consumption is also promoted. Groupings of foods into the five food groups was determined by their nutrient profile and recommended amounts for consumption were determined using a food modelling system with consideration given to the nutrient requirements for each life stage and age.[13, 40, 48]

Discretionary food and drinks, such as cakes and biscuits, hot chips, pasties, confectionary, sugar-sweetened drinks and processed meats, are not included as a food group. Consumption of these foods is discouraged in Guideline 3, which states that people should 'limit intake of foods

containing saturated fats, added salt, added sugars and alcohol'.[13] Foods that fall into the discretionary items category are typically higher in saturated fat, added sugar and salt. Examples of such items include alcohol, drinks high in sugar such as sugar-sweetened soft drinks and cordials, fruit drinks and energy drinks; as well as foods high in fat such as biscuits, cakes, pastries, pies, processed meats, takeaway foods and fried foods. Discretionary items may contribute to the overall enjoyment of eating but are not necessary for providing nutrients.[13]

Consumption of discretionary foods is associated with greater intakes of energy and nutrients that contribute to the risk of obesity and chronic disease.[49, 50] Discretionary items can be energy dense and therefore contribute to an overall positive energy balance that can lead to childhood obesity.[11, 49] High consumption of sodium (salt), saturated fat and added sugar in childhood can lead to associated health impacts in adulthood such as obesity, elevated blood pressure, hypercholesterolaemia and insulin resistance. Impacts of these can snowball into the development of chronic disease in later life.[9, 20]

Consuming the recommended amounts of the five food groups as appropriate for age and gender will provide adequate energy and nutrient intake for health and wellbeing.[13, 44] In Australia and internationally, the dietary patterns of both children and adults are not meeting dietary guideline recommendations.[1, 15, 51, 52] Overall, in 2018, Australian children aged 2–3 years were exceeding the recommended daily serves of fruit and dairy, but fell short of the recommended daily serves of vegetables, cereals and grain, and meat foods.[53] Patterns were similar for children aged 4–8 years, although most were not meeting recommendations for the dairy food group. Vegetables were the most poorly consumed food group across all age groups. In 2018, 99% of children aged 2–18 years did not consume the recommended serves of vegetables.[53] More recent data (2020–21) show that this proportion, although reduced to 91% (children aged 2–17 years) remained high.[15, 53, 54]

Furthermore, Australians, even from an early age, are eating a large proportion of discretionary foods. Around one-third of Australians' energy, across all age groups, comes from discretionary food and drink.[53] Discretionary foods that contribute to a large proportion of children's diets include sweet biscuits, cakes and muffins, potato and corn chips, pastries, ice cream and fried potato products.[53] This is consistent with findings of Johnson et al.'s (2017) secondary analysis of 24-hour dietary recall data from the 2011–2012 *National Nutrition and Physical Activity Survey* that identified discretionary choice contributors to energy and key nutrient intakes in children aged 2–18 years.[50] This study revealed cereal-based takeaway foods; cakes, muffins and slices; meat pies and other savoury pastries; and processed meats as top contributors to energy, saturated fat and sodium across most age groups in children under the age of 18 years. The over consumption of discretionary foods is associated with displacement of core foods such as fruit, vegetables, cereals and breads.[40]

Inadequate consumption of the five food groups and over consumption of discretionary items is associated with a range of chronic health conditions.[13, 23, 25] Across both Australian adults and children, vegetables are the most poorly consumed food group. Recent data indicate that younger children (aged 2–3 years) are more likely to meet fruit and vegetable recommendations than are older children (aged 14–17 years). Food preferences are most malleable in early childhood and track into adulthood. This is why early intervention is essential to establish and maintain healthy dietary patterns from childhood to adulthood. In particular, increasing children's vegetable consumption in the context of an overall healthy diet is a key public health nutrition priority.

1.2.2 Vegetable Consumption in the Early Years

A considerable body of evidence has established the importance of vegetables as part of a healthy diet.[9, 13, 21, 23, 26] Vegetables are a vital source of fibre, vitamins, minerals and phytonutrients for healthy development.[13] Numerous studies and reviews have indicated the protective role vegetable consumption plays in reducing the risk of chronic diseases such as cardiovascular disease[22, 23, 25-28], diabetes[9, 10, 51], bowel cancer[9, 10, 21, 26], hypercholesterolemia[21, 27] and osteoporosis.[55] There is also substantial scientific evidence for a protective benefit of consuming a variety of vegetables—generally determined by colour (green, yellow, orange and red in Australia).[13, 57]

The WHO recommends consumption of at least 400 g of edible fruit and vegetables per day for the prevention of non-communicable diseases and nutrient deficiencies.[55] Not unlike global dietary guidelines, the *Australian Dietary Guidelines* recommend enjoying 'plenty of vegetables, including different types and colours'.[13] The importance of the vegetable food group is emphasised in the guidelines by the use of the word 'plenty'. Vegetables (and legumes) are the only food group in the guidelines of which 'plenty' should be eaten. The use of the word plenty was described as a deliberate measure to encourage increased consumption of this food group.[58] For the remaining five food groups, the guidelines instead focus on the consumption of an adequate amount.[13, 58] The *Australian Dietary Guidelines* recommend around five daily serves of vegetables for adults—equivalent to 375–450 g of vegetables each day (one serve of vegetables is ~75 g, or 100 kilojoules). The daily recommended serve of vegetables for children aged 2–3 is 2.5 serves (equivalent to ~180 g) and for those aged 4–8 years, 4.5 serves (equivalent to ~340 g).[13]

Despite national efforts to improve vegetable intake, there is a large gap between recommended and actual consumption of vegetables.[59] The 2020–21 *National Health Survey* indicated only 6.1% of Australian adults met the recommended guidelines for serves of vegetables, representing a 0.9% decrease from 2017–18, when 7.0% of adults met guidelines. While vegetable consumption by children appears to be on the rise,[15] the proportion of children meeting vegetable intake guidelines dramatically decreases with age, particularly during the transition from the 2–3-year age group to 4–8 years. Key statistics for child consumption of fruit and vegetables from the 2020–21 *National Health Survey* revealed that 27.7% of children aged 2–3 years but only 8.4% of children

aged 4–8 years met the recommendations for daily consumption of vegetables. These results overall show a promising increase in child consumption of vegetables compared with results from the 2017–18 *National Health Survey*, where 18.5% of children aged 2–3 years and 3.8% of those aged 4–8 years met the recommendations for their age group.[15] Despite increases over the last five years, Australian children's consumption of vegetables is still substantially low, particularly compared with that of other food groups such as fruit. For example, results from the 2020–21 *National Health Survey* show that 93.8% of children aged 2–3 years and 69.4% of those aged 4–8 years consumed the recommended daily amount of fruit.[60] As described earlier, the proportion of both children and adults meeting vegetable recommendations remains low.

Barriers to Children's Vegetable Consumption

Discretionary Items are Displacing the Five Food Groups

There are a number of reasons for children's low vegetable consumption. As mentioned earlier, over consumption of discretionary foods and drinks has been associated with the displacement of more healthful core foods such as vegetables.[40] Analysis of data from the *Continuing Survey of Food Intake by Individuals* (1994–1998) and the *Supplemental Children's Survey* (1998) indicated that children who ate fast food consumed fewer non-starchy vegetables than individuals who did not.[61] In Australia, more recent data indicate that discretionary foods were displacing more nutrient-dense foods, or core food groups. Discretionary foods contributed a large proportion to the overall energy intake in children aged 16–24 months. Similarly, children with higher intakes of discretionary foods and drinks had diets lower in micronutrients.[62]

The Impact of Hedonic Hunger

Recent Australian data indicate that discretionary foods continue to contribute a large proportion (40%) to the diet of children and adolescents (aged 2–18 years).[50] However, this preference for discretionary foods is not unusual. 'Hedonic hunger' refers to the drive to consume foods for pleasure and enjoyment, irrespective or nutritional need or value.[63] Discretionary foods are highly palatable and associated with greater enjoyment when consumed. These foods are typically sweeter, saltier and more energy dense than 'core foods', and are more desirable for consumption.[18, 64-66] By their nature, sweet foods are often high in carbohydrates and energy, which make their flavours more desirable.[6, 67-69] The biological impact of this pattern is evident in the preference for sweet flavours that is innate in newborns and infants.[70-73] These unlearned predispositions are likely related to the energy density associated with sugars and sweet foods.[67, 69] After infancy, the preference for sweet foods remains heightened throughout childhood before beginning to decline as children enter adolescence.[71]

Sensory Characteristics of Vegetables

Bitter flavours are the opposite of sweet and are often innately rejected by infants and children. Healthful foods such as vegetables are low in energy and typically associated with a bitter flavour, which can act as a barrier to preference or acceptance of such foods by children.[71, 74] However, the individual flavour profile of vegetables should not be overlooked.[75] Vegetables that evoke even a small perceived sweet taste, may be enough to elicit a preference for that food over more bitter vegetables.[76] Some vegetables such as carrots are well accepted by children due to the sweet flavours.[75] However, many bitter vegetables such as broccoli, are typically poorly accepted by both children and adults.[76, 77] As children are not born with a biological disposition to prefer vegetables, this makes the process of developing a preference for vegetables difficult, but not impossible. As described earlier, the five food groups, and vegetables in particular, are imperative for healthy growth and development.[9, 18, 21, 26, 34, 36, 78]

The textural characteristics of foods, particularly vegetables, are important determinants of their acceptance in early childhood. Because of the developmental stage of infants and young children, texture is a property of food that takes time to adapt to, given the length of time it takes to chew and swallow.[79] There is mixed evidence about the effect of texture on vegetable acceptance in children.[79-81] A recent study comparing the key flavour and texture properties of vegetables consumed by Australian children with the properties of other core food groups found that vegetables were harder in texture than other core foods and lower in fatty mouthfeel.[80] Hard, raw vegetables were identified in this study as being among the types of vegetable identified by previous research as well-liked by children. Previous studies have demonstrated an effect of bite effort and eating rate on food and energy intake.[82, 83] Hard foods may consumed in smaller quantities because of the increased effort required in the chewing/mastication phase of eating.[84] Children with greater exposure to different textures display greater confidence in trying more complex textures, particularly among vegetables.[82, 85]

Food Neophobia

Food neophobia is an inherent trait that leads to the rejection of foods that are novel or unknown, and is strongly related to ‘fussy eating’ in young children.[65] Food neophobia is influenced by the look, colour or expectations of a food. Evidence suggests that food neophobia peaks in children aged 2–6 years before declining in adolescence and adulthood. [2, 65] From an evolutionary perspective, food neophobia can protect an individual from consuming potentially dangerous foods.[86] The decline in neophobic tendencies towards adulthood stems from the evolutionary need for a varied diet for survival, as well as improved cognitive abilities to assess the safety of a food.[86, 87] As children become more familiar with food in general, neophobic tendencies gradually decrease over time.[65, 86, 87] Despite such decreases over time, food neophobia can interfere with children’s acceptance of novel foods, or less palatable foods such vegetables.[65, 86]

Neophobic behaviour ends when the 'phobia' towards a food item is overcome through taste or consumption.[65] Neophobic behaviour poses a unique barrier in early childhood as it prevents the acceptance of a new food through exposure. This can influence consumption of bitter foods like vegetables, which benefits from learned taste acceptance through exposure.[86] The expectation that the food will be unpleasant before experiencing it blocks the opportunity for children to learn to accept the new food.[86, 88]

Picky Eating

Rejection of a food once tasted or consumed is typically defined as 'picky or fussy' eating.[38, 65] Picky or fussy eating is distinct from food neophobia as it encapsulates the rejection of both familiar and unfamiliar foods, and is characteristically related to the taste or texture of the food once consumed.[39, 65] Unlike food neophobia, where rejection occurs before tasting, picky/fussy eaters may reject the food upon consumption.[65] Furthermore, there is no widely accepted correct terminology for picky or fussy eating behaviour in children, nor a formal tool to assess its prevalence.[39] For the purposes of this review, the term picky eating has been selected as it is currently the most common used in the literature.

It is generally agreed that peak prevalence of picky eating occurs at around 4–6 years of age[39] and affects dietary consumption.[39, 65] Poor dietary variety can lead to adverse health and development outcomes if not resolved.[39] Picky eaters often consume less fruits, vegetables, vitamins, wholegrain foods and dietary fibre.[65] A common finding among picky eaters is the reduced consumption of vegetables and a preference for nutrient-poor, energy-dense foods.[39] It is not uncommon for children identified as picky/fussy eaters to be overweight.[88] Nutrient-poor, energy-dense foods often displace healthful foods in the diet, exacerbating poor health outcomes.[13, 50, 62]

In summary, barriers influencing children's liking for vegetables include flavour, texture, food neophobia and picky or fussy eating. Early childhood is a key development stage where experiences with food shape preferences later in life. Although these barriers are considered developmentally normal, literature reviews have demonstrated that acceptance of vegetables in early childhood can be improved through repeated exposure and positive associations with vegetables throughout the first 2,000 days of life (birth–5 years). Such strategies can play an important role in increasing acceptance of such foods in early childhood.[6, 65, 68, 89, 90]

Overcoming Barriers to Children's Vegetable Consumption

As discussed, children face a number of barriers to vegetable consumption, acceptance and liking. These barriers include flavour, texture, food neophobia and picky or fussy eating. This may seem counterintuitive given the healthful properties of vegetables and positive impacts on growth,

development and health. However, there are strategies to overcome these barriers and support acceptance of vegetables. Such strategies include exposure, modelling and availability and accessibility of vegetables.

Exposure

Exposure, or repeated exposure, is a well-known strategy to increase vegetable acceptance in children. The premise of repeated exposure involves multiple encounters with the same food product, without a negative association, until a positive change in awareness of that food product is formed.[91] This strategy in particular is used to elicit positive regard to an unfamiliar taste of food and thus improve acceptance in children.[65, 68, 91-93] The effects of exposure can begin as early as in the womb, with exposure to flavours in the amniotic fluid, and after birth when flavours are transferred through breastmilk.[94]

Exposure to a variety of textures may also be a supporting factor in encouraging acceptance of foods with harder texture, such as vegetables. As described earlier, greater exposure to different textures is associated with increased confidence and acceptability of more complex textures, like vegetables. Furthermore, children with greater exposure are less likely to reject textured foods like vegetable. Delayed introduction of lumpy or chopped foods is associated with a greater likelihood of rejection of these foods.[85] This emphasises the importance of parents' and the mother's role from as early as conception, in encouraging healthy eating behaviours. Parents are at the forefront of making decisions about their child's needs and home environment, particularly during early childhood. This gives them an influential role in providing opportunities for exposure to vegetables. A lack of exposure can be a missed opportunity for creating a liking for vegetables among children.[95]

Parent and Caregiver Modelling

Parental food consumption and behaviour is another strong influence on and predictor of child consumption within the home.[93, 94, 96-98] Parents and caregivers who engage in healthy behaviours are likely to have children that exhibit similar behaviours.[97] Harper and Sanders (1975) reported that children were more likely to try a new or unfamiliar food when witnessing a parent or adults trying the same food, rather than a parent simply offering the food.[99] More recently, Draxten and colleagues found that parents who role modelled fruit and vegetable consumption were more likely to have children that met fruit and vegetable recommendations.[100] Evidence shows that parent intake of vegetables is positively associated with children's vegetable consumption.[95, 101, 102] It is evident that the role of the parent is essential to the development of food preferences from a young age.

Food Availability and Accessibility

While taste preferences are key determinants of vegetable consumption, an emerging literature recognises the effect of availability on consumption.[103, 104] Fruit and vegetable consumption is positively associated with socio-economic status (SES); however, globally, many individuals are not consuming enough vegetables regardless of SES.[103] Krølner and colleagues (2011) described availability as a multidimensional construct involving the relative importance of a variety of factors influencing the dimensions of the home, school and local area.[104, 105] These factors include presence, variety, visibility, quality, texture, cost, convenience, time, access to competitive discretionary items and methods of preparation.[104] Furthermore, the family environment, such as parents' own consumption and preferences, as well as parenting style feeding practices, all play a role in shaping children's liking of vegetables.[103, 104, 106] Recommendations suggest considering vegetable availability in environments in which children spend their time, such as their own home or that of caregivers (such as grandparents), as well as settings outside the home such as childcare.[81]

There are a number of barriers in the journey to vegetable acceptance in young children, however, strategies to overcome such barriers can support improvements in vegetable liking in young children. Key strategies include exposure, parent and caregiver modelling and vegetable availability and accessibility in the child's food environment.[65, 68, 90, 91, 101, 107] First and foremost, it is important to look at the places where children eat and learn about eating. The first role model in a child's life is that of their parent or primary caregiver, in the home.[30, 33, 68, 101, 102, 107-109]

The Home Environment and Parental Influence

Much of the early learning about food and eating occurs during the period of childhood development.[2, 5, 6] Parents and the home environment play a significant role in the development of children's eating behaviours.[94-96, 101, 102, 109-113] As described earlier, the mother's influence on child food preferences begins as early as pre-conception.[94, 102] As a child develops from infancy to childhood, transitioning from milk to solid foods, parental influence is at its peak. [4, 5] Parents are the primary caregivers who shape children's food environment and experience.[102] As gate keepers of the home food environment, parents influence when children eat, what they are eating and how much is available to eat.[33, 102, 112]

The relationship between parent and child diets has been widely investigated.[96, 101, 102, 110, 112, 113] Research over recent decades has identified an association between parents' dietary patterns and those of their children.[112] Furthermore, there is a clear relationship between parent and caregiver modelling of foods and children's food preferences.[96, 112] Parent modelling is associated with increased intake of foods when children observe their parents. Family meals in the home have been identified as a key environment in which children can eat with parents and observe their

behaviours.[109, 112] Family mealtime practices were found to be associated with higher consumption of core food groups including dairy foods, fruits and vegetables.[94, 96, 101]

Targeting Settings Where Children Eat and Learn

While parental influences and the home setting are the primary influences on children's eating behaviours, emerging evidence indicates the vital importance of community setting and a network of caregivers in influencing child health behaviours. [30, 102, 107, 114, 115] The WHO recommends implementing community-based interventions to target healthy eating.[16] In particular, evidence from high-income countries such as Australia demonstrates the effectiveness of such interventions in early childcare settings, primary and secondary schools, religious settings, sporting centres and primary health care settings.[16] An umbrella review of sensory and behavioural strategies to facilitate liking of vegetables recommended considering environments where children spend their time, such as the home and childcare settings, to target vegetable availability and consumption.[81] This is consistent with an increasing body of literature that recognises early childhood education and care (ECEC) as a key setting shaping young children's dietary behaviours.[17, 116-118]

Two main food environments have been identified to date as the most influential for children attending care: the family food environment and the childcare centre food environment.[119] The food provided in these spaces is likely to influence children's eating behaviours at a crucial developmental stage of their lives. Given how much time Australian children spend in childcare, which is only increasing, this setting provides a key opportunity to promote healthy eating behaviours.[17] Australian ECEC is categorised as formal and informal.[120] Almost half of Australian children under the age of 5 years participate in formal ECEC as their usual form of care.[120, 121] Formal ECEC services include LDC centres, family day care, occasional care services and some crèches.[120] Informal care refers to care delivered by grandparents, non-resident parents, other relatives of the children (which includes siblings) and unrelated persons (e.g. nannies, friends and neighbours).[120, 122] Most Australian children aged 1–5 years attend formal ECEC.[121, 122]

1.2.3 Childcare is an Opportune Setting

Early childhood education and care settings both in Australia and globally provide care and education services to children from birth to school age.[123] While the structure and delivery of ECEC may vary across different countries, Australia provides setting with exclusive educational programme, or integrated education and care programmes. Furthermore, all ECEC educational programmes in Australia are underpinned by the Early Years Learning Framework (Belonging, Being and Becoming) for all children prior to schooling.[124] Across Organisation for Economic Co-operation and Development countries, the enrolment rate of children in ECEC services or primary

school is 87%.[123] Australian children spend a considerable time in ECEC. Almost all of Australia's children (3.8 million) aged under 12 years participate in a form of ECEC setting. Often, by the time a child is 4 or 5 years of age, they are attending a preschool program within a LDC setting or preschool.[120] During school age (typically 5 years and over), many children begin to participate in before and after school care.[120, 123]

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Drivers of Participation in Early Childhood Education and Care

Over the last few decades, women's participation in the workforce and rates of return to work after childbirth have been on the rise.[120] Highly educated mothers are more likely to be employed or work longer hours than mothers with less educational qualifications. Trends over the period 2002–08 show an increase in mothers' educational profiles. This might be one factor contributing to women's increasing participation in the workforce.[125] Census data for two-parent households in 2000 show that among families in which the youngest child was 2 years of age, over half of the mothers were employed.[126] In families with children under 5 years of age, less than 28% upheld the traditional 'stay at home mother, working father' stereotype.[126] The increased participation of children in care has led to a substantial increase in the number of ECEC services, to keep up with demand.[120] In 2018 a total of 7,765 centre-based day care services were recorded nationwide; in 2021, this number had risen by 10% to approximately 8,554 centres.[121, 127] Over half (66%) of children participating in formal ECEC (other than preschool) were attending because of parents' work commitments.[122] The shift in parents' participation in the workforce has been a key contributing factor in the increased use of ECEC by Australian households. The increasing trajectory of child engagement with the ECEC setting makes these spaces a key novel space for targeting health promotion strategies.

Participation of Australian Children in Early Childhood Education and Care

In Australia, children's participation in ECEC is rising. Data from the *Childhood Education and Care Survey* (2011) indicate that ECEC attendance peaked for children aged 4 years. Over 80% of children aged 4 years were in some form of ECEC; 82% of these were enrolled in formal care.[122] The June quarter of 2021 recorded 46.4% of Australian children (over 1.3 million children) aged under 5 years attending approved childcare.[121] This was an increase from the June quarter of 2019, when 43.9% of Australian children attended childcare.[128] The average weekly attendance

had also increased, by around one hour (24.1 hours/week in 2019 *v*. 25.2 hours/week in 2021). More children under 5 years are attending and spending time in ECEC settings, which emphasises the importance of these spaces as a key health promotion setting.

Long Day Care Centres In Australia

For Australian children below school age, LDC is the main source of care, particularly for children aged 2–3 years.[122, 129] Children who spend the longest time in care are those who attend LDC centres. Average weekly attendance is 20 hours/week, and over 90% of these children are attending for an average of longer than 10 hours/week.[122, 129] Among children attending LDC, 52% spend around three to five days in care per week.[122] In Australia, LDC centres typically operate for a minimum of eight hours, but can be open for up to 12 hours, five days per week.

Childcare use in South Australia

Despite figures being below the national average for ECEC attendance, a large proportion of South Australian children aged 5 years or under attend some form of centre-based care. In 2021 it was recorded that 46,420 children were enrolled in centre-based care across the state.[121] South Australia offers universal enrolment for 4-year-old children in preschool, before most children start compulsory formal schooling at the age of 5 years. Prior to preschool, over 75% of South Australian children aged 3 years attend ECEC (LDC, sessional preschool and family day care).[130]

1.2.4 Governance and Regulatory Context of Early Childhood Education and Care, and Long Day Care Centres

As the most widely ratified human rights treaty in the world, the *Convention on the Rights of the Child* (1989), sets out the civil, political, economic, social, health and cultural rights of children. The charter establishes the responsibilities of governments to ensure the needs, including nutritional needs, of children are met.[131] A simplified version of the treaty states that articles 6 and 27 of the charter relate to the responsibilities of governments to ensure children lead a full life and have the right to a standard of living that meets both their physical and mental needs.[131] The Australian government ratified the treaty in 1990, and thus has the responsibility to meet the requirements set out in the charter. The ECEC setting facilitates reach to a large number of children at a key influential stage of development.[17] Given that low SES can be a determinant of poor diet quality and low research engagement, the LDC setting may also provide an opportunity to target children from low SES backgrounds.[132] As a large proportion of Australian children engage with centre-based care it is essential that these settings are governed by a legislative requirement to ensure children's needs are met.

In Australia, the *Education and Care Services National Law Act 2010* (Cth) is a national law designed to regulate education and care services for children. Under this law, the Australian

Children's Education and Care Quality Authority (ACECQA) was established as the national authority overseeing and supporting implementation of the *National Quality Framework* (NQF) for ECEC. The NQF includes the *National Law and National Regulations*, *National Quality Standards* (NQS), assessment and quality rating process of ECEC (through ACECQA) and national learning framework.[133, 134]

The NQS establishes a national benchmark for overseeing the quality of education and care services. The NQS is comprised of seven 'quality areas' that identify key outcomes for children: 1) Educational program and practice, 2) Children's health and safety, 3) Physical environment, 4) Staffing arrangements, 5) Relationships with children, 6) Collaborative partnerships with families and communities, 7) and Governance and leadership.[133] Under each quality area, specific standards and elements that centres are required to meet are outlined. Centres are assessed and rated against the NQS by the ACECQA. Centres are given a rating for each of the seven quality areas and an overall rating based on these results. The quality area pertaining to children's nutrition is Quality Area 2, Children's health and safety, described in further detail shortly.

1.2.5 Food Provision and Menu Compliance in Childcare

Regulatory Context for Long Day Care Menus In Australia

Within the NQS the benchmark relevant to healthy eating in childcare centres lies within Quality Area 2: Children's health and safety. The standards describe the aims of Quality Area 2 as being to 'safeguard and promote children's health and safety, minimise risks and protect children from harm, injury and infection'.[135] Within this area, Standard 2.1 Health states that 'Each child's health and physical activity is supported and promoted'. Element 2.1.1 requires that 'Healthy eating and physical activity are promoted and appropriate for each child'. [135] [133, 135] Additionally, the *Education and Care Services National Regulations* (2011 SI 653) briefly outline that the approved 'provider of an education and care service' must ensure that children being educated and cared for by the service have access to drinking water and are offered food and beverages that meet their nutritional needs and are adequate in quantity.[134] The regulations further require centres to cater to any specific cultural, religious or health requirements children may have. Centres are also required to ensure that a weekly menu accurately describing the food and beverages served to the children is displayed at the service premises and is accessible to parents.

Food Provision In Early Childhood Education and Care Settings

Children may consume 40–60% of their daily food intake while in care.[136, 137] Food is often served on site in centres, where meals are typically prepared fresh each day by an in-house cook. Alternatively, centres may follow a lunch box model where parents provide a packed meal for their child each day.[138] The proportions of menu and lunch box centres in Australia are unclear;

however anecdotal evidence suggests that South Australia and Victoria are menu centre dominant (e.g. 70% of LDC centres in South Australia; unpublished, Egan & Cox 2015), whereas centres in Queensland are more likely to be lunch box centres.[139]

The most common LDC food service model in South Australia is where food is provided on site, typically by an in-house cook.[17, 140] An unpublished study in 2015 reported that 70% of LDC centres in South Australia adopted this model (Unpublished, Egan & Cox, 2015).[139] LDC centres that provide food on site typically serve at least one main meal and two snacks each day. This is often a lunch meal along with a morning and afternoon snack. Some centres may opt to offer breakfast or a late snack for children attending earlier or later in the day.[141] Centres where food is provided on site can be a key setting to target health promotion interventions as they can provide an avenue to target the whole eating environment.

Menu Planning Guidelines In Australian Long Day Care Centres

There is no legislative requirement for LDC centres to provide specific quantities or proportions of a child's nutrient requirements while in care. However, services must demonstrate their ability to meet the NQS (Quality Area 2) requirement that 'healthy eating and physical activity are promoted and appropriate for each child childcare'.[133, 135] To support this need, the *Get Up and Grow: Healthy Eating and Physical Activity for Early Childhood Guidelines* (hereafter, *Get Up and Grow*) resources were developed by the Australian government to guide food provision in care settings.

Get Up and Grow is a collection of resources recognised through the NQS for ECEC, designed for use with a range of early childhood settings in mind. These resources include four books—1) *Director/Coordinator Book*, 2) *Staff and Carer Book*, 3) *Family Book* and 4) *Cooking for Children*—along with a range of additional supporting resources. The content was developed by child health and early childhood professionals underpinned by both the *Australian Dietary Guidelines* and *Infant Feeding Guidelines*, and is delivered through the Australian Government Department of Health and Ageing.[13, 41] Despite the availability of these evidence-based resources (the *Australian Dietary Guidelines*, *Infant Feeding Guidelines* and *Get Up and Grow*), guidance for specific types and quantities of food group to provide to children in care is not nationally outlined or provided.[41, 142]

In the absence of national guidelines, it is the responsibility of individual states and territories to provide their own guidelines for childcare menu provision. Across most states and territories in Australia, nutrition policy and menu planning guidelines exist to support a cook's nutrition knowledge and skills to plan and provide appropriate meals.[143] States and territories provide their own resources and guidelines for childcare menu provision. Jurisdictional guidelines outline the appropriate number of serves from each food group that should be provided to children over all eating occasions throughout the day. Examples of currently active or past resources include the

Healthy Eating Advisory Service, *Munch and Move*, *Caring for Children Guide* and *Start Right–Eat Right*. Table 1.2 provides a summary of each state/territory menu planning guidelines and resources.[140, 141, 144, 145 143]

Spence et al. (2020) identified, mapped and compared menu planning guidelines across Australian jurisdictions.[143] They concluded that state and territory guidelines were based on *Australian Dietary Guidelines* and the AGHE, but did vary to some degree. However, all guidelines recommended that each day in care should provide children with around half of their recommended daily intake from each of the five food groups (of the *Australian Dietary Guidelines* and AGHE) over one meal and two snacks.[143] The age groups covered by recommendations differed slightly across jurisdictions, ranging between 6 months and 5 years. Although all guidelines were described to meet half of a child's daily requirements, quantities in each food group varied across jurisdictions. For example, guidelines for the provision of the vegetable food group varied between 95 g and 150 g. Furthermore, most guidelines allowed no discretionary food or drink to be provided on the centre menu, with the exception of those for Queensland, South Australia and Western Australia, which allowed for less than one serve daily or less than two serves fortnightly.

Table 1.2 LDC menu planning guidelines, support and resources for each Australian state and territory, adapted from Spence et al. 2020.[143]

Jurisdiction	Guidelines	Delivery
ACT	*Menu Planning in Childcare*	ACT Nutrition Support Service, delivered by Nutrition Australia (ACT Division)
NSW	*Caring for Children—Birth to 5 Years* (food, nutrition and learning experiences resource)	NSW Ministry of Health
NT	*Long Day Care Menu Planner*	Department of Health, NT government
Qld	*Menu Planning in Queensland ECEC Settings*	NAQ Nutrition—Nutrition Australia (Qld Division)
SA	*Start Right–Eat Right* (ended 2013)	Department of Health and Human Services, SA government
Tas	*Move Well, Eat Well*	Department of Health and Human Services, SA government
Vic	*Menu Planning Guidelines For Long Day Care*	Healthy Eating Advisory Service, delivered by Nutrition Australia (Vic Division)
WA	*Supporting Nutrition for Australian Childcare* website	Edith Cowan University
Abbreviations: ACT, Australian Capital Territory; NSW, New South Wales; NT, Northern Territory; Qld, Queensland; SA, South Australia; Tas, Tasmania, Vic, Victoria; WA, Western Australia.		

The Start Right–Eat Right Program In South Australia

Currently, there are no menu planning guidelines or resources for menu planning in LDC settings in South Australia. The defunct government-funded initiative *Start Right–Eat Right* nutrition award scheme was developed to support menu planning in LDC centres. These guidelines were developed using the *Australian Dietary Guidelines* and were successfully implemented in around 80% of state centres between 2001 and 2013.[140, 146] Despite promising evidence of improvements in the food environment across participating centres, the program was ceased in 2013,[146] since which time no updated guidelines have been developed or implemented in the state.

Menu Compliance and Child Dietary Consumption In Australian Long Day Care Centres

Analysis of childcare menus both in Australia and internationally shows that centres typically do not meet local menu guidelines, particularly for vegetables.[147-151] An analysis of 46 centre menus in the Hunter New England region of New South Wales, Australia found that no centres met the menu guideline recommendations for all food groups.[151] No centres met the recommendations for vegetables and only 59% met guidelines for the meat and alternatives food group. For cereals and breads, 87% met the recommendations; for dairy, 89%; and for fruit, almost all (96%) centres met recommendations.[151] An analysis of eight centre menus in Perth, Western Australia reported similar outcomes: none met the recommendation for all food groups.[152] The food groups for which the recommended serves were least likely to meet were meat (and alternatives); dairy; vegetables; and cereals and breads.[152]

Adoption and Use of Menu Planning Guidelines In Long Day Care

Cooks play an important role in the adoption and implementation of menu planning guidelines. As described earlier, Australian LDC centre menus often do not meet guidelines.[151, 152] Research in childcare centres has shown that nutrition guidelines are of little perceived value by centre staff.[153] In one study, interviews with Australian LDC staff, including cooks, indicated that most were not using guidelines to determine the adequacy of food on their menu, and generally relied on personal knowledge.[154] Some staff were using guidelines that were no longer current or had been retired, which revealed a lack of awareness regarding updated evidence-based guidelines and resources.[154] Similarly, interviews with 14 South Australian centre cooks revealed that many cooks were not aware of menu planning guidelines or resources.[155] As a large proportion of cooks in that study had been involved in the *Start Right–Eat Right* program, many were drawing on residual knowledge from past training, as a result of their long-term employment in the LDC setting.[155] Although this residual knowledge still aligned with the *Australian Dietary Guidelines*, a gap remains for cooks who have not been in the industry long enough to have received suitable training.

Implications for Child Dietary Provision

In South Australia, an evaluation of the *Start Right–Eat Right* nutrition award scheme found that 22–50% of centres were not meeting menu guideline recommendations for the meat and alternatives, dairy and vegetable food groups at baseline. Vegetable provision at mealtimes was close to the recommendations to provide 40–60% of a child's daily requirements across the day.[156] Such findings for Australian centres are similar to those from evaluations of childcare menus internationally.[157-159] For example, an assessment of food group portions served to and consumed by 3–5-year-olds across 20 childcare centres in North Carolina, United States of America (USA), found that the quantity of vegetables served at mealtimes was below 25% of recommendations (of 2.5 cups of vegetables each day).[157]

Implications for Child Dietary Consumption

Similarly, for consumption, the *Start Right–Eat Right* evaluation found that across all food groups, mean consumption fell below recommended levels. While vegetable provision was closer to guidelines, child mealtime consumption of vegetables fell short of guidelines, by 40–60% (recommendation of 75g per day). Child-level consumption was below recommendations for all food groups except fruit.[156] Ball et al.'s (2008) study in North Carolina found that child vegetable consumption was only 16.7% of recommendations (of 2.5 cups of vegetables each day).[157]

Cooks' Role in Food Provision

Childcare staff have a key role in making decisions that will influence the centre food environment. Such decisions will influence children's dietary behaviours while in care.[154, 155, 160-162] In centres where food is provided, various staff responsibilities can affect the food environment at different levels. Managerial roles can influence the food policy and budget; educators and teachers play a key role in mealtime practices and curricula; and cooks are generally responsible for menu planning, food purchasing and preparation (Figure 1.1).[163] These responsibilities shape children's food environment end experiences by determining the availability, accessibility and variety of foods.

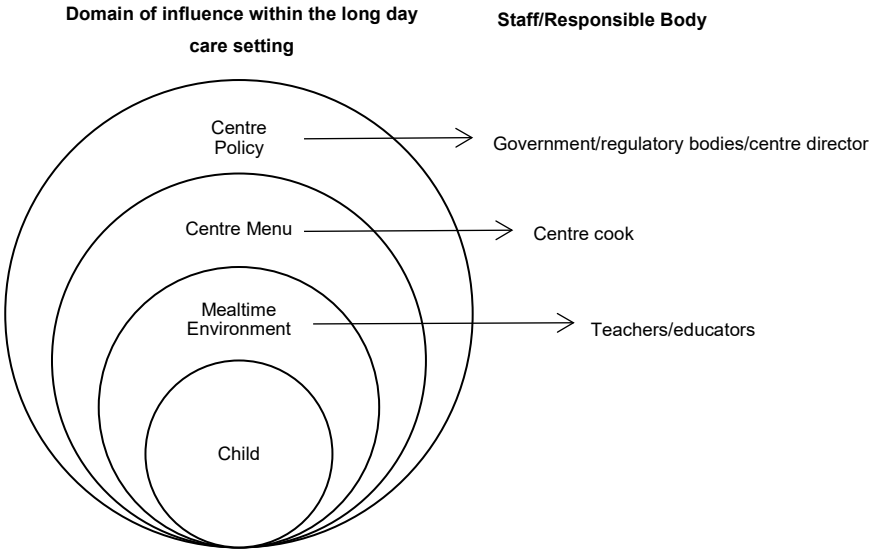

Figure 1.1 Influences on the child food environment in the LDC setting

Among these varying roles, the centre cook is the key purveyor of food to the centre. The responsibilities of a centre cook can vary depending on the operational characteristics of different centres. In brief, cooks are typically responsible for the centre menu, food preparation, ordering and procurement of ingredients and kitchen operations. Maintaining a centre menu can involve menu planning as well as writing or sourcing suitable recipes. Aside from the physical cooking and preparation of meals, cooks must also consider the nutritional requirements, specific diets and preferences of children. Procurement of ingredients can involve ordering, receiving and packing away food deliveries. Finally, cooks are often responsible for kitchen operations such as cleaning and maintenance, safe storage of food items and relevant paperwork/record keeping. Underpinning these responsibilities are centre menu budgets, staffing hours and considerations for menu planning guidelines and policies. On top of these daily responsibilities, interviews with centre staff and cooks have revealed a universal sense of responsibility for providing children with healthy and nutritious meals.[154, 155]. In Australia, childcare cooks require food safety certifications, but do not require formal nutrition training. Despite this lack of formal nutrition training, these cooks are expected to provide a nourishing and healthy menu to children while in care (NQS Quality Area 2).[135]

What Are Some of the Barriers to Meeting Menu Guidelines for Centres?

Cooks report a sense of responsibility to provide healthy meals to children under their care.[155] Despite the availability of evidence-based guidelines and resources for menu planning, LDC centres continue to fall short of meeting guideline recommendations for most food groups. Given the centre menu is the gateway to the food environment in LDC centres, it is important to explore the factors that both obstruct and facilitate the implementation of menu planning guidelines. A small body of literature exploring such factors is emerging.

A systematic review by Seward and colleagues (2017) explored factors influencing the implementation of menu guidelines in centre-based care where food is served, against the Theoretical Domains Framework (TDF).[164] The TDF combines a number of behaviour change theories into a framework comprised of 84 constructs across 14 domains.[165] The framework can be used to identify factors that influence behaviour and behaviour change. The domains are 1) knowledge, 2) skills, 3) professional role and identity, 4) beliefs about capabilities, 5) optimism, 6) beliefs about consequences, 7) reinforcement, 8) intentions, 9) goals, 10) memory, attention and decision processes, 11) environmental context and resources, 12) social influences, 13) emotion and 14) behavioural regulation.[165] Table 1.3 below summarises the domains, a definition of the domains and the constructs that make up each of the domains, adapted from Atkins et al. (2017).[166]

Table 1.3 The Theoretical Domains Framework (v2), with domain definitions and component constructs adapted from Atkins et al. 2017.[166]

Domain	Definition	Constructs
Knowledge	An awareness of the existence of something	Knowledge (including knowledge of condition/scientific rationale), Procedural knowledge, Knowledge of task environment
Skills	An ability or proficiency acquired through practice	Skills, Skills development, Competence, Ability, Interpersonal skills, Practice, Skill assessment
Social/professional role and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting	Professional identity, Professional role, Social identity, Identity, Professional boundaries, Professional confidence, Group identity, Leadership, Organisational commitment
Beliefs about capabilities	Acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use	Self-confidence, Perceived competence, Self-efficacy, Perceived behavioural control, Beliefs, Self-esteem, Empowerment, Professional confidence
Optimism	The confidence that things will happen for the best or that desired goals will be attained	Optimism, Pessimism, Unrealistic optimism, Identity
Beliefs about Consequences	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation	Beliefs, Outcome expectancies, Characteristics of outcome expectancies, Anticipated regret, Consequents
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus	Rewards (proximal/distal, valued/not valued, probable/improbable), Incentives, Punishment, Consequents, Reinforcement, Contingencies, Sanctions
Intentions	A conscious decision to perform a behaviour or a resolve to act in a certain way	Stability of intentions, Stages of change model, Transtheoretical model and stages of change

Goals	Mental representations of outcomes or end states that an individual wants to achieve	Goals (distal/proximal), Goal priority, Goal/target setting, Goals (autonomous/controlled), Action planning, Implementation intention
Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives	Memory, Attention, Attention control, Decision making, Cognitive overload/tiredness
Environmental context and resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour	Environmental stressors, Resources/material resources, Organisational culture/climate, Salient events/critical incidents, Person X environment interaction, Barriers and facilitators
Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours	Social pressure, Social norms, Group conformity, Social comparisons, Group norms, Social support, Power, Intergroup conflict, Alienation, Group identity, Modelling
Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event	Fear, Anxiety, Affect, Stress, Depression, Positive/negative affect, Burn-out
Behavioural regulation	Anything aimed at managing or changing objectively observed or measured actions	Self-monitoring, Breaking habit, Action planning

Twelve studies were identified by Seward et al. (6 qualitative and 6 quantitative).[167] The domains in which barriers were identified were most commonly identified were 'environmental context and resources', 'skills', 'knowledge' and 'social influences', 'beliefs about capabilities' and 'beliefs about consequences'. Facilitators identified included 'environmental context and resources', 'social influences', 'skills' and 'goals'.[164] The study identified 'environmental context and resources', 'social influences' and 'skills' as both barriers and facilitators for implementing menu planning guidelines in centres. Beliefs about capabilities and consequences were two domains that were identified as barriers, but not enablers.

A study in 2017 described the development and evaluation of the 75-item 14-domain Theoretical Domains Framework Questionnaire (TDFQ) adapted for use in the childcare setting to measure the implementation of menu planning guidelines (*Caring for Children Guide*).[168] The questionnaire was used to identify perceived barriers and enablers to implementation of dietary guidelines reported by 202 LDC cooks in New South Wales using the *Caring for Children Guide*.[169] The lowest scoring domains—that is, those perceived as barriers to guideline implementation—were 'behavioural regulation', 'reinforcement', 'goals' and 'emotions'. Key domains identified as

facilitators were ‘social/professional role and identity’, ‘beliefs about consequences’ and ‘intentions’.

A more recent study published in 2022 with a sample of 89 centre cooks in Victoria used the TDFQ to evaluate perceived barriers and facilitators to menu planning using the Victorian *Menu Planning Guidelines For Long Day Care* (hereafter the Victorian Menu Planning Guidelines).[141] The domains perceived as barriers by these cooks were ‘environmental context’, ‘optimism/intent’, ‘skills/role’, ‘behavioural regulation’ and ‘reinforcement/influence’. Facilitators identified included ‘knowledge/awareness’ and ‘capabilities/consequences’.[163] Within this study, domains and questions were regrouped to align with menu planning practices and address limitations identified by Grady et al. (2018).[169]

Across the two studies and review exploring the TDFQ in the long day care setting, it is evident that various domains can be identified as both barriers and facilitators to implementation of menu planning guidelines.[163, 164, 169] This could be that the domains can operate as a spectrum, where a domain can be both a barrier or facilitator dependent on the context. For example, Seward et al.’s (2017) review of barriers and facilitators identified ‘skills’ and ‘social influences’ as both barriers and facilitators.[164] Social influences relate to the interpersonal processes that cause an individual to change their thoughts, feelings or behaviours, whereas as skills is defined by an ability acquired through practice.[166] Whereas both Grady et al. (2018) and Elford et al. (2022) identified the ‘beliefs about consequences’ domain as facilitators, whereas the review by Seward et al. (2017) categorised this as a barrier.[163, 164, 169] This domain is related to the constructs such as self-confidence, self-esteem or professional confidence.[166] Suggesting that ‘beliefs about consequences’ might be common domain impacting menu planning guideline implementation in the childcare setting and cooks self-confidence may impact the implementation of menu planning guidelines. Furthermore, the ‘reinforcement’ and ‘behavioural regulation’ domains were perceived as barriers by both studies, however not identified as a key domain (as facilitators or barriers) in the review. Similarly, ‘knowledge’ and ‘beliefs about capabilities’ were classed as barriers by Seward et al. (2017), but facilitators within Elford et al. (2022).[163, 164]

As mentioned, both studies described above identified the ‘behavioural regulation’ and ‘reinforcement/influence’ domains as barriers, which was attributed to cooks’ ability to self-monitor and plan action to implement guidelines; and the recognition or reward they expect to receive when implementing guidelines.[169] The only facilitators identified by both studies pertained to ‘beliefs about consequences or capabilities/consequences’ (grouped version by Elford et al. 2022).[163] The consequences domain relates to centre cook beliefs about the benefits and disadvantages of implementing menu planning guidelines. These outcomes are supported by findings from interviews with 14 South Australian centre cooks who identified a common sense of responsibility to provide children with healthy and nutritious meals.[155] Evidently, cooks feel it is their

responsibility to provide healthy and nutritious meals to children attending care and are motivated by the belief that implementing guidelines can benefit children.[155, 163, 169]

A key barrier identified was cost; in particular that related to sourcing new foods, cooking tools, recipes and the upskilling of staff, which adds further expenditure (Seward et al. 2017).[167] An exploration of cost and menu compliance in Western Australian LDC centres identified an association between menu expenditure and likelihood of menu compliance. Centres with lower food expenditure were less likely to meet menu planning guidelines for all core food groups.[170] A study of LDC centres in the Ottawa region of Canada reported budget restrictions were a key factor in food selection in centres. In particular, participants reported that the budget affected their ability to provide suitable fruit and vegetables on the menu.[153] This may be exacerbated by the belief that new or healthy foods are not liked by children, particularly given the power that children's preferences have over menu decisions in LDC settings.[153, 155]. Matwiejczyk et al. (2019) identified that one of the most influential factors in menu decisions for all cooks was children's food preferences. Pressure is added with the addition of beliefs around the perception that healthy foods such as vegetables will cost more and may not be liked by children, resulting in food waste.[170]

Overall, cooks experience a number of barriers or difficulties to implement menu planning guidelines within long day care centres across Australia and globally. Use of the Theoretical Domains Framework to identify the barriers and facilitators to menu planning guideline implementation in the long day care setting is an emerging practice pioneered by the development of a questionnaire tailored to the setting by Seward et al. (2017).[167] Application of this questionnaire has identified the domains 'skills', 'social influences', 'beliefs about consequences', 'reinforcement' and 'behavioural regulation' are key barriers and facilitators reported by cooks in long day care settings. Considering further barriers reported by cooks such as menu expenditure (costs), child preferences and reducing waste, cooks face a number of challenges to meet menu planning guidelines within centres. The following section takes an exploration of interventions that specifically support menu compliance within centres by way of the centre menu withing childcare centres.

1.3 Narrative Review: Interventions in Centre Settings to Improve Menu Compliance

1.3.1 Introduction

Early childhood, defined here as the first five years of life, represents a period of development in which food preferences and experience are shaping.[35, 105] It is also a period when dietary behaviours are most malleable and able to be influenced. As described earlier, there is a growing

body of evidence behind the recommendation to target healthy eating opportunities in settings where children spend most their time.[16, 31, 106] Outside the home, the childcare setting has been identified as an opportune setting to target children's food environment and influence positive food preferences.[17, 171] Vegetable consumption among Australian children and adults has been persistently low, while discretionary food and drinks contribute to around a third of energy consumption.[15, 53] The childcare setting provides a key opportunity to focus on interventions to improve dietary quality, particularly vegetable consumption, and in an environment where discretionary items are restricted.[143]

Previous reviews have broadly explored interventions to improve diet quality or vegetable consumption in children aged under 5 years[14, 31, 172, 173] An umbrella review exploring the characteristics of healthy eating interventions in childcare settings in children aged 2–5 years was published by Matwiejczyk et al. in 2018.[171] The primary aims of the review were threefold: to identify (1) the effectiveness of interventions to promote healthy eating in children aged 2–5 years attending centre-based childcare; (2) intervention characteristics associated with promoting healthy eating and; (3) recommendations for child health policies and practices.[171] The study identified 12 relevant systematic reviews, which included 101 primary studies. Findings indicated that centre-based healthy eating interventions can be effective. More importantly, multicomponent and multilevel interventions that target both environmental level and individual outcomes are more likely to be successful.

Hodder et al. (2020) conducted a living systematic review of interventions to increase fruit and vegetable intake in children aged 5 years and under, which identified 80 interventions. Of these interventions, very few led to improvements in vegetable consumption. Furthermore, the studies identified in the review were limited in terms of quality of evidence and magnitude of effect. This review was preceded by Golley and Bell's (2015) review of interventions to improve child diet quality more broadly in early childhood settings, which identified a total of 26 studies set in childcare (*n* = 14), preschool (*n* = 10), family day care (*n* = 1) and nursery school (*n* = 1) settings.[172] The review identified that small increases in fruit and vegetable consumption in studies were associated with environmental determinants, suggesting that interventions that target the centre environment, such as the menu, could improve children's dietary consumption.

Hendrie et al. (2016) published a review that identified intervention characteristics associated with increasing consumption of vegetables in children in a broad age group of 2–12 years, specifically focussing on the home and community settings.[31] The review identified six studies set in preschool or childcare settings from a total of 22 studies. Promisingly, the review identified interventions delivered in preschool and childcare settings as more effective than those in the home, particularly in the long term. More recently, Nekitsing et al. (2018) narrowed their systematic review to analyse interventions that increase vegetable consumption in children aged 2–5 years in the childcare or

home setting.[173] While the review found taste exposure to be the most successful strategy for improving vegetable consumption, effective strategies were identified as those that targeted food service—such as food portions, accessibility and availability or food provision—along with nutrition education.

Key characteristics associated with successful multicomponent interventions included the centre environment, an educator component, a child component and a parental component.[171] Interventions in centre environments involved healthy policy changes and modifications to both meals and snacks in the menu. Specific recommendations included making vegetables easily available and implementing family-style meals where vegetables are served in advance. Educator components included educator mealtime training and positive mealtime behaviours such as role modelling, encouragement and allowing children to self-select meals.[171] Child recommendations included providing age-appropriate activities related to food and nutrition, and interactive skill development sessions involving children in hands-on activities such as cooking, food preparation and growing vegetables. Another recommended component was the involvement of parents in multiple capacities such as engagement in curriculum and policy planning, education information, providing written material about food and menus, and education.[171] Furthermore, interventions with frequent application, and long-term interventions of greater than one year, were more likely to be successful. Research recommendations by authors of the review suggest drawing on existing activities, measuring cost-effectiveness, measure children's dietary changes, conducting longer follow-up periods and high-quality RCTs, collaborating with parents and measuring the impact of engagement, identifying barriers to implementation, and targeting environmental- and individual-level determinants (multicomponent and multilevel interventions). [171]

Matwiejczyk et al.'s umbrella review (2018) identified the centre environment as a key element of multicomponent interventions, echoing the findings of other key systematic reviews discussed earlier.[31, 106, 173] Both Golley and Bell (2015) and Nekitsing et al. (2018) identified effective strategies as those that included food services.[172, 173] This is consistent with recommendations from Hendrie et al. (2017) to focus on meals.[31] Hendrie et al. (2017) identified initiatives that aimed to improve vegetable intake in care that focus on whole meals within the context of a balanced diet, rather than isolating the food group were more effective.[31] Paired with a focus on both meals and snacks in the centre menu, this further solidifies the importance of the centre menu in supporting healthy eating behaviours.[31] All of these align with recommendations by Matwiejczyk et al. (2018) to target food and nutrition policies, and the food environment.[171]

The Cook and Menu are at the Supply Level of the Centre Food Environment

The food environment in the LDC setting is complex and there is a multitude of key players including children, staff, cooks, parents and policy when considering child food provision and consumption. In childcare centres where food is provided, the centre menu, while informed by

policy, shapes the food environment (Figure 1.1). More importantly, it is the entry point for food availability and accessibility. It could be considered counterproductive to focus on elements at the child or mealtime level if the centre menu does not meet guidelines. It is both rational and logical to ensure the centre menu and food environment is conducive to supporting improvements in child provision and consumption of core food groups and vegetables. While multicomponent interventions have been proven to have some effect, it is moderate, and adoption at scale can be difficult given that some interventions can be quite intensive for centres to adopt. Therefore, innovation and refinement are needed within each component to ensure adoption and sustainability of health promotion interventions in childcare settings. By targeting centre cooks as the key driver of the menu, we can ensure that the food supply at the centre is suitable before concentrating on other elements such as mealtime practices.

Furthermore, the menu is, typically, solely the responsibility of cooks in most centre settings. Cooks are the key players in the procurement and provision of the centre menu. As established earlier in this chapter, LDC centre menus in Australia often do not meet guidelines.[148, 151, 152] While guidelines and supporting resources are available to assist cooks in implementing guidelines in their centres, evidence shows that these are not often understood or actioned by cooks.[154, 155] Support for cooks thus far has traditionally been online or paper resources and/or provision of training. Given the importance of the role of a childcare cook as the first step to creating a healthy food environment within centres, interventions to specifically target cooks and the centre menu to align with guidelines is the topic on an emerging body of literature over the past decade.

Currently, there is no clear understanding of the characteristics and effectiveness of interventions that target the menu. To gain a deeper understanding of the types of intervention and their outcomes, a narrative review of the literature was conducted. The aim of this narrative review was to first identify interventions that target implementation of menu planning guidelines in centres where cooks prepare meals. More specifically, the review explored the characteristics of these interventions and the outcomes measured, as well as their effectiveness in improving outcomes, such as the food environment or child dietary outcomes. The followings sections describe the findings of this narrative literature search of interventions or cohort studies that aimed to support implementation of menu planning guidelines in childcare settings. In particular, the characteristics and findings of these interventions are explored.

1.3.2 Search Methods

Inclusion and Exclusion Criteria

Studies were included if 1) the study reported outcomes related to trials or cohort studies on interventions, strategies or programs to support menu compliance with local guidelines, 2) the study was in a centre-based ECEC setting, 3) the primary sample included children aged 2–5

years, and 4) the study reported any outcomes related to menu compliance, child dietary provision or consumption, staff feedback, or feasibility and acceptability. All studies were published in English with no limits on publication date applied. Studies were excluded if 1) the setting was a school, family or home-based care, or community setting outside the ECEC setting, 2) the primary sample was children 5 years or older, or 3) they involved settings where menu planning and food provision did not occur on site. Protocol papers, literature reviews, conference papers and non-English publications were excluded.

Search Strategy and Screening

A search was completed on 5 April 2022 using Web of Science, PubMed and Scopus. Search terms were as follows:

> Childcare*: childcare, day care, long day care, preschool, early childhood education and care, ECEC, childcare cent*, child day care cent**
>
> Menu: *menu, menu-planning, menu planning, nutrition guidelines, dietary guidelines, menu compliance, cook*
>
> Intervention: *intervention*, nutrition, intervention trial*, strateg*, program*, implementation randomized controlled trial*

A hand search was completed to identify any known or additional relevant literature. All results were imported into Covidence (Veritas Health Innovation, Melbourne, Australia) where duplicates were identified and removed prior to screening. Title, abstract and full-text screening was performed using Covidence and performed by the PhD candidate.

Data extraction focussed on the study sample, design, intervention length and delivery, menu guidelines, outcome measures and key outcomes, particularly those related to vegetable outcomes where available. The quality of each individual study was assessed using the Effective Public Health Practice Project Quality Assessment Tool for Quantitative Studies.[174] Assessment outcomes of this tool provide an overall rating of weak, moderate or strong. Overall assessment is determined by the rating of six components: 1) selection bias, 2) study design, 3) confounders, 4) blinding, 5) data collection method and 6) study dropouts. Where two or more domains were rated as weak, studies were categorised as ‘weak’; studies with one weak rating were categorised as ‘moderate’; and studies with no weak ratings were rated as ‘strong’.

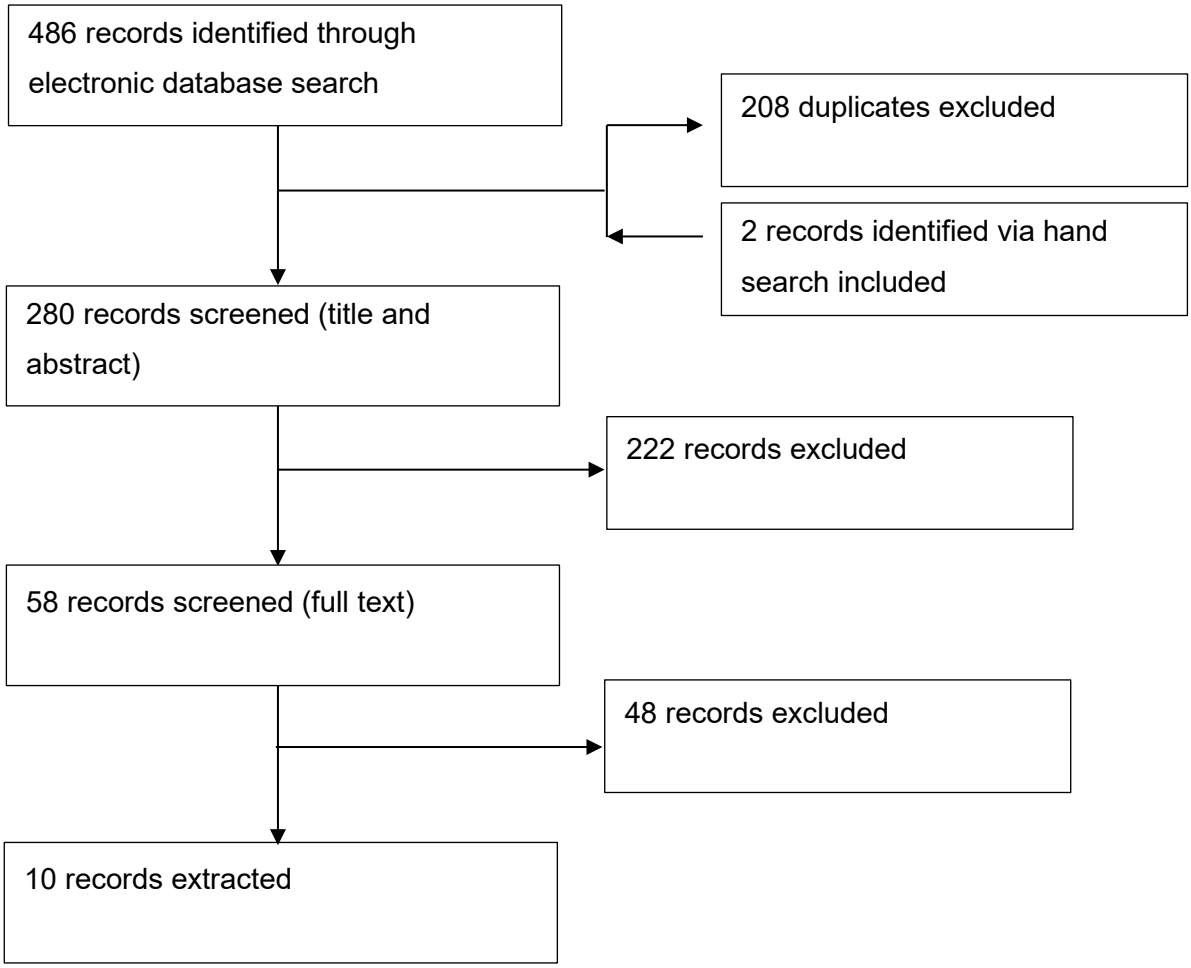

Figure 1.2 Narrative literature search flow

1.3.3 Results

Study Design and Characteristics

A total of ten papers were identified from the search, reporting the outcomes of eight interventions (Figure 1.2). A number of publications reported outcomes of the same, concurrent, or embedded studies. Yoong et al. (2020) reported the child-level outcomes of the same intervention reported by Grady et al. (2020b).[175, 176] Three publications identified by the search reported outcomes of a concurrent study. Grady et al. (2020b) reported the 12-month follow up outcomes of three intervention arms: high intensity, low intensity and control.[177] Each intervention arm was an individual study that ran concurrently, but each shared the same control group. Two publications reported the six-month outcomes of each intervention arm: low intensity intervention (Finch et al. 2018) and high intensity intervention (Seward et al. 2017).[147, 164] Grady et al. (2020b) reported 12-month follow up for both studies, examining longer-term outcomes and whether findings at six months were sustained over time.[177] Because of the differing outcomes reported in each paper, each was treated as a separate intervention for the purposes of this review. No date limits were set on the search, but publication date for studies ranged over a five-year span from 2016 to 2021.

Most of the studies were set in Australia (*n* = 8),[147, 150, 156, 175-179] while one was conducted in Thailand (*n* = 1)[180] and another in Canada (*n* = 1).[181]. Most studies described the setting as a LDC centre (*n* = 7), two studies described the setting as a childcare centre (*n* = 2), and the remaining studies were set in preschools situated within schools (*n* = 1).[180] Eight studies were RCT (*n* = 8), and two were pre-post cohort designs (*n* = 2).

1.3.4 Intervention Design and Delivery

One study provided centre cooks with educational material and a menu planning checklist without any research involvement or training (Table 1.3).[179] Eight of ten publications reported multi-strategy interventions that involved provision of staff training and resources.[147, 150, 156, 175-178, 180, 181] Suwimol et al. (2021) provided preschools with a multicomponent intervention pack, but no training was provided to staff.[180] All interventions that reported delivery of training sessions involved both cooks and centre directors. Training was delivered by staff with a nutrition or dietetics background. Where implementation frequency was reported, training sessions were delivered in person and ranged from two to three hours or was described as full-day training. Yoong et al. (2020) and Grady et al. (2020b) implemented follow-up support calls to centres at two and eight weeks; and then six and eight months during a 12-month intervention period.[175, 176] Two interventions offered centres booster training in person[181] and online.[175] [149] One intervention (outcomes reported across two studies) evaluated the implementation of a web-based menu planning tool.[149, 175] Three interventions provided feedback on centre menus via an assessment or audit by implementation staff.[147, 150, 156, 175, 177] All interventions described implementation or provision of resources by research staff.

Table 1.4 Characteristics of interventions supporting menu compliance in ECEC settings

Reference	Study setting, design & country	Sample	Menu planning guidelines, intervention description & duration/follow up	Outcomes reported	Quality rating
Abobakar et al. 2021	Childcare centre Waitlisted cluster RCT Canada	Centres: 29 Staff: NA Children: NA	Guidelines: *Saskatchewan Childcare Nutrition Guidelines* Intervention: *Healthy Start/Depart Sante* initiative. Program consists of 6 components: 1) implementation manual, 2) 2-hr on-site training session (followed by boosters), 3) evidence-based resource provision, 4) supplementary resources, 5) communication strategy between parents, communities and organisations, and 6) inter-sectional partnerships with organisations. Duration/follow up: 8 mths	Congruence between planned menus and actual food served and adherence to guidelines	Moderate
Bell et al. 2015	Long day care centre Pre–post cohort study Australia	Centres: 20 Staff: NA Children: NA	Guidelines: *Start Right–Eat Right* (South Australia) Intervention: Centre director and cook nutrition training delivered by program dietitians. The training covered general child nutrition, importance of children's eating environment, menu modification, and developing and improving a nutrition policy. Post-training, program dietitians worked with centres to analyse centre menu. Duration/follow up: 6 mths	Child dietary food group provision and consumption Menu compliance with guidelines Intervention fidelity: nutrition policy, menu, food safety training and eating environment	Moderate
Grady 2020a et al.*	Long day care centre Parallel group RCT Australia	Centres: 52 Supervisors: 25 (Intervention only) Children: NA	Guidelines: *Caring for Children—Birth to 5 Years* (New South Wales [NSW]) Intervention: Centres received access to a web-based menu planning program and training/support from a qualified nutritionist/dietitian. Support consisted of 1) face-to-face (3 hr) training session in use of program, 2) support calls to centres at 2 wks, 8 wks, 6 mths and 8 mths (5–30 mins each point), and 3) support content provided via newsletter at 4 months. Centres were provided with a tablet to support integration of the menu planning program into practice. Duration/follow up: 3 mths	Menu compliance with guidelines Mean servings of individual food groups on menu Menu planning program use Intervention delivery and acceptability	Moderate

Table 1.4 Characteristics of interventions supporting menu compliance in ECEC settings

Reference	Study setting, design & country	Sample	Menu planning guidelines, intervention description & duration/follow up	Outcomes reported	Quality rating
Yoong et al. 2020*	Long day care centre Cluster RCT Australia	Centres: 35 Staff: NR Children[b] Diet quality: 334 Diet Observation: 297	Guidelines: *Caring for Children—Birth to 5 Years* (NSW) Intervention: Centres received access to a web-based menu planning program and training/support from a qualified nutritionist/dietitian. Support consisted of 1) face-to-face (3 hr) training session in use of program, 2) support calls to centres at 2 wks, 8 wks, 6 mths, 8 mths (5–30 mins each point), and 3) support content provided via newsletter at 4 months. Centres were provided with a tablet to support integration of the menu planning program into practice. Duration/follow up: 12 mths	Child dietary food group consumption (observed and educator reported) Child BMI z-scores and HRQoL	Moderate
Grady et al. 2020b**	Long day care centre Three-arm RCT Australia	Centres: 59 Staff: Cook: 59 Children: NA	Guidelines: *Caring for Children—Birth to 5 Years* (NSW) Intervention: Two intervention groups—low intensity (LI) and high intensity (HI)—plus control group. Multi-strategy implementation intervention including 1) securing executive report and update to nutrition policy (HI only), 2) provision of staff training involving 1-day face-to-face menu planning workshop (LI & HI), 3) provision of resources (LI & HI), 4) menu audit and feedback from study staff (LI–once, written only; HI–twice, written and oral), 5) implementation support from support officer including two face-to-face contacts following workshop and provision of two newsletters (HI only). Control: posted a hard copy of the *Caring for Children* resource, and continued usual practice/support. Duration/follow up: 6 mths	Menu compliance with guidelines Mean servings of individual food groups on menu	Moderate

Table 1.4 Characteristics of interventions supporting menu compliance in ECEC settings

Reference	Study setting, design & country	Sample	Menu planning guidelines, intervention description & duration/follow up	Outcomes reported	Quality rating
Seward et al. 2017**	Long Day Care Centre Parallel Group RCT Australia	Centres: 44 Staff [a] Supervisors: 38 Cooks: 40 Children: NA	Guidelines: *Caring for Children—Birth to 5 Years* (NSW) Intervention: Multi-strategy implementation intervention involving: 1) securing executive report; memorandum of understanding outlining each party's responsibilities for implementing guidelines and updating policy 2) provision of staff training; 1-day face-to-face menu planning workshop (cooks and supervisors) 3) provision of resources (written) 4) audit and feedback (from staff) on menu 5) implementation support from support officer; 2 face-to-face contacts following workshop, two newsletters. Control: posted a hard copy of the *Caring for Children* resource, plus continued usual practice/support. Duration/follow up: 6 months	Menu compliance with guidelines Mean servings of individual food groups on menu Service-level child dietary food group consumption	Moderate
Finch et al. 2019**	Childcare centre Parallel group RCT Australia	Centres: 44 Staff [a] Supervisors: 42 Cooks: 41 Children: NA	Guidelines: *Caring for Children—Birth to 5 Years* (New South Wales) Intervention: Provision of training, written menu feedback and printed resources to centres by implementation support officers, including face-to-face, over the phone or email correspondence. Duration/follow up: 6 mths	Food group compliance with guidelines Cook knowledge of menu guidelines Intervention uptake, fidelity and acceptability Theoretical Domain Framework constructs	Moderate

Table 1.4 Characteristics of interventions supporting menu compliance in ECEC settings

Reference	Study setting, design & country	Sample	Menu planning guidelines, intervention description & duration/follow up	Outcomes reported	Quality rating
Suwimol et al. 2021	Preschool (within schools) Pre–post cohort Thailand	Schools: 4 Staff: NA	Guidelines: *Thai School Lunch Guidelines* Intervention: Multicomponent study targeting 3–5 year olds, which involved: 1) hero plate: portion-controlled plate to help staff match the amount of food required for each food group 2) hero book and stickers: children who completed their meals received stickers and a full book of stickers could earn a reward 3) hero menu: 16 menus developed by dietitians, chefs and school staff to meet *Thai School Lunch Guidelines* 4) hero content: knowledge related to healthy eating and physical activity, and nutrition posted on Facebook for school staff and parents; schools encouraged to print and post content in school. Duration/follow up: 4 mths (1 semester)	Frequency of foods served in school lunch Nutrient profiling scores of menus Child dietary food group and nutrient consumption Percentages of food, energy and nutrient consumption compared to the *Thai School Lunch Guideline* values	Weak
Yoong et al. 2016	Long day care centre Parallel group RCT (post-intervention data only) Australia	Centres: 77 Staff Cooks: 77 Children: NA	Guidelines: *Caring for Children—Birth to 5 Years* (NSW) Intervention: Intervention cooks were mailed a 2-page education resource and the menu planning checklist from the *Caring for Children* resource. Control: continued usual practice Duration/follow up: 1–8 wks	Cook-reported number of serves of fruit and vegetables provided on menu in the previous week Cook intentions (to implement guidelines) Awareness of guidelines or other implementation support Intervention receipt	Moderate

Table 1.4 Characteristics of interventions supporting menu compliance in ECEC settings

Reference	Study setting, design & country	Sample	Menu planning guidelines, intervention description & duration/follow up	Outcomes reported	Quality rating
Yoong et al. 2019	Long day care centre Exploratory cluster RCT Australia	Centres: 25 Staff: NA Children: NA	Guidelines: *Caring for Children—Birth to 5 Years* (NSW) Intervention: Nested evaluation within a larger study (Seward et al. 2017) for information. Intervention centres received an intervention delivered by implementation staff that involved: 1) securing executive support at the commencement of the intervention via service managers and cooks 2) provision of group training 3) provision of resources, audit and feedback 4) one-on-one implementation support provided by an experienced implementation support officer Duration/follow up: 6 mths	Child dietary food group consumption Child diet quality while in care	Moderate

*Yoong et al.'s (2020) study was embedded within Grady et al.'s (2020a) reporting on child-related outcomes

**Seward et al.'s (2017) 6-month follow up and Finch et al.'s (2019) 6-month follow up studies ran concurrently and shared the same control group; Grady et al. (2020b) reported 12-month follow up for both studies

[a]Total sample completed the survey at follow up

[b]Total sample at follow up

Abbreviations: BMI, Body mass index; HRQoL, health-related quality of life; NA, not applicable; NR, cot reported; RCT, randomised controlled trial

Table 1.5 Key outcomes of interventions supporting implementation of menu planning guidelines in the ECEC setting

Reference	Outcomes measured	Measurement tool/methodology	Key findings	Vegetable-specific findings
Abobakar et al. 2021	Congruence between planned menus and actual food served, and adherence to guidelines	Foods served: weighed plate waste Menu: menu assessment Indicators of congruence with menu: percent match, omissions, additions, substitutions and total match	<u>Adherence of the planned menus to the guidelines</u> Increased adherence to the guidelines for breakfast (80% to 100%), lunch (12.5% to 18.8%) and foods to limit (37.5% to 43.8%) among the intervention centres ($p < 0.05$) No improvements at usual practice centres, with the exception of the guidelines on foods to limit (27.8% to 44.4%) <u>Frequency of total food listed on menus *v.* items served at endpoint</u> Intervention centres: match, *n* = 123, 76.4%; substitutions, *n* = 8, 5.8%; omissions, *n* = 8, 5.8%; additions, *n* = 32, 19.9%; total match, *n* = 129, 80.1% (out of 161 items) Usual practice centres: match, *n* = 96, 61.9%; substitutions, *n* = 12, 7.7%; omissions, *n* = 16, 12.9%; additions, *n* = 47, 30.3%; total match, *n* = 108, 69.7% (out of 155 items)	<u>Frequency of food listed on menus *v.* items served at endpoint</u> Vegetables Intervention centres: match, *n* = 19, 67.9%; substitutions, *n* = 3, 3.7%; omissions, *n* = 2, 8.3%; additions; *n* = 6, 21.4%; total match, *n* = 22, 13.7% Usual practice centres: match, *n* = 21, 58.3%; substitutions, *n* = 4, 11.1%; omissions, *n* = 3, 10.7%; additions, *n* = 11, 30.6%; total match, *n* = 25, 16.9%

Table 1.5 Key outcomes of interventions supporting implementation of menu planning guidelines in the ECEC setting

Reference	Outcomes measured	Measurement tool/methodology	Key findings	Vegetable-specific findings
Bell et al. 2015	Menu compliance with guidelines, child dietary provision and intake	One fortnight of menu analysed using invoice-based Menu Assessment Tool Child provision and intake measured via plate waste	Number of centres meeting menu compliance, n (%) BL 0(0%), FUP 15(75%) Mean menu criteria compliance (of a maximum of 25) BL 14.9(1.9), FUP 24.2(2.5), p < 0.001 (paired t-test) Significant improvements in number of median (IQR) serves on menu (p < 0.05): Meat and alternatives, BL 0.8 (0.6–0.9), FUP 1.1 (1.0–1.3) (p = 0.001) Child provision and consumption Provision of core food groups increased significantly (p < 0.001) While the provision of vegetables increased, the increase in consumption was not statistically significant Nutrient provision and consumption of energy from BL to FUP increased, but still below 50% benchmark	Median daily servings of vegetables on menu significantly improved (p < 0.001) from 1.0 serves (IQR 0.6–1.2) at BL to 1.4 serves at FUP (IQR 1.1–1.8) Median daily child mealtime servings of vegetables: BL 1.0 (IQR 0.6–1.2) *v*. FUP 1.4 (IQR 1.1–1.8) (p < 0.001) Median daily child mealtime consumption of vegetables: BL 0.4 (IQR 0.0–0.9), BL 0.55 (IQR CI 0.0–1.0) (p = 0.083)

Table 1.5 Key outcomes of interventions supporting implementation of menu planning guidelines in the ECEC setting

Reference	Outcomes measured	Measurement tool/methodology	Key findings	Vegetable-specific findings
Grady 2020a et al.*	Menu compliance with guidelines and servings of individual food groups on menu Supervisor feedback	Menu review by dietitian/nutritionist Supervisor feedback via questionnaire	<u>Mean number of food groups compliant (out of 6), mean(SD) (p > 0.05)</u> Intervention BL 1.19(1.33), 3-mth FUP 2.15(1.90), 12-mth FUP (*n* = 25) 1.80(1.55) Control BL 0.96(1.13), 3-mth FUP 1.41(1.15), 12-mth FUP 1.30(1.10) <u>Compliance for all food groups (out of 6), *n* (%)</u> Intervention BL 0(0), 3-mth FUP 1(4), 12-mth FUP 0(0) Control BL 0(0), 3-mth FUP 0(0), 12-mth FUP 0(0) <u>Number of food groups compliant (of a total 6), mean(SD):</u> Intervention: BL 1.19(1.33), FUP 2.15(1.90) Control: BL 0.96(1.13), FUP 1.41(1.15) Mean difference(95%CI): 0.52(–0.35–1.9 = 39), p = 0 <u>Supervisor feedback questionnaire</u> 84–92% agreement with questionnaire items	Vegetable intervention: BL 1(4), FUP 6(22) Control: BL 1(4), FUP 4(15) OR(95%CI): 1.65(0.07–40.33), p = 0.76
Yoong et al. 2020*	Cook-reported number of serves of fruit and vegetables provided on menu in the previous week and Theory of Planned Behaviour constructs	Cook self-reported questionnaire	<u>Cooks in the intervention arm had significantly higher mean(SD) scores on:</u> Intention to use the guidelines: Intervention 6.6(0.4) Control 6.2(0.6), (p = 0.0005) Perceived behavioural control: Intervention 6.2(0.6), Control 5.8(0.8) (p = 0.0008) Attitude: Intervention 6.7(0.4), Control 6.4(0.5) (p = 0.0071) Social norms: Intervention 6.1(0.8), Control 5.8(0.8) (p = 0.6088)	Mean(SD) serves of vegetables on the menu (self-reported) Intervention: 3.8(0.4) serves, Control: 3.3(0.8), (p = 0.0573)

Table 1.5 Key outcomes of interventions supporting implementation of menu planning guidelines in the ECEC setting

Reference	Outcomes measured	Measurement tool/methodology	Key findings	Vegetable-specific findings
Grady et al. 2020b**	Menu compliance with guidelines and servings of individual food groups on menu	Menu review by dietitian/nutritionist	No centres in the intervention and control groups were compliant with overall menu guidelines at baseline or follow up <u>Low intensity (LI) *v*. Control intervention group:</u> Significantly greater proportion of centres compliant for dairy food group, (multiple imputation: no longer significant) relative to control Significantly greater number of food groups compliant with guidelines, relative to control Significant increase in servings of fruit, dairy and discretionary items in the LI intervention relative to Control <u>High intensity (HI) *v*. Control intervention group:</u> Significantly greater proportion of centres compliant for vegetables, fruit, dairy, breads and cereals, and discretionary food groups, (multiple imputation: no longer significant) relative to control Significantly greater number of food groups compliant with guidelines, relative to control Significant increase in servings of vegetables, fruit, dairy and discretionary items found in the HI intervention relative to control <u>LI *v*. HI intervention group:</u> Pairwise comparisons indicated a significant difference between the intervention groups for servings of vegetables	Pairwise comparisons indicated a significant difference between the intervention groups for servings of vegetables Group interaction: significant differences in the servings of individual food groups found between groups for vegetables, fruit, dairy and discretionary items

Table 1.5 Key outcomes of interventions supporting implementation of menu planning guidelines in the ECEC setting

Reference	Outcomes measured	Measurement tool/methodology	Key findings	Vegetable-specific findings
Seward et al. 2017**	Menu compliance with guidelines and servings of individual food groups on menu Child service-level consumption	Menu compliance: menu review by dietitian/nutritionist Child-level outcomes: service-level plate waste measures	One intervention service (4%) and no control services were compliant with overall menu guidelines at baseline or follow up <u>Food group menu compliance:</u> Fruit (p = 0.0024) Meat and meat alternatives (p = 0.023) Dairy (p = 0.006) Discretionary foods (p = 0.002) Significant difference between groups at follow up in mean number of food groups compliant in intervention services, mean difference 1.57; 95% CI 0.82, 2.33 (p ≤ 0.001) Child service-level consumption Significant improvements in consumption in the intervention services found for vegetables: adjusted difference 0.70; 95% CI 0.33, 1.08 (p < 0.001) and fruit: adjusted difference 0.41; 95% CI 0.09, 0.73 (p = 0.014)	Child service-level vegetable consumption Intervention BL 0.58(0.45) FUP 1.33(0.60), Control BL 0.51(0.37) FUP 0.56(0.27) Using all available data OR 0.70, 95% CI 0.33, 1.08 (p ≤ 0.0001) Using all multiple imputation OR 0.56, 95% CI 0.19, 0.94 (p = 0.005)
Finch et al. 2019**	Food group compliance with guidelines Cook knowledge of menu guidelines Intervention uptake, fidelity and acceptability Theoretical Domain Framework constructs	Menu review by trained research staff (2 wks of menu)	<u>Menu compliance with guidelines</u> No centres in the intervention and control groups were compliant with overall menu guidelines at baseline or follow up No centres showed significant improvements in number of serves of food groups on menu <u>Cook knowledge of correct serves *n* (%)</u> Intervention: BL 5(31.3) FUP 14(93.3), Control: BL 4(30.8) FUP 4(36.4), p = 0.008 (adjusted) <u>Cook and manager acceptability questionnaire</u> Acceptability across cooks and managers scored 71–95%	No centres in the intervention and control groups were compliant for vegetable food group at BL or FUP Number of centres compliant with vegetables food group: Intervention BL 0(0), FUP 0(0); Control BL 0(0), FUP 0(0), OR(95% CI): NA, p = NA

Table 1.5 Key outcomes of interventions supporting implementation of menu planning guidelines in the ECEC setting

Reference	Outcomes measured	Measurement tool/methodology	Key findings	Vegetable-specific findings
Suwimol et al. 2021	Frequency of foods served in school lunch Nutrient profiling scores of menus Child consumption compared with the *Thai School Lunch Guideline* values	Menus examined against Thai nutrient profile by research staff Consumption measured via service-level plate waste	<u>Child consumption of foods:</u> Fruit increased by 44.8% from 8.1 (3.9, 12.4) g to 11.7 (5.4, 21.8) g ($p < 0.001$) Rice and starchy foods increased by 12.6% from 47.6 (37.1, 59.3) g to 53.6 (41.7, 66.1) g ($p < 0.001$) Meat increased by 2.0% from 32.8 (24.2, 43.5) g to 33.5 (26.1, 42.0) g ($p = 0.85$)	Child vegetable consumption increased by 127.2% from 6.0 (3.2, 12.9) g to 13.7 (6.7, 18.9) g, $p < 0.001$).

*Yoong et al.'s (2020) study was embedded within Grady et al.'s (2020a) reporting on child-related outcomes.

**Seward et al.'s (2017) 6-month follow up and Finch et al.'s (2019) 6-month follow up studies ran concurrently and shared the same control group; Grady et al. (2020b) reported 12-month follow up for both studies.

Abbreviations: BMI, Body Mass Index; HRQoL, Health-related quality of life; NA, not applicable; NR, not reported; RCT, randomised controlled trial, BL, baseline; C, control; CI, confidence interval; FUP, follow up; OR, odds ratio; IQR, inter-quartile range

Intervention Findings

Key findings of each intervention are reported in Table 1.5, while Table 1.6 provides a summary of the types of outcome reported. The following sections summarise the findings by outcome type, including menu compliance, vegetable outcomes, child provision and consumption, and feasibility and acceptability.

Outcome Measures

Table 1.5 presents the outcomes and levels of outcomes reported by studies included in this narrative review. Overall, all studies reported centre-level outcomes (*n* = 10);[147, 150, 156, 175-181] and five reported child-level outcomes (*n* = 5);[150, 156, 175, 178, 180] four reported cook-related outcomes (*n* = 4);[147, 150, 177, 179] and three reported manager/director outcomes (*n* = 3).[147, 150, 176] Outcomes reported in studies varied. The outcomes most commonly reported were menu compliance (*n* = 7)[147, 156, 176, 177, 179, 180] and intervention feasibility, fidelity and/or delivery (*n* = 5).[147, 150, 156, 176, 179] Child dietary consumption was reported in five studies (*n* = 5),[150, 156, 175, 178, 180] whereas only one study reported child dietary provision while in care (*n* = 2).[156] Less commonly reported outcomes were child diet quality (*n* = 1),[178] intervention acceptability and satisfaction (*n* = 2),[147, 176] and self-reported menu compliance (*n* = 1).[179] No studies reported outcomes or evaluations in relation to costs. Most of the studies reported vegetable-related outcomes (*n* = 9).[147, 150, 156, 175-180]

Table 1.6 Summary of narrative literature review paper sample and outcomes, in order of frequency, number of studies (n)

Level of outcome reported	***n***
Centre level	10
Child level	4
Cook level	4
Manager/director level	3
Outcome reported	
Menu compliance	6*
Intervention feasibility/fidelity/delivery	5
Child dietary consumption	4
Child dietary provision	1
Child dietary quality	2
Intervention acceptability/satisfaction	2
Cook knowledge/intention	2
Child BMI z-scores/HRQoL	1
Congruence between planned and served menus	1
Menu compliance cook self-report	1**
Cost	0
Vegetable-specific outcomes	
Reported	9
Not reported	1
Abbreviations: BMI, Body Mass Index; HRQoL, health-related quality of life *5 studies reported food group compliance; 1 reported nutrient compliance **Fruit and vegetable food groups only	

Menu Compliance

Overall, five studies reported outcomes for food group menu compliance[147, 156, 177, 179, 180] and one reported menu compliance with nutrient outcomes.[180] Most studies found that few if any centres were compliant with overall menu guidelines (all food groups) at baseline.[150, 156, 175-177] Similarly, overall menu compliance at follow up was low across all studies, although four reported significant improvements in compliance for individual food groups.[150, 156, 175-177] Improvements for menu compliance were reported across most core food groups including vegetables, fruit, meat and alternatives, and dairy. Findings also indicated that the intensity of intervention was not necessarily related to stronger effects on menu compliance.[177] A comparison of high- and low-intensity menu interventions indicated that any level of intervention could be enough and was associated with a significant difference in the number of compliant food groups. Grady et al. (2020b) reported the outcomes of a three-arm intervention that compared high and low intervention intensities. Outcomes (at 12-month follow up) revealed that any level of intervention intensity could elicit

improvements in menu compliance. Overall, both the high- and low-intensity arms improved menu compliance within centres. Most studies only reported outcomes of a six-month follow up, so long-term impacts remain unclear. One study that reported longer-term follow up (12 months) found poor sustainment of improvements made at the six-month follow up. Menu compliance was only sustained in the fruit and discretionary food and drink groups. One study measured cook self-reported servings of fruit and vegetables on the menu, but the outcomes did not show significant differences between intervention and control centres.[179]

Vegetable Outcomes

Overall, nine of ten papers reported vegetable-specific outcomes (Table 1.6). Of the five studies that reported menu outcomes, four found improvements in menu vegetable compliance, three of which were found to be statistically significant ($p < 0.05$).[150, 156, 177] One study did find improvements in vegetable compliance; however, these were not found to be significant and only one centre involved in the study showed compliance for the vegetable food group.[176] One study that asked cooks to self-report the number of vegetable serves on the menu demonstrated a greater provision of vegetables on intervention centre menus (increase of 0.5 serves); however, this was not statistically significant ($p = 0.0573$).[179] Finch et al. (2018) reported significant improvements in cooks' knowledge of vegetables ($p = 0.0008$) after participating in a menu compliance intervention that provided them with menu training, written menu feedback and printed resources to support menu compliance.[147] However, in that study, intervention centre menus were not compliant with the overall menu guidelines or the vegetable group.

Only one study measured menu compliance (by number of serves on the menu) along with child vegetable mealtime provision and consumption.[156] Median daily servings of vegetables on the median value for the sample increased by just less than half a serve (0.4 serves) at follow up ($p < 0.001$). Three studies found improvements in vegetable consumption by children at mealtimes.[150, 156, 175] However only two of these found this to be significant ($p < 0.001$ for both) and increases were by only around 0.1 serves:[150, 156] improvements in vegetable consumption ranged from 0.3 to 0.7 serves across both studies. Suwimol et al. (2021) found a significant increase by 127% in median vegetable consumption ($p < 0.001$) across the lunch meal in a sample of preschool children residing in Bangkok, Thailand (median IQR: baseline 6.0 [3.2–12.9] g; follow up 13.7 [6.7–18.9] g).[180]

Child Dietary Provision and Consumption

Only Bell et al. (2015) reported on child mealtime provision.[156] At follow up, provision of all core food groups had increased significantly from baseline following implementation of the program ($p < 0{\cdot}001$). Degree of improvement ranged from 0.1 to 0.2 serves for all food groups. Provision of the fruit and grain food groups increased by a larger proportion, of 0.5 and 0.4 serves, respectively.

Child mealtime consumption was more likely to be reported than provision. Dietary consumption was reported across a small number of studies (*n* = 4) and outcomes varied in consistency.[147, 150, 156, 177] All studies found significant improvements in fruit consumption ($p < 0.05$), but significant improvements in the other core food groups varied. The food group most likely to show significant improvements in consumption, following fruit, was grains and cereals (*n* = 3),[156, 175, 180] followed by dairy (*n* = 2),[156, 175] meat and alternatives (*n* = 2),[156, 180] and vegetables (*n* = 2).[150, 180]

Feasibility and Acceptability

Two studies measured cook feedback on acceptability,[147, 150] and five studies evaluated the feasibility and fidelity of the intervention.[147, 150, 156, 176, 179] Finch et al. (2017) measured acceptability among cooks and managers, whereas Grady et al. (2020) evaluated manager acceptability. Both interventions were conducted in the same region of New South Wales and utilised the *Caring for Childcare Guidelines*.[168] The delivery mode was the same between studies, but with some minor differences. Finch et al. (2018) implemented an intervention that provided menu planning training (delivered in person by trained staff), and written menu feedback from a nutritionist or dietitian; and provided resources for centre staff.[147] However, Grady et al. (2020b) implemented an online web-based menu planning program that allowed staff to self-audit and prepare menus with reference to guidelines.[176] Implementation of this intervention still involved providing centres with training sessions with trained staff, as well as frequent contact and support from implementation staff. Both the in-person support and online menu planning tools elicited positive responses from centre cooks and managers. The proportions of cooks and managers scoring the intervention as acceptable ranged from 71% to 94% for all domains measured.

One intervention measured centre compliance with intervention checklists via a baseline and follow up.[156] This study showed a significant ($p < 0.001$) improvement in mean centre compliance with intervention protocols (assessed via a checklist) at follow up (baseline 36.6 ± 2.7 *v*. follow up 62.4 ± 4.2, out of a possible 64). At follow up, 75% of centres in that study were compliant with guidelines, compared with zero at baseline. Three studies reported centre and staff participation with intervention materials and support.[147, 150, 176] Seward et al. (2017) reported high engagement across all intervention elements (90%), whereas Finch et al. (2019) recorded only 50% receiving all strategies as planned. Elements delivered by researchers and implementation staff were more closely followed as prescribed, than were those that required staff to independently participate or implement.

Cook and director participation in training sessions ranged from 75% to 100%. Where ‘refresher’ training was offered to centres, engagement was low,19–42% among both cooks and directors.[147, 176] Furthermore, in interventions where there were elements with which both cooks and directors could engage either together or independently, engagement was greater among cooks than

directors. Finally, Yoong et al. (2016) reported cook (self-reported) intentions to implement guidelines.[179] Cooks in the intervention arm had significantly higher mean scores for intention to use the guidelines (p = 0.0005), perceived behavioural control (p = 0.0008) and attitude (p = 0.0071).

Quality Assessment

The quality assessment of each paper using the EPHPP tools is reported in Table 1.4. Overall, most studies received a rating of 'moderate', with one receiving a 'weak' rating. No study received a 'strong' quality assessment. One reason for this moderate rating for most studies was the lack of participant blinding that was common to all interventions. This is likely a result of the difficulty of blinding participants to an intervention that requires implementation or knowledge of menu planning guidelines. No studies scored a strong rating for this component. Another component that scored poorly was selection bias; again, all studies scored a weak–moderate rating *(n* = 10). Because of the nature of conducting research in childcare centres, achieving a representative sample can be difficult. Finally, many studies used data collection tools that were not validated, or for which validation was unclear, leading to a large proportion of weak or moderate scores for the data collection method component of the EPHPP assessment tool (*n* = 8).

The components with ratings ranging from moderate to strong were study design (strong: *n* = 7, moderate: *n* = 3), and withdrawals and dropouts (strong: *n* = 10). Most study designs were RCTs. Those that did not involve trials were cohort studies and deemed likely to be appropriate for the study aims. A strength of this body of literature was the reporting of participant flow throughout the study. All studies clearly reported sample sizes for recruitment and analysis, while appropriately informing reasons for dropouts and withdrawals.

1.3.5 Discussion

This narrative review evaluated and appraised interventions and programs in the ECEC settings that aimed to improve menu compliance. Ten published papers met the inclusion criteria and reported the outcomes of seven interventions. Nine of these ten studies received a moderate and one study received a weak rating when assessed using the EPHPP quality assessment tool. Heterogeneity in the types of outcome reported was observed. With regard to menu compliance, feasibility and fidelity were the most common outcomes reported. Child dietary outcomes were less likely to be reported. Other outcomes reported were intervention acceptability, cook knowledge or intention, child Body Mass Index z-scores and health-related quality of life (HRQoL). No studies reported cost or cost-effectiveness. Nine of ten studies reported vegetable-specific outcomes.

Given the heterogeneity in types of outcome reported by each study, comparisons were difficult to make. For the vegetable-specific outcomes reported in nine of ten overall studies, the most

common outcome reported was menu compliance (five of nine studies). Menu compliance for vegetables improved across all centres, and in four of five studies this was a statistically significant outcome. Overall menu compliance with all food groups was not observed in any intervention; improvements in individual food group compliance were more likely. Food groups for which compliance was most likely to improve were vegetables, fruit, meat and alternatives, and dairy.

In studies that reported child dietary consumption, fruit (four of four studies), and grains and cereals (three of four studies) were most likely to show significant improvements in children.[156, 175, 180] Increases in vegetable consumption were less likely (two of four studies).[150, 180] These findings are similar to those reported in a review and meta-analysis by Evans and colleagues (2012) of school-based interventions on fruit and vegetable consumption in children aged 5–12 years.[182] A total of 27 school-based programs involving 26,361 children were analysed. Findings of this review indicated that school-based interventions can moderately improve fruit consumption but have very little impact on vegetable consumption. Furthermore, this is consistent with literature demonstrating a preference for fruits in young children in this age group (under 5 years). Both fruits and grains are often more affordable and well-liked by children, making this an easier food group to enhance in such settings.

Matwiejczyk et al. (2018) recommended long-term follow-up periods of 12 months or longer (ideally two to four years) for healthy eating interventions in childcare settings. Very few studies identified in this review collected follow-up data longer than a six-month follow-up period. Only two studies reported outcomes at 12-months post-intervention.[176, 177] Long-term impacts or sustainment of outcomes are unknown. One study that reported a longer-term follow up (12 months) found poor sustainment of menu compliance improvements. Although improvements were observed in menu compliance for multiple food groups at three-month follow up, particularly for vegetables, menu compliance was only sustained for the fruit, and discretionary food and drink groups at 12 months.

Golley and Bell's (2015) review of childcare interventions to improve diet quality indicated that environmental interventions in these settings can achieve improvements in determinants of children's dietary intake.[172] Studies in this review that measured both menu compliance and child mealtime provision or food consumption found increasing consumption of core food groups was not observed. This may be due to the shorter follow-up periods with these interventions. As mentioned earlier, most interventions did not use a follow-up period longer than six months.

Acceptability of an intervention is essential to ensure its suitability for long-term adoption and implementation. Staff feedback was positive among interventions that measured cook or director acceptability. No studies reported adverse effects such as negative feedback about menus or significant food wastage after centre participation in a study. Only four of ten interventions measured cook feedback and three of ten evaluated director feedback, which is a small sample

size from which to draw inferences but suggests that interventions targeting centre staff might be well received.

Little to no interventions reported cost outcomes, let alone cost-effectiveness. Outcomes of economic evaluations of early childhood obesity prevention interventions are scarce. Such evaluation is an expanding area of research; currently few if any childcare menu intervention studies report costs. This is highlighted by a scoping review of outcomes commonly reported in obesity prevention interventions in early childhood, which identified a small number of studies (7%) reporting economic outcomes in trial registry records. This emphasises the need for economic-related outcomes to be included in trials, particularly the increasing need to demonstrate cost-effectiveness in public health interventions.[183, 184] Furthermore, findings of these studies were typically inconclusive because of ambiguity in measures of effect.[185] What constitutes a suitable outcome measure in this area of research is uncertain. A systematic review by Zanganeh et al. (2019) reported that there was no consistent measure of outcomes among childhood obesity intervention evaluations.[185] Clinical outcomes were more likely to be reported than were the health-related outcome measures commonly used in economic evaluations, such as quality-adjusted life years (QALY), disability-adjusted life years (DALY) and HRQoL.[185] Currently, there is a lack of economic evaluations in this body of literature.

Overall, this narrative review highlights the scarcity of menu compliance interventions and the heterogeneity of outcomes. Outcome measures varied from individual level to environmental level, including outcomes such as menu compliance, child dietary provision and consumption, and staff feedback. Positive intervention effects were found for menu compliance for individual food groups for most studies. This shows that menu compliance interventions can be successful in improving alignment of a centre menu with guidelines. Long-term impacts of interventions were, however, difficult to assess as most interventions employed follow-up periods of only six to eight months. Interventions with longer-term follow-up times found that improvements in vegetables were not sustained over time. It is difficult to determine whether improving menu compliance feeds through to child mealtime provision and food consumption, given the small sample of interventions that have measured both.

A Need to Overcome Barriers

As described earlier, LDC settings can adopt one of two food service models: food provided on site, or packed meals from parents (lunch box centres). Centres can provide food prepared on site by an in-house cook, or can order meals from caterers. In South Australia, the most common model is food prepared and served on premises by a centre cook. Currently, LDC centres often rely on personal knowledge to evaluate the adequacy of their meals and menus. Centre cooks are facing a number of barriers in implementing menu planning guidelines in centres, including cost,

knowledge and time. Implementation of interventions to support menu planning in centres has provided promising evidence of improvements in food group menu compliance. However, these outcomes vary across studies and translation to improvements in child provision and consumption is scare.

1.4 Proposed New Food Model

A meal kit-style delivery service for LDC could be an innovative food service model that may support LDC centres to align with policy and guidelines and overcome common barriers to healthy food provision. The following sections propose a novel food service model and how it could support menu compliance in LDC settings.

Despite the lifelong nutritional benefits of vegetable consumption, a broad literature demonstrates poor vegetable consumption among Australian children. Children spend a considerable time in ECEC settings. Outside the home, these settings are a key influence shaping early dietary behaviour. LDC centres that provide meals to children have a responsibility to serve nutritious and healthy meals. Although there are no nationally overarching guidelines for the types and amounts of food to be served in centres, many states provide their own evidence-based, best practice guidelines to support centre menus. Analyses of childcare centre menus have shown that many are failing to meet menu planning guideline recommendations for many food groups; vegetables are consistently the worst faring core food group.

While multi-strategy interventions have been shown to be the most effective way to improve child dietary provision and consumption while in care, the centre menu and cook are the entry point of the food environment of centres. Interventions targeting centre menus and cooks have delivered promising evidence that with support, centres can improve menu compliance across all food groups, including vegetables. Although limited, the evidence does show that these improvements are often not sustained over time for vegetables.[177] Also, they do not necessarily translate to improved child provision and consumption at mealtimes.[156] Interviews with LDC cooks have identified a number of key barriers to implementing menu planning guidelines, including lack of time, budget, knowledge and confidence.[153-155, 186] As described earlier, a meal kit-style delivery service for LDC may be an innovative food service model to overcome the common barriers to meeting menu planning guidelines reported by cooks.

1.4.1 The Emergence of Meal Kit Subscription Services

Meal kit subscription services have been growing in popularity internationally across many countries including Australia, New Zealand and the USA. Domestic models have been positively received by families worldwide as a way to integrate home cooking into busy, time-poor lifestyles. The meal kit subscription services food model is a subscription service that delivers a package or

pre-portioned amounts of ingredients and recipes to homes of subscribers. Quantities of recipes and ingredients are tailored to meet the number of serves ordered by households. Subscribers can often pick their weekly recipes, and most suppliers provide options suited to dietary requirements, such as vegetarian and gluten-free meals. Domestic models of meal kit delivery services provide a convenient option for families or individuals who like to cook at home, while removing the need to go grocery shopping or deciding what to eat. Studies with Danish families suggested that meal delivery kits in the home were well received because of the convenience they provide, while maintaining the socially acceptable standard of a home-cooked meal.[187, 188]

Although meal kit subscription services are not specifically designed to meet *Australian Dietary Guidelines*, they are often marketed as healthy and nutritionally balanced meals.[188, 189] To test this, Gibson and Partridge (2019) analysed 60 recipes from five meal kit subscription services in Australia to assess their nutritional suitability. While changes could be made to improve alignment with guidelines, recipes tested in this study were indeed found to provide adequate micronutrients. Furthermore, serves of core food groups, particularly vegetables, were provided in suitable quantities. Despite lacking fibre and often exceeding salt recommendations, meal kit subscription services can be a suitable option for providing a nutritious home-cooked meal.[188, 189]

1.4.2 Adapting Meal Kit Subscription Services for Long Day Care Settings

The elements of a domestic meal kit subscription service model could integrate easily into the childcare setting. To the best of the PhD candidate's knowledge, there is no recorded or published evidence relating to the upscaling of a domestic meal kit-style food service model to larger commercial settings. While current subscription services do not endeavour to meet specific guidelines, the potential to tailor a meal kit subscription service to meet menu planning guidelines could allow a streamlined approach to ensuring appropriate provision of core food groups in LDC settings.

A novel food service model for LDC would pair the food supply to the centre menu to provide a meal kit subscription service compliant with sector menu guidelines. By providing a menu tailored to the number of children attending a centre, recipe ingredients can be delivered in adequate quantities that align with menu planning guidelines. Such a model could address cook barriers to implementing guidelines across the centre menu and the supply chain (food procurement).

By underpinning the service with a menu that complied with menu planning guidelines, tailored to the number of children attending the centre, the barrier of staff knowledge could be addressed. Further, the time and cost related to training or upskilling cooks would be removed. The streamlining of the ingredients to a subscription service and use of set menus could save cooks time in planning menus and ordering ingredients. Additionally, this model could introduce purchasing power that may overcome costs associated with procuring raw ingredients, such as

vegetables, for childcare centres. This may lead to increased accessibility and exposure to such foods, which are often perceived as too expensive or disliked, and therefore wasteful to serve in centres.

1.5 Addressing the Gaps

In summary, the dietary intake of Australian children is poor. At the forefront of poor dietary intake, vegetable intake of Australian children is well below guideline recommendations.Growing evidence emphasises the importance of setting-based nutrition promotion intervention. With the increase in engagement of families and young children with the ECEC setting, such a setting could lend itself to establishment of key targets. In particular, the LDC setting is an opportune setting to target healthy eating behaviours, particularly in centres where cooks prepare meals on site. While evidence-based menu planning guidelines are available across jurisdictions in Australia, cooks report a number of barriers preventing implementation of guidelines within centres, impacting the nutritional intake of children.

A meal kit subscription service-style food service model could be an innovative strategy to improve menu compliance in centres by removing the need for cook knowledge in planning, preparing and delivering menus that meet guidelines. Furthermore, this model has the potential to save centres time and costs in labour. Additionally, the streamlined menu approach could provide purchasing power to increase expenditure on ingredients previously deemed too expensive.

The PhD candidate is not aware of any literature describing the use of a meal kit-style food service model in a LDC centre. The innovative combination of sector guidelines and an emerging food model could support longer-term, sustainable improvements in centre menu compliance—an outcome that has been poorly demonstrated in interventions to date. Targeting the centre menu and food environment may support the development of healthy eating behaviours in young children. This could cascade to improvements in children's dietary consumption while in care, and help them build habits that can last through to adulthood.

1.6 Thesis Aims and Objectives

The primary aim of this study was to develop, implement and evaluate the impact on the food provision and intake—including of vegetables—of children aged 2–5 years, of a menu box delivery service tailored to the LDC setting. The objectives were as follows:

1) to evaluate the feasibility and acceptability of a menu box delivery service delivered straight to LDC centres

2) to evaluate the impact of a menu box delivery service on food provision and consumption, in children aged 2–5 years while in care
3) to compare the cost-effectiveness of the menu box delivery intervention with standard practice (i.e. menu planning) in LDC centres.

To evaluate objective two (outcome evaluation), this study tested two hypotheses, that:

a) Food provision to and consumption of *vegetables will be greater* in centres that receive and implement the menu box delivery service, by half a serve per child, per day compared with standard practice.
b) Food provision to and consumption of the *five food groups will be greater* in children attending centres that receive and implement the menu box delivery service compared with standard practice.

1.6.1 Addressing Barriers Identified by the Application of the Theoretical Domains Framework

As described, application of the TDF has been used to identified the barriers and facilitators long day care centres may face when implementing menu planning guidelines within the setting. Of the 14 TDF domains, key domains that serves as barrier and facilitators to implementing menu planning guidelines within long day care centres as reported by cooks were ‘skills’, ‘social influences’, ‘beliefs about consequences’, ‘reinforcement’ and ‘behavioural regulation’.[164] The menu box delivery service may serve as a tool to overcome these key barriers.

Firstly, the menu box delivery service will provide cooks with ingredients and quantities that meet the guidelines according to the number of children attending their centres. This reduces the burden associated with skills to plan a menu according to guidelines. Which has been previously identified as a key barrier in this space.[164] By providing a standardised menu and recipes to cooks and centres, this may provide a clear framework to work within. This may overcome barriers identified by cooks within the ‘social influences’ of the TDF, by setting norms within the workplace through the implementation of the menu box delivery service. The ‘beliefs about consequences’ domain reflects the cooks acceptance of outcomes of a behaviour, which in this case is implementing a menu that meets menu planning guidelines. As a key barrier identified by Seward et al. 2017, the menu box delivery service may support cooks to overcome this barrier through provision of menus and recipes designed by dietitian to meet guidelines.[164] The menu box delivery service is designed to be a streamlined service that provides weekly deliveries of all ingredients required without cooks needing to place regular orders to provide the entire menu. This may overcome barriers identified by cooks with the ‘reinforcement’ domain as cooks a relieved of the burden of placing large orders. Furthermore, the provision of recipes and menus will reduce menu planning burdens on cooks,

providing a simple solution to implement menus within centres. ‘Behavioural regulation’ is the final key domain identified as barrier to implement menu planning guidelines in childcare menus. This domain encapsulates constructs such as action planning and breaking habit. As previously described, the streamlined service of the menu box delivery service could support cooks in maintaining habits or behaviours to plan menus as it reduces the labour involved with planning and ordering menus. By overcoming these barriers, the menu box delivery service may provide the tools to enable centre cooks to implement menu planning guidelines within their centre menus. Objective one, which evaluates the feasibility and acceptability the menu box delivery service will address cooks perspectives within the lens of the TDF.

CHAPTER 2 MENU BOX DELIVERY DEVELOPMENT AND METHODOLOGY

2.1 Chapter Overview

This chapter provides a description of the development and trial methodology of the menu box delivery service tailored to LDC centres. The chapter begins by reporting the development of the menu box delivery service (Section 2.2). The remainder of the chapter reports the design and methods the cluster randomised controlled trial to pilot and evaluate the implementation of the menu box delivery service in South Australian LDC services (Section 2.3 onwards).

2.2 Menu Box Delivery Service Development

A key original contribution to knowledge of this thesis is the development of a novel food service model for the LDC setting. The following sections provide an overview of the various components of the menu box delivery service evaluated in the trial described in the latter part of this chapter. The menu box delivery service consists of three key components brought together to create the service: (1) the menu and recipes, provided within the menu packs, (2) order forms and (3) delivery of weekly ingredients. The following sections describe the development of each component in detail.

2.2.1 Partnerships Established

A number of partnerships were essential to the successful development and delivery of the menu box delivery service. The delivery service consisted of three key players: 1) an organisation to create and develop a menu compliant with guidelines, 2) a supplier to coordinate procurement and delivery of ingredients and 3) the childcare centre to receive deliveries and implement the menu. To create the menu box delivery service itself, a partnership between a menu developer and a supplier was established for the purposes of this study. The menu used in this study was provided by Nutrition Australia (Victoria), as one of the services offered by the organisation. Menus are available for online purchase and use across Australia. To procure and deliver the ingredients required to prepare recipes, this study partnered with a local supplier. The supplier was a local small business with a long-standing foothold in the South Australian retail food market, with the infrastructure and business model enabling it to offer a menu box delivery style food delivery service.

2.2.2 Menu and Recipes

Menu Planning Guidelines

As mentioned earlier, no standardised menu guidelines for ECEC settings are currently used in South Australia. For this reason, the Victorian Menu Planning Guidelines were used for this study, as they are consistent with national guidelines and similar to those previously implemented in South Australia.[140-144, 156, 168] The Victorian Menu Planning Guidelines outline the minimum number of serves of each food group that should be provided to children aged 1–5 years attending LDC. The scope of the guidelines encompasses three meals: lunch, morning snack and afternoon snack. The guidelines provide further recommendations for breakfast and a late afternoon snack; however, these meals are not included in the minimum requirements outlined in the guidelines. The food groups are (1) vegetables, (2) fruit, (3) cereals and breads, (4) dairy and alternatives, for example, milk, yoghurt, cheese and/or alternatives, and (5) meat and alternatives, for example, lean meat and poultry, fish, eggs, tofu and nuts, with further recommendations for discretionary food and drinks, and fats and oils.

Children should receive around half their daily recommended intake from the five core food groups, as outlined by the *Australian Dietary Guidelines* and the AGHE while in care.[13] Serves are further defined as the 'children's serve', which is the portion of food that is appropriate for children aged 1–5 years and practical for use in the LDC setting. These serve sizes were adapted from the *Australian Dietary Guidelines*. Section 2.3.5 provides a summary of the food groups, serve sizes and example foods included in the menu planning guidelines.

Menu and Recipe Development

As a goal of using the menu box delivery service was to reduce cooks' burden, pre-designed menus from Nutrition Australia (Victoria) were used. Two menus—a standard menu and a vegetarian menu—covering four weeks were designed to meet the Victorian Menu Planning Guidelines by dietitians experienced in working with childcare services. Recipes were provided for morning snack, lunch and afternoon snack, and the vegetarian menu mirrored the standard menu with suitable alternatives. To accompany recipes, a comprehensive shopping list containing all ingredients and the quantity required for the week was provided by Nutrition Australia for use within the menu box delivery service.

Tailoring Menus for Individual Centres

Upon group allocation, intervention centres were sent a menu box delivery details form (Appendix 1). This form asked centres to report the number of children's meals required on each day of the week (Monday–Friday) for each of the standard and vegetarian menus. The vegetarian menu

required a minimum of five children (or serves) per day; if centres had fewer children requiring the vegetarian menu on any given day, the number was rounded up to five. The form confirmed delivery and contact details for the menu box to be provided to the local supplier. It also asked cooks to report typical breakfast and late snack meals served at their centres. The form was then passed on to Nutrition Australia (Victoria) to tailor the recipes and weekly shopping lists to each centre.

Menu Pack Development

The LDC menu and recipe service provided by Nutrition Australia (Victoria) was delivered to centres as an online PDF 'menu pack'. The menu pack was used as a companion to the standard and vegetarian menus and weekly shopping lists, and included information about how to use the menu packs, appropriate substitutions, recommendations for breakfast, late snack and drink options and general information about the Victorian Menu Planning Guidelines. A similar menu pack concept was used for the menu box delivery. Menu packs adapted from the Nutrition Australia (Victoria) menu packs were designed for the study. These packs included information on how to use the menus and recipes, how the menu box delivery concept works, how to order additional ingredients for the menu boxes and management of dietary requirements. For ease of use, menus and recipes were included in the menu packs and centres were emailed PDF copies of the menu packs and order forms. The shopping list was also provided to the supplier. Table 2.1 provides a comparison of the original sections of the menu packs with the new outline for the menu box delivery pack and how the packs were adapted for the study.

Table 2.1. Summary of changes and adaptations made to menu packs for the menu box delivery study

Original menu pack	**Menu box delivery pack**	**Adaptation/changes made**
Title Page	Title Page	Title adapted to menu box delivery study
Welcome	Welcome	Study summary
Conditions of Use/Disclaimer	Conditions of Use/Disclaimer	Unchanged
	1.0 What are the Menu Boxes and How Do They Work?	Summary of the menu box delivery *new section added
Menu Overview	1.1 The Menu	Menu development and why this menu is used in the study
1.1 Recipe Ingredient Quantities	Recipe Ingredient Quantities	Unchanged
1.2 Breakfast	1.2 Breakfast	Unchanged
1.3 Late Snack	1.3 Late Snack	Unchanged
1.4 The Standard and Vegetarian Menu	1.4 The Standard and Vegetarian Menu	Unchanged

Table 2.1. Summary of changes and adaptations made to menu packs for the menu box delivery study

Original menu pack	Menu box delivery pack	Adaptation/changes made
	1.6 Substituting Recipes for Health, Cultural or Religious Requirements	Advice for adaptations for dietary requirements *new section added
1.8 Drink Provision	1.7 Drink Provision	Unchanged
	1.8 How to Order	Using order form, adding on ingredients for breakfast/late snack and dietary requirements *new section added
	1.9 What to do When the Menu Box Arrives	What to expect on delivery of menu boxes, storage and checking all ingredients have arrived *new section added
	Daily Schedule	Outline of which days' order forms and deliveries are due *new section added
	Order Form Example	Example of how to complete order form for additional items (breakfast, late snack, babies and dietary requirements) *new section added
1.5 Infants Starting Solids	2.0 Infants Starting Solids	Unchanged
1.6 Trying New Flavours and Textures	2.1 Trying New Flavours and Textures	Unchanged
1.7 Tips for Food Preparation and Provision	2.2 Tips for Food Preparation and Provision	Unchanged
	2.3 Getting the Most out of Your Produce	Storage tips from supplier to maximise quality and longevity of ingredients *new section added
3.0 Food Safety and Hygiene Practices	3.0 Food Safety and Hygiene Practices	Unchanged
4.0 Training	4.0 Training	Unchanged
5.0 Helpful Links and Resources	5.0 Helpful Links and Resources	Unchanged
2.0 Substituting	Removed and incorporated into new section: 1.6 Substituting Recipes for Health, Cultural or Religious Requirements As centres were not purchasing their own ingredients, recommendations for substituting ingredients were primarily provided to the supplier	
2.1 Ingredients		
2.2 Recipes		

2.2.3 Add-on Ingredient Order Forms

Development of Additional Ingredient Order Forms

The Victorian Menu Planning Guidelines provide recommendations for one main meal and two snacks per day; therefore, menus used in this study only encompassed these three meals. However, centres may provide a breakfast or late snack for children arriving earlier or staying later

in the day. To address these extra meals, an order form was developed and provided to centres so they could order additional ingredients to ensure the menu box delivery could extend to these extra meals. Additional ingredients ordered could include ingredients for meal items not included in the standard or vegetarian menus, breakfast and late snack provision, drinking milk (not included in recipes) and ingredients to manage dietary requirements of children at the centre. As the menu planning guidelines and menu box delivery do not provide or include recipes for breakfast and late snack, it was up to the centre to order and provide these meals. The menu box delivery menu pack (Section 2.2.3) provided recommendations to centres regarding the types and amounts of appropriate food to be served at these mealtimes based on guidelines.[141] To streamline the full centre menu including additional meals, an order form was designed by the PhD candidate in collaboration with centres and the supplier to reflect typical LDC menu items. This did not include staff provision, which was up to the centre to provide.

Breakfast, Late Snack and Drinks (Milk)

Breakfast and late snack order form items were specific to each centre. When completing the menu box delivery details form, centres were asked to report typical ingredients and food items that they served at breakfast and late snack. These items were then collated and added to the order form aligned to items stocked by the menu box delivery service supplier. This form also included a section for ordering drinking milk for daily consumption in centres, as menu recipes did not account for this.

Managing Dietary Requirements

Centres were provided with a standard and vegetarian menu for each week. Recipes did not include any nut-containing ingredients. Additionally, the meat in the menu boxes provided by the supplier was Halal certified (except pork). However, the menu could not account for all allergies, intolerances or specific dietary requirements as these were expected to vary across centres. It was therefore the responsibility of the centre cook to review recipes and place orders for the ingredients they would need to make appropriate substitutions that met the dietary requirements at their centre. A list of common dietary alternatives was added to the order form to allow cooks to order these ingredients with their menu box delivery (Appendix 2). Examples of such items include lactose-free dairy products, tofu, legumes, gluten-free pasta, plant-based milks and dairy-free dips. Items were checked by the supplier to ensure they could be supplied to centres.

Placing Add-on Item Orders

To coordinate weekly deliveries, a line of communication was established between the individual centres and the supplier wholesale manager. This was done to avoid interference from the PhD candidate or research team, and achieve a study environment similar to a ‘real world’ setting.

Centres were provided with order forms and advised to send them to the supplier in advance to allow time for additional ingredients to be added to the menu box delivery.

2.2.4 Delivery of Ingredients

Partnership With a Local Supplier

A partnership was established with a local grocer supplier to coordinate weekly delivery of ingredients. As mentioned in Section 2.2.2, once centres completed the menu box details forms, delivery and contact details were passed on to the supplier. The supplier was provided with a weekly shopping list for each centre that included the quantity of ingredients required for both the standard and vegetarian menu tailored to each centre. The supplier was then responsible for sourcing, assembling and coordinating weekly delivery of ingredients required by each centre.

The business model of the supplier gave the ability to provide all ingredients required for the menu box delivery recipes, including pantry items, dairy items, fresh fruit and vegetables, and meat. Furthermore, as the supplier had previous experience delivering to childcare and aged care facilities, it was familiar with the nature of standards and policies in relation to delivery to childcare centres. Examples of such requirements include temperature control and food handling experience.

To account for unavailability or seasonality of certain ingredients, brief guidelines for appropriate ingredient substitutions were provided to the supplier; for example, replacing fresh vegetables with frozen equivalents. These were written by the PhD candidate and adapted from Nutrition Australia (Victoria) (Table 2.1).

Delivery Schedule and Execution

Menu boxes were delivered by the supplier on Fridays, integrated into the regular delivery service; that is, centre deliveries were added to delivery routes. A Friday delivery day was chosen in collaboration with the supplier, which allowed cooks to receive and store ingredients ready for menu start on the following Monday. Both centres and the supplier were provided with a delivery calendar, designed specifically for this study to outline specific order, delivery and menu week dates.

The supplier was provided with weekly ingredient lists tailored for each centre. These lists were used in conjunction with the calendar to ensure the correct quantity of ingredients was delivered to each centre for the correct week. For any additional ingredients, called ‘add-ons’, centres were advised to submit order forms on Monday for add-ons to Friday’s delivery. Order forms were emailed directly to the supplier’s wholesale manager (contact person). For example, Week 2 ingredients were delivered on Friday Week 1. Week 2 order forms were sent to the supplier on

Monday Week 1, to be added to delivery by Friday (Appendix 3). During the study period, any queries, delays or issues with deliveries were directed to the suppliers to mimic a real world experience. To enable monitoring, the supplier provided to the PhD candidate a summary of weekly communications with centres throughout the intervention period.

2.3 Study Methodology

The following sections are an expanded version of a protocol published in BMJ Open, 2021 (Appendix 4): Kashef S, Zarnowiecki D, Brown V, Arguelles JC, Cox DN, Golley RK. Cluster randomised controlled trial of a menu box delivery service for Australian long day care services to improve menu guideline compliance: a study protocol. BMJ Open. 2021 Apr 14;11(4):e045136. doi: 10.1136/bmjopen-2020-045136. PMID: 33853802; PMCID: PMC8054071.

The following sections describe the methodology for the cluster RCT evaluating the impact of a menu box delivery service in the LDC setting on child dietary provision and intake, centre menu compliance, cook and director acceptability and cost. The purpose of this study was to support childcare cooks employed in LDC centres to provide healthy meals, with a focus on vegetable intake, through piloting the delivery of menu boxes straight to centres. The menu box delivery service included recipes and ingredients that met healthy eating guidelines with a specific focus on vegetables, tailored to the number of serves required by the centre. This was compared with an Online Cook Training module supported by an online menu planning tool to improve centre menu compliance with menu planning guidelines.

The following sections and the protocol paper were developed using the Consolidated Standards of Reporting Trials (CONSORT) Guidelines (Extension for Cluster Trials) for trial methodology (Appendix 5).[190] The economic evaluation methodology was developed using the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement (Appendix 6).[191]

2.3.1 Study Design

A cluster RCT with LDC centres randomly allocated to one of two study groups was conducted, guided by the CONSORT Guidelines (Extension for Cluster Trials).[190] Each centre was randomly allocated to one of two study groups:

1. The intervention centres received a menu box delivery service that provided a menu plan, and all the ingredients and recipes required to provide a menu compliant with the Victorian Menu Planning Guidelines.[141]
2. The comparison centres, reflective of current nutrition promotion practice in LDC, were asked to utilise an online menu planning tool and online training module to support cooks to

develop and deliver a menu that is compliant with the Victorian Menu Planning Guidelines.[141, 192, 193]

As South Australia does not provide standardised guidelines for ECEC settings, this study used the Victorian Menu Planning Guidelines, which are based on the *Australian Dietary Guidelines* and the AGHE, and are consistent with recommendations from the Australian government's *Get Up and Grow* resource.[142, 168] These guidelines are the closest to the *Start Right–Eat Right* nutrition award scheme previously implemented in South Australian childcares.[140, 141, 143, 144, 156]

2.3.2 Ethics and Study Registration

This study was approved by the Flinders University Social and Behavioural Research Ethics Committee (Approval 8566) (Appendix 7). The trial was registered on the Australian New Zealand Clinical Trials Registry on 4 March 2020 (ACTRN12620000296932).

2.3.3 Setting and Eligible Population

In South Australia, approximately 40,860 children aged 0–5 years of age were enrolled in LDC centres in 2018. [118,] In 2020, a total of 423 LDC centres were recorded in South Australia .[127, 194] It is unclear what proportion of these centres were privately owned and how many children were enrolled with each service provider. The study population were privately owned LDC centres in the Adelaide metropolitan region, South Australia. To conduct the study, a partnership was formed with a local LDC service provider with 25 centres across the state (23 of which were within metropolitan Adelaide).

Within centres, study participants included the directors, cooks and children attending centres. Centre directors were approached and asked to nominate their centre to participate in the study. Directors were also asked to provide feedback at follow-up data collection. Centre cooks were the key study participants as they were directly involved in the intervention either through participating in the menu planning activities (comparison centres), or receiving and implementing the menu box delivery service (intervention centres). Eligible children in participating centres were included in measurement of dietary provision, consumption and waste data.

Sampling, Eligibility and Recruitment

LDC centres were eligible to participate if (1) they were located in metropolitan Adelaide; (2) they operated for at least eight hours per day, Monday to Friday; (3) they had an on-site cook that prepared and served a minimum of one main meal and two mid-meal snacks—otherwise known as morning snack, lunch and afternoon snack—each day; (4) their menu planning decisions were made at centre level; and (5) they had minimum enrolment of 20 children aged 2–5 years old.

Centres that did not prepare meals or make menu planning decisions on site, or where food was brought from home (e.g. lunch box centres) were excluded.

Eligible centres (*n* = 16) were stratified by SES using Socio-Economic Indexes for Areas (SEIFA) determined by postcodes (ranging from 5000 to 5199). SEIFA are a validated measure of SES. Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) scores summarise the economic and social conditions of household and individuals within an area, relative to advantage and disadvantage measures. The IRSAD is scored on a scale of 1–10, where 1 is the lowest score, indicating disadvantage and 10 is the highest score, indicating advantage. A high IRSAD score for an area indicates a relative lack of disadvantage, whereas a low score indicates relatively greater disadvantage for the area.[195] Three SES categories—low (IRSAD of 1–3) mid (IRSAD of 4–7) and high (IRSAD of 8–10)—were formed using these indices. Of the 16 eligible centres, five were categorised as low SES, six as mid-SES and five as high SES.

Recruitment

Centres were invited in random order from a list of 16 eligible centres provided by the supplier. Centres were invited to participate, until the required sample size of children was achieved. Directors of eligible centres were emailed a recruitment package including study information and an invitation to participate (Appendix 8). Emails were followed by a phone call within a week to confirm eligibility and interest in participating. If a centre was interested in participating, a face-to-face meeting with the centre director and cook was arranged to provide in-depth study information and obtain centre and cook consent (Appendix 9 and Appendix 10). The 30-minute face-to-face meetings with cooks and directors enabled provision of a detailed outline of the study timeline and what their participation would involve. This session also served as an opportunity for staff to ask questions about involvement in the study.

Study participants in centres included centre directors, cooks, educators, teachers and children. Children deemed eligible to participate in data collection were any child enrolled in the centre aged 2–5 years and present on data collection days, whose parents had not returned an opt-out form. Children with allergies, intolerances or medical conditions that significantly affected their food intake or prevented them from receiving the standard or vegetarian centre menu were excluded.

Following recruitment of centres, parents of children enrolled at centres were informed of the study and that their child would be exposed to the intervention. Information about the intervention taking place at the centre was distributed through the centre's primary communication mode to parents—the Storypark electronic communication platform.[196] Electronic communication applications such as Storypark are currently the primary mode of communication and management tool for childcares in Australia.[197] Such platforms allow centres to share announcements, forms, policies and updates directly with parents using the program. Parents of children attending the centre were also

provided with an opt-out opportunity to exclude their child from data collection (Appendix 9). Parents were able to return the form to the centre director or PhD candidate. Verbal opt-out was accepted if parents communicated to centres that they did not want their child involved in data collection.

Group Allocation

The eight participating centres were randomly allocated to either the menu box delivery (intervention) or menu planning (comparison) group. Centres were stratified into two equal groups (four centres in each) matched for centre size and centre SES using SEIFA indices of postcode. Centre size was categorised as either small (average child attendance ≤ 250 per week) or large (average child attendance ≥ 251 per week) using attendance numbers provided by the LDC service management office. Group allocation was conducted by a staff member outside the study research team, and took place after all baseline data, child dietary provision and intake and menu compliance, had been completed, to ensure blinding of centres and research staff. The two groups of centres were randomly assigned to receive either the intervention or comparison group using a random number generator (random.org).

Staff in each centre, along with research staff delivering the intervention, were notified of group allocation after baseline data collection was complete across all centres. Centres were then provided with flyers to place in high-traffic areas of centres, such as the sign-in desk, to notify parents of group allocation and the centre's participation in the research project.

2.3.4 Treatments

Childcare Guidelines

The intervention targeted the LDC menu and food service system of centres, with a focus on supporting the childcare cook. In the absence of South Australian menu planning guidelines for ECEC settings, this study used the Victorian Menu Planning Guidelines. These guidelines are based on the *Australian Dietary Guidelines* and the AGHE and are consistent with recommendations from the Australian government's *Get Up and Grow* resource.[142, 168] These guidelines are the closest to the *Start Right–Eat Right* nutrition award scheme previously implemented in South Australian childcares.[140, 141, 143, 144, 156] The Victorian Menu Planning Guidelines cover two snacks (morning and afternoon) and a main meal (lunch) each day, but not breakfast or a late snack.

Intervention Centres: Menu Box Delivery

Centres allocated to the intervention group received a weekly menu box delivery service that included all ingredients and recipes required for morning snack, lunch and afternoon snack for the

week. Intervention centres were asked to provide enrolment numbers for each day of the week, Monday to Friday. Daily recipes and quantities were tailored to the number of children in attendance and dietary requirements (for both standard and vegetarian menus). Centres were then provided with menu packs that included information about the delivery process, copies of tailored recipes, ingredient lists for each week of the menu—which included types and quantities of ingredients—and advice for appropriate substitutions to manage dietary requirements. Centres were also provided with contact details of the PhD candidate and menu box supplier for support throughout the duration of the study or delivery queries.

The supplier was provided with a copy of each individual centre's list of ingredients for each corresponding study week. A list of suitable food substitutions, based on the Victorian Menu Planning Guidelines[141] was developed by the study team and provided to the supplier in the event a food item was not in stock. Allergens were identified on foods provided in the menu boxes, as per regulated Australian labelling requirements. Centres were asked to apply standard practices and policies to manage the preferences and dietary requirements of children in their care. As described earlier, an order form was provided to centres to order to order additional 'add-on items' to cater for specific dietary requirements at their centre as well as breakfast and late snack food item (Appendix 2). Centres sent order forms directly to the supplier (via email) on the Monday before the meal week to ensure delivery by Friday. The cost of the intervention centre menus (menu box delivery) were subsidised in full by the research project funding.

Comparison Centres: Menu Planning

Comparison centres used a menu planning training and assessment program designed for LDC cooks and delivered online to support implementation of a centre menu that met menu planning guidelines, ascribed as 'standard practice'. The program supported centres to meet Quality Area 2.1.3 (Healthy Lifestyle) of the *National Quality Standard Education and Care Services National Law and Regulations*.[11, 37] The training modules were accessible through a website link and did not require any additional programs or downloads to access. The training consisted of six modules and took approximately 45 minutes to complete. Modules supported menu planning and implementation of menu planning guidelines with topics such as implementing healthy eating guidelines and strategies to overcome common challenges. Modules provided material on topics such as the importance and benefits of healthy eating, how to utilise the menu planning tool, case study examples and activities, what is a serve of vegetables, and strategies to overcome common challenges, with a particular focus on 'making vegetables fun' and including vegetables across all meals (see Table 2.2 for an outline of module components). In Module 6, the training prompted LDC cooks to use an online menu assessment tool to plan healthy menus online according to the Victorian Menu Planning Guidelines.

Table 2.2 Online training module outline

Module 1: Introduction	About this course Australian children: the statistics Why is healthy eating important? Benefits of providing healthy foods and drinks Promoting healthy eating–a whole of service approach Promoting healthy eating About this course
Module 2: Menu Planning	Why is menu planning important? Menu planning checklist Main meals Lean meat, poultry, fish, eggs, legumes, nuts Alternatives to processed meat Vegetarian meals Creating a healthy vegetarian meal Create a healthy vegetarian meal Fruit Vegetables and legumes/beans Reviewing vegetables in a menu Milk, yoghurt, cheese and alternatives Grain (cereal) foods Do not include these foods Food swaps Salt Fats and oils Breakfast Morning tea and afternoon tea Healthier baked items Drinks Feeding infants Food variety Sample menu
Module 3: Making Changes Successfully	A case study (example)
Module 4: Common Challenges	Cost Allergies
Module 5: Scenario (Activity)	Scenario long day care centre Scenario: activity 1 Scenario: activity 2 Scenario: activity 3 Scenario: activity 4 Scenario: activity 5
Module 6: Next steps	What next? Menu Assessment Well done!

The training was complemented by an automated menu assessment tool that assessed menus and recipes against the Victorian Menu Planning Guidelines. The tool allowed cooks to assess one week or one day of their centre menu. To assess a week, cooks were prompted to enter into the tool recipes including ingredients, quantities and number of children served. The tool allowed users

to create and save recipes, assess current menus and create new menus. When menus were submitted for assessment, the assessment tool provided a summary of compliance with guidelines for each day of the week. The summary included an overview of the serves of each food group provided by the menu, which was compared with target values and areas for improvement to support centres to meet guidelines. After completing the training cooks would implement their new or revised menu as per their standard protocol; however, it was anticipated this would involve use of the Menu Assessment Tool to support centre menus to meet the Victorian Menu Planning Guidelines.[141]

Study Flow and Data Collection Time Points

The intervention was conducted during the centre's spring seasonal menu, running from September to December 2020. The intervention period was approximately 12 weeks and was comprised of a four-week menu planning period (comparison centres only) and eight-week menu implementation period (all centres). Data collection was led by the PhD candidate with the project research team. Baseline assessments (Week 0) included child dietary provision; consumption and waste; assessment of the centre's current menu compliance with guidelines; food group provision; and centre and cook characteristics. During the menu planning period (Weeks 1–4), comparison centres were provided with access to the Online Cook Training program and asked to plan a new menu or revise their existing menu using the online menu planning tool for LDC. Intervention centre cooks were provided with a copy of the menu pack at the same time to allow them to become familiar with the process and recipes.

During the eight-week active menu implementation period (Weeks 5–12), the comparison centres were asked to implement their new or revised menu, while the intervention centres received a weekly menu box delivery service. Throughout this period, weekly data collected included menu box delivery weekly feedback cook time questionnaires and menu cost data (invoices).

Follow-up data collection was scheduled during the last two weeks of the eight-week intervention phase (Weeks 11 & 12) to capture data while the intervention centres were receiving and implementing the menu box delivery service. Follow-up data collected for intervention centres included child dietary provision, consumption and waste, centre menu compliance and food group provision, intervention fidelity and feasibility, and overall cook and director feedback (satisfaction and acceptability). Follow-up data collected for comparison centres included child dietary provision, consumption and waste, centre menu compliance and food group provision, intervention fidelity and feasibility at Weeks 11 and 12. Overall cook and director feedback (satisfaction and acceptability) was collected at Weeks 5 and 6, shortly after the cook online training and menu assessment was complete for comparison centres.

For comparison centres, cook and director feedback was collected after training was complete (Week 4), rather than at the end of the eight-week active intervention period, to capture feedback at a time closer to engagement with both the Online Cook Training and Menu Assessment Tool. Therefore, staff provided feedback on the training modules and Menu Assessment Tool approximately four weeks after baseline measures. However, dietary intake data were collected only in the last two weeks of the eight-week intervention.

After the eight-week intervention period, the menu box delivery service ceased and intervention centres returned to their usual centre menu and practices. Comparison centres continued using their current menu as per usual practice (see Figure 2.1).

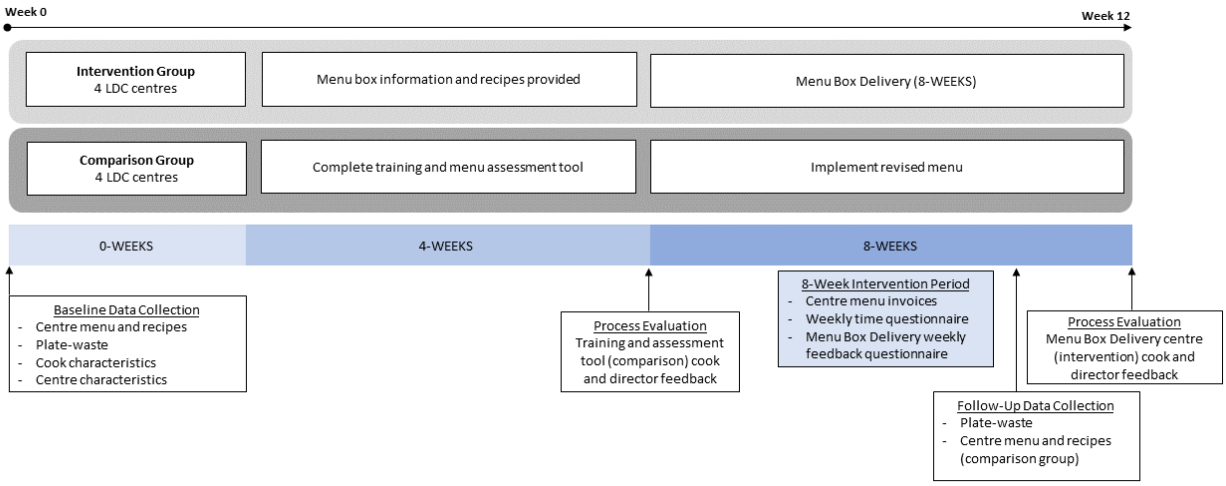

Figure 2.1 Intervention flow and data collection points.
Abbreviations: LDC, long day care.

2.3.5 Evaluation and Data Collection

Each study objective in Chapter 1 lent itself to an evaluation as outlined in Table 2.3. Process evaluation measured feasibility and acceptability of the intervention through menu compliance and staff feedback. Outcome evaluation measured child dietary provision, consumption and waste. The economic evaluation explored the cost-effectiveness of the menu box delivery service compared with the menu planning of comparison centres. All evaluations were underpinned by a key focus on the vegetable food group. The following sections detail the outcomes and measurement tools.

Table 2.3. Summary of study objectives and evaluations

Study objective	Evaluation
1. To evaluate the feasibility and acceptability of a menu box delivery service delivered straight to long day care centres	Process
2. To evaluate the impact of a menu box delivery service on food provision and consumption, in children aged 2–5 years while in care	Outcome
3. To compare the cost-effectiveness of the menu box delivery intervention with standard practice (i.e. menu planning) in long day care centres	Economic

Primary Outcome

Vegetables

The primary outcomes assessed were children's provision and consumption of vegetables, and core food groups. Menu compliance was measured via menu assessment, and child dietary provision, consumption and waste were measured at mealtimes through plate waste. Measuring both menu compliance, and child dietary provision and dietary intake provides a better picture of relationships between the two. Changes in food provision and dietary consumption were the primary focus of this intervention; menu assessment and plate waste measures provided data on all food groups served pre-intervention and during intervention implementation. This also provided the opportunity to compare changes in consumption of vegetables and all food groups, and how the intervention influenced this. Data for each food group as per the AGHE, consistent with Victorian Menu Planning Guidelines, were collected.

Vegetable Provision Recommendations

The Victorian Menu Planning Guidelines recommend provision of 1–1.5 children's serves of vegetables and legumes/beans per day for each child under care (Table 2.4). One serve of vegetables is equivalent to approximately 75 g of fresh, frozen, canned (drained) or cooked vegetables, which may look like half a cup of cooked green or orange vegetables such as broccoli or pumpkin, or one cup of leafy green vegetables. Furthermore, vegetable provision and consumption data provided the opportunity to assess differences in the variety and types of vegetables served.

Core Food Groups

The core AGHE food groups that were assessed were (1) vegetables and legumes, (2) fruit, (3) grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties (cereals and breads), (4) lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans, (meat and alternatives) (5) milk, yoghurt cheese and/or alternatives (dairy and alternatives). Foods classified as discretionary were also measured. As outlined by the AGHE, these foods do not fit into any core

food group as they are nutrient poor and characterised by being higher in kilojoules, saturated fat, added sugars and added salt (Table 2.4).[13]

Table 2.4 Menu planning for LDC food groups, and child serve size examples[141]

Food group	Target serves	Serve size examples
Vegetables and legumes	1–1.5	75 g fresh, frozen, canned (drained) or cooked vegetables 1 cup leafy greens 30 g dry weight beans or legumes (75 g cooked)
Fruit	1	75 g fresh, frozen, tinned (in natural juice) or cooked fruit 15 g dried fruit.
Cereals and breads	2	40 g bread 30 g cereal flakes 30 g dry weight rice, pasta, noodles or couscous 30 g flour 35 g crispbread
Dairy and alternatives; e.g. milk, yoghurt, cheese and/or alternatives	2	100 ml milk 100 ml custard 80 g yoghurt 15 g hard cheese 50g ricotta cheese
Meat and alternatives; e.g. lean meat/ poultry, fish, eggs, tofu, nuts or meat	1	50 g raw lean red meat (30 g cooked) 40 g cooked poultry (skin off) 60 g raw fish (50g canned or cooked) 85 g cooked beans or legumes 1 egg 85 g tofu 60 g hummus 15 g nuts or nut butters
Discretionary food and drinks	0	1 serve = 600 kJ of discretionary food items: • chocolate, confectionary, jelly • high-fat/high-salt commercially made savoury biscuits, chips and crackers • high-sugar/high-fat sweet and savoury baked items such as muffins, cakes, loaves and non-baked slices • cream, ice cream, sour cream, commercially made frozen yoghurts • meats such as sausages, frankfurts/hot dogs, salami, strasburg, devon, some commercial chicken nuggets and fish fingers • pastry-based foods such as pies, pinwheels, pasties and sausage rolls • soft drinks, fruit juice and fruit drinks, cordial, sports drinks, sports waters, flavoured waters, flavoured mineral waters, iced teas and energy drinks
Fats and oils	<1	No more than 10 g/ml (2 teaspoons) of monounsaturated or polyunsaturated oils/spreads per child, per day

Outcome Evaluation

Outcome evaluation measured individual child dietary consumption of each of the food groups outlined in Section 2.3.5 by measuring provision and waste at mealtimes in centres. The following sections describe the process for measuring child provision, consumption and waste.

Child Dietary Provision, Consumption and Waste

Dietary consumption, or dietary intake, was calculated by measuring provision and waste through individual plate waste (direct observation). Children's dietary consumption at morning snack, lunch and afternoon snack was measured using weighed plate waste—a common way of measuring child food intake in the childcare setting.[156, 198] At centre visits, the two largest rooms occupied by the eligible age group (2–5 years) were selected to be involved in plate waste measures. Typically, centre rooms are filled according to age. Eligible room types were toddlers (aged 2–3 years), pre-kindergarten (aged 3–4 years) and kindergarten (4–5 years). Plate waste data collection occurred on two days at each centre: once at baseline, and once at two–four day follow up, depending on centre size. The plate waste methodology used at baseline was as planned, but follow-up data collection was modified because of COVID-19 restrictions that prevented entry of research staff into the rooms.[199] The methodology for plate waste measurements at both time points is described below, highlighting areas where adaptations were made.

Plate Waste at Baseline Data Collection

A dietitian (the PhD candidate) and a research assistant attended each centre for approximately six hours to complete plate waste measurements. On arrival, eligible children present on the day were identified from the attendance list and allocated a study identification (ID) number.

Mealtime Plate Waste Measurement Process

At the start of each mealtime (morning snack, lunch and afternoon snack) eating utensils (bowls, plates and cups) were labelled with child ID numbers. Centre staff then served the children's meals as per usual practice. Each plate and meal component was weighed by the PhD candidate and researchers prior to serving. For example, if a meal was a curry and rice, the curry was weighed first, and then the rice. During the meal, any additional serves were weighed and recorded by researchers using the same protocol. Centres were asked to refrain from allowing children to self-serve during data collection visits; however, centres involved in the study were not practicing self-serve due to COVID-19 restrictions in place at the time. Once each child had finished their meal, their plate was collected and weighed again to measure how much food was remaining (waste). Each component of waste was weighed separately, using the same protocol described above. Plates, servings and waste were weighed using calibrated electronic kitchen scales to the nearest 1.0 g (Kenwood DS607).

Measuring Dietary Consumption

To measure provision, the weight of the bowl, plate or cup was subtracted from the total weight of the food. The amount of food consumed was calculated by subtracting the mass of the food waste left over from the food weight: dietary consumption (g) = served (provision) (g)–leftovers (waste) (g).

Detailed information about recipes, including the type or brand of specific food items, was collected from centre cooks. Mixed meal data were entered into FoodWorks Professional version 10 (Xyris Software Pty Ltd, Queensland, Australia) to calculate the proportional weight of each ingredient. Food provision and dietary consumption was measured in grams and converted to equivalent servings based on the AGHE and Victorian Menu Planning Guidelines.[141]

Plate Waste at Follow-up Data Collection (Modified Protocol Because of COVID-19 Restrictions)

Follow-up plate waste data collection and centre visits were scheduled for the same days of the week and rooms as baseline for each centre, to collect data from the same children as present at baseline wherever possible. Methodologies for plate waste at follow up were modified to accommodate COVID-19 restrictions in place at the time of data collection. These did not allow researchers to enter rooms, or handle utensils or food items prior to or during meal service. Furthermore, only one researcher was allowed on site at any time. Therefore, one researcher attended each centre for approximately six hours to complete plate waste measurements at morning snack, lunch and afternoon snack. On arrival, all eligible children present that day were identified from the attendance list and allocated their previous study ID number, or a new one if they were not present at baseline.

To adapt to COVID-19 restrictions, measurement of plate waste was modified to incorporate a hybrid use of photography and weight measures. Adaptations took into consideration time constraints and the study's limited ability to purchase photography equipment.[200] As research assistants were permitted on site but not inside rooms, the hybrid plate waste methodology involved an educator-led method with photographs and weighing by researchers. This methodology was adapted using the digital photography of foods method outlined by Williamson et al. (2003), modified and evaluated in preschool settings by Nicklas et al. (2012).[201, 202]

Digital Diet Estimation

The digital diet estimation methodology described by Nicklas and colleagues (2012) was adapted for the purposes of this study.[201] The digital photography of foods method, or digital diet estimation, uses photographs of meals taken at a 45-degree angle, which are then compared with images of 'standard portions' to estimate weight and quantities in units of 10%.[202] Testing of this method in preschool centres found the average correlation between estimated weights and actual weights

was 0.96 ($p < .001$), and the average mean difference was 10.6 g.[201] This suggests the approach may be a valid and feasible method for assessing food consumption in the preschool setting.

Adaptation to follow-up plate waste measures took into consideration COVID-19 restrictions in place in the Adelaide metropolitan area at the time.[200] As researchers were not allowed to enter the rooms where child meals were served, or to handle eating utensils or food items before the meals, all photographs had to be taken by educators and support staff at centres. However, as food waste and bowls were permitted to be handled by the researcher outside the room and after the meal, this allowed scope for waste portions to be weighed, rather than photographed and estimated. The following sections describe each stage of the digital method in further detail.

Mealtime Process

At the start of the meal, educators served three reference child-sized portions, which were set aside for the researcher to weigh after meal service. The researcher took reference photographs of the meal or snack, from 0 to 200 g (i.e. minimum to maximum weight of meals), in increments of 10 g.

Educators were provided with a computer tablet to take photographs of meals and labels pre-filled with child ID numbers by the PhD candidate or a research assistant. Educators labelled and photographed children's bowls using equipment provided. To photograph meals, educators were instructed to photograph the child from a birds-eye view with the ID label and a 30-centimetre ruler provided for reference being clearly in view. The birds-eye view angle was chosen in lieu of suitable equipment to determine a 45-degree angle as described by Nicklas and colleagues (2012).[201] Staff were provided with instructions along with example images of how photos should be taken. A mealtime checklist developed for this study was also provided to educators so they could record the number and size (standard or half serve) of each food item provided to each child during the meal. A new mealtime checklist was provided at each meal; pre-populated with child names with identification numbers, and food items being served.

If children received additional serves during the mealtime, educators were advised to (1) photograph the empty or leftovers bowl, (2) provide the additional serve, (3) photograph the bowl with the new serve and (4) note on the mealtime checklist that the child was provided with an additional serve. Alternatively, if sufficient crockery was available, educators could serve a new bowl (additional ID labels provided by researcher), photograph the new bowl and collect the previous serve for later measurement. At the end of the meal, educators collected all left-over bowls with remaining food waste intact; these were provided to the researcher situated outside the room. The mealtime checklist was collected by the researcher at the end of the meal and used to cross-check with images to confirm how many serves a child had received.

At the end of the meal, the PhD candidate or a researcher photographed and weighed the left-over food waste following the protocol used in the original plate waste methodology. The three child-sized reference portions were also weighed and photographed (with ruler as reference) to be used as reference portions for comparison with child images. The recipe for each meal and food item was collected from the centre cook on the day of data collection.

Visual Estimation of Child Meal Provision

Two trained dietitians (including the PhD candidate) assessed each child meal photograph in comparison with the reference photos to estimate the amount of food in each photograph. The ruler in the images was used as a guide to compare plate waste images to images of the reference portion, to calculate provision. The amount of food was estimated both in grams and as a percentage of the reference portions, in units of 10%; for example 80% or 120%. The mealtime checklist was used to cross-check the number of serves a child had received. The estimated weights were entered into a data entry spreadsheet in Microsoft Excel (Microsoft Corporation, Version 2019). As three reference portion weights and photographs had been collected, one reference portion was elected as the 'primary' reference. The primary reference was the portion that was closest to the mean portion weight. To measure inter-rater reliability, 10% of children were assessed by both assessors; this showed a 93% agreement within 10 g between assessors.

Process Evaluation

Process evaluation was conducted on two levels: (1) intervention feasibility and fidelity, and (2) acceptability and satisfaction of the intervention. As this is the first study to test a menu box delivery food service model in LDC centres, evaluation of feasibility and acceptability will provide crucial information for future development of the approach for the sector. Feasibility measures allow researchers to determine whether an intervention was delivered to participants as planned. Fidelity determines the extent to which and intervention was implemented as intended. The two measures are closely related and can be used as indicators of feasibility.[203] Feasibility and fidelity of the intervention in this study were evaluated through childcare and staff recruitment and retention rates. Fidelity in the menu box delivery group was determined from menu box delivery courier records and use of the menu and recipes by centre cooks. Fidelity in the menu planning group was determined from cooks' completion of the online training module and Menu Assessment Tool.

Acceptability of an intervention determines the suitability of the intervention from the perspective of the population of interest, which in the LDC setting is the centre cooks and, potentially, directors.[203] Measures of acceptability generally capture end-user satisfaction. Staff acceptability and satisfaction of the menu box delivery service and cook training and Menu Assessment Tool was evaluated.

Intervention Feasibility and Fidelity

Feasibility and fidelity were evaluated on the basis of childcare and staff recruitment and retention rates, menu assessments and time taken to complete training modules. Information about time taken to complete the training, menu assessment and menu box orders was collected from responses to two questions in the interviewer-administered questionnaire described below.

Fidelity in the menu box delivery centres was determined from menu box delivery courier records and use of the menu and recipes by centre cooks using a weekly over-the-phone check, described in more detail below. In the menu planning centres, the follow-up cook interview included questions regarding cook completion of the online training module and Menu Assessment Tool.

Acceptability and Satisfaction

Staff acceptability of and satisfaction with the menu box delivery service, and cook training and Menu Assessment Tool was assessed through cook and director interviews. All cooks and directors completed a follow-up interview. In addition, intervention centre cooks participated in a weekly phone check-in to provide regular feedback about the menu box delivery service.

Data Collection Methods for the Process Evaluation

Data on feasibility, fidelity, acceptability and satisfaction were collected using menus provided by centres, and questionnaires complete by cooks and directors both during the intervention and at follow up. The following sections describe the data collection methods for each component of the process evaluation.

Centre Menu Compliance With Guidelines

Compliance of the centre menu with the Victorian Menu Planning Guidelines was assessed at baseline and follow up. Assessment of the centre menu was completed using an online Menu Assessment Tool. At each time point—baseline and follow up—centre cooks were asked to provide (1) a copy of their current full centre menu cycle, (2) full recipes including quantities of foods for two weeks of the menu and (3) the number of children for which the recipe provided serves. If recipes were not available, standardised recipes for the closest matching meal from the Australian Food, Supplement and Nutrient (AUSNUT) 2011–13 database were used.[204] Two weeks of the menu were used as a proxy for the entire menu as centres differed in their menu cycle lengths (typically 2–6 weeks). This information was then entered into the online Menu Assessment Tool. The tool provided an assessment of the menu reflecting the number of serves of each food group against target serves in the Victorian Menu Planning Guidelines, which are based on the AGHE food groups.[13]

Weekly Phone Check-in Questionnaire (Intervention Centre Cooks)

Intervention centre cooks completed a weekly over-the-phone check in with the PhD candidate at the end of each week of the menu box delivery. Specifically, the 12-item questionnaire asked each cook for their feedback on ingredient quality, overall satisfaction, whether any meals needed to be modified and whether additional ingredients had been required. This included Likert scale questions (four items) rating satisfaction with the menu box overall, quality of the ingredients, recipe quality and timing of the delivery. One short answer item provided the opportunity for cooks to report any modifications they may have made to recipes (and why) and four items pertained to ingredient quantity, such as missing ingredients. This questionnaire was designed for the purposes of this study and took around 10 minutes to complete on each occasion. At the end of each weekly check in, cooks were asked a series of time questions, specifically about time spent (1) menu planning, (2) placing menu orders, (3) receiving and packing away deliveries and (4) shopping for ingredients additional to weekly deliveries.

Follow-up Cook Interview Questionnaire

Feedback from cooks in both groups was collected through a structured interviewer-administered questionnaire to evaluate cooks' acceptability of intervention components, and collect feedback on training material at follow up (Figure 2). Questionnaires were administered by the PhD candidate during a face-to-face interview (n = 4), or, because of COVID-19 restrictions at the time, over the phone (n = 4).

The questionnaire contained a combination of multiple choice and open-ended questions. Multiple choice questions included items such as time taken, quality of materials, effectiveness and readiness to implement the menu, with the opportunity to comment further on responses. Process evaluation questionnaires were administered for both study groups. Intervention centre cooks completed a 44-item interviewer-administered questionnaire on completion of the eight-week menu box delivery intervention, and cooks in the menu planning group completed a 42-item interviewer-administered questionnaire following the training and menu revision phase (Figure 2).

The purpose-designed questionnaires adapted items from the Learning Object Review Instrument (LORI) and TDFs, alongside questions specifically tailored to the study.[165, 167, 205] The LORI framework was used to evaluate the acceptability and usability of learning resources, providing insights on content quality, staff motivation, interaction usability and presentation.[205] Perceived barriers and enablers of implementing the menu planning guidelines were evaluated using the TDFQ for cooks developed by Seward (Comparative Fit Index of 0.78), which included domains such as staff knowledge, environmental context and resources, and social influences, to provide an understanding of factors that may have affected implementation of the intervention.[165, 169]

Both intervention and comparison centre cook questionnaires included 15 items taken from the TDFQ for cooks (five-point agreement scale, where responses range from strongly disagree to strongly agree). The intervention centre cook questionnaire had three additional domains: 1) menu pack (9 items), 2) order process (6 items) and 3) overall menu box delivery (14 items). Within each domain, question responses were collected using a five-point agreement scale (16 items), short answer (11 items), yes/no response (1 item) or multiple choice response (1 item). Therefore, cooks in the intervention group completed a 44-item interviewer-administered questionnaire. The comparison centre cook questionnaire consisted of two domains: 1) Online Cook Training (12 items) and the online menu planning tool (15 items). Within each domain, question responses used a five-point agreement scale (10 items), short answer (10 items), yes/no response (3 items) or multiple choice response (4 items). Therefore, cooks in the comparison group completed a 42-item interviewer-administered questionnaire.

Follow-up Director Questionnaire

At follow up, centre directors were asked to provide feedback via a short interviewer-administered questionnaire. The questionnaire contained a combination of Likert scale and open-ended questions pertaining to the menu box delivery service, or the cook training and Menu Assessment Tool. The comparison centre director questionnaire consisted of 11 items about the Online Cook Training (5 items), the online Menu Assessment Tool (5 items) and overall comments. Questions were responded to using a five-point agreement scale (10 items) and one short answer. The intervention centre director questionnaire consisted of 7 items about the menu box delivery service. These questions pertained to overall satisfaction, acceptability and willingness to spend on the menu box delivery service. The questionnaire used five-point agreement scales (5 items) and short answers (2 items).

2.3.6 Covariates

Centre Operational Data

Operational data for the centres were collected at baseline. Data collected included the number of enrolments, the average weekly attendance by day and room (age group), the number of Aboriginal or Torres Strait Islander children enrolled, centre operating hours, meals and snacks served, menu cycle length, current food budget allocations, food and menu policies, and current or previous menu guidelines or policies used at the centre. At follow up, centres were asked to report whether they had implemented any new or alternative nutrition policies or programs during the intervention period.

Staff Characteristics

Staff characteristics collected included the number of staff employed as cooks and kitchen assistants, hours worked per week, age, gender, years in current position, years employed in the ECEC sector and any qualifications relevant to their role as a cook. All cooks were asked if they had completed any training or qualifications related to menu planning, or if they had used (or were currently using) any menu guidelines and assessment tools to plan centre menus. In centres where more than one cook was employed, such as in a job share arrangement, characteristics were collected for the primary cook in charge of menu planning, ordering and implementation.

Child Characteristics

Child characteristics were collected for all children participating in plate waste data collection. Age, gender and Aboriginal and Torres Strait Islander background of children were recorded at each data collection stage, along with any dietary requirements and allergies.

2.3.7 Statistical Analysis

Sample Size and Power Calculations

Sample size calculations were conducted using G*Power Software40 based on α of 0.05 and power of 0.80. Cohen's *d* of 0.65 was calculated following a similar menu compliance intervention study in the Australian LDC setting, which reported a change in child dietary intake of 0.4 serves of vegetables from 0.9 (0.8) serves at baseline to 1.3 (0.9) serves at follow up.[178] Using an intra-class correlation coefficient of 0.1, to account for clustering by centre, the required sample size was approximately 180 children. The average place allocation per centre was estimated at approximately 60 children,[194] with the majority of children being 2–5 years of age. Recruiting eight centres with plate waste data for a minimum of 20–25 children met the sample size requirement of 180 children.

Data Entry and Management

All participant and centre data were recorded on standardised forms designed for the study. Plate waste data were recorded on paper at both baseline and follow up. At follow up, portion estimation was entered directly into Microsoft Excel. Menu assessment data were entered into the online Menu Assessment Tool and reports were exported as PDF files. All data were entered into Microsoft Excel.

Follow-up cook questionnaire responses were voice recorded at the same time as being recorded on paper questionnaire forms, and were then entered into Microsoft Excel. Interview recordings were downloaded and transcribed in Microsoft Word (Microsoft Corporation, Version 2019). Menu

invoices were scanned and entered into Microsoft Excel. Data were anonymised on entry. Physical data sheets were stored separately in locked filing cabinets; digital data files were saved on the secure university network.

Data Preparation

Plate Waste Data

Data (provision and waste) from plate waste records were entered into a Microsoft Excel spreadsheet. Individual food items were matched to food codes from the AUSNUT 2011–13 database.[204] Where foods were served with inedible portions (such as inedible fruit rind), standardised edible portion percentages from the AUSNUT 2011–13 database were applied. If only the inedible portion remained as waste (noted on data collection entry), the edible portion was calculated by subtracting the inedible waste.[204] Where a mixed meal was served and individual ingredients could not be weighed, recipes were collected from centre cooks to determine proportions.

Mixed meals or recipes were entered into FoodWorks Professional version 10 to calculate the proportional contributions of each ingredient. Where specific weights or quantities were not provided for recipe ingredients, standardised portions within the FoodWorks program were used. For instance, if a cook reported adding ‘three zucchinis’ to a recipe, this was entered as the three ‘medium’ zucchinis as listed in the system. Recipe proportions were then exported into Microsoft Excel where plate waste data were disaggregated to individual ingredients and matched to food codes from the AUSNUT 2011–13. Proportions were calculated based on the weights of each ingredient, derived from the full recipe.

Plate waste data were then exported into SPSS 24.0. The AUSNUT 2011–13 food codes were used to create food group variables in serves and grams based on the Victorian Menu Planning Guidelines food groups for provision, consumption and waste. The discretionary food and drink flag was used to identify discretionary foods.[206] Data were then aggregated for each child for one day of eating and the number of grams and respective serve size for each food group and type were calculated using the Victorian Menu Planning Guidelines.[141]

Analysis of Plate Waste Data

All statistical analyses were performed using SPSS 24.0 statistical software. Data were visually assessed for normality using frequency histograms, which were then compared with the results of Kolmogorov–Smirnov and Shapiro–Wilk tests of normality. As child dietary provision and consumption data were not normally distributed, data were reported as median and inter-quartile range. For categorical variables, count and percentage (count) was used. The primary sample for analysis of child dietary provision and consumption was eligible children with complete data for a

full day of eating at follow up (i.e. two snacks and one main meal). Sub-group analysis was conducted for children present at baseline and follow up, with complete data for a full day of eating.

Linear Mixed Model of Child Dietary Provision and Consumption

Linear mixed model analysis can be used where there is non-independence of data, and allows for both fixed and random effects within the model.[207, 208] As child dietary provision and consumption data were collected at LDC centres, it cannot be assumed that children were independent of the centres they attend. In short, a linear mixed model considers clustering of children within individual centres. Provided that the residuals are normally distributed, non-normally distributed data can be analysed using linear mixed modelling.[207, 208]

The linear mixed model adjusted for clustering of centres (random effect), and controlled for child age and gender, SES of centre location and centre size (fixed effects). Log-transformation was performed for variables that did not fit model assumptions. Estimates for transformed variables are reported as the ratio of geometric means, whereas non-transformed variables are reported as geometric means. Statistical significance was considered at $p < 0.05$.

Coding of Follow-up Cook Interviews

Cook interviews were undertaken with a mixture of multiple choice and short answer responses. As cooks provided comments and detailed responses throughout, these were transcribed and coded to identify any recurring themes. Where cooks did not provide consent to be recorded, detailed notes were collected.

Responses were coded in a two-stage process. First, interviews were coded with a deductive approach using predetermined codes adapted from the questionnaires; however the process transformed into an inductive approach as themes and codes were uncovered in the responses. Once all interviews had been coded once, the second stage involved the recoding and refining of themes and codes established in the first stage. Similar or overlapping codes were removed or grouped before themes and sub-themes were established.

The cost-effectiveness of the menu box delivery intervention in comparison with use of the cook training and menu planning tool (i.e. usual practice) was analysed using a within-trial cost-effectiveness analysis (CEA) and cost consequence analysis (CCA) as estimated from the centre perspective. The economic analysis is described in detail in the next section.

2.3.8 Economic Evaluation

Economic Evaluation Aim

An economic evaluation compares both the costs and the outcomes of at least two alternative interventions.[209] It is important for decision makers to understand both the cost and effectiveness of a particular resource or outcome to make an informed decision on the most efficient use of the resources available to them.[191, 210] The WHO (2012) highlighted the need for identifying cost-effective interventions to improve program sustainability.[16] Despite the importance of economic evaluations, systematic reviews have identified a lack of such evaluations being conducted in public health interventions to improve diet quality or vegetable consumption. They are even more scarce in childcare interventions.[14, 171]

The aim of this economic evaluation was to compare the cost-effectiveness of the menu box delivery intervention with that of menu planning (i.e. usual practice) in LDC centres. The research question for the economic evaluation was: Is an eight-week menu box delivery service cost effective (in terms of cost per vegetable serve menu compliance, serves of vegetables provided to and consumed by children at mealtimes) when compared with an online menu planning tool, from a childcare centre perspective?

A prospective, within-trial cost-effectiveness and CCA was conducted to estimate cost-effectiveness of the menu box delivery intervention. Cost-effectiveness and cost-consequence analyses were selected over a cost-utility analysis, as measuring utility in a within-trial analysis was not feasible.[209] The CEA allowed for comparison of different outcomes, whereas the CCA presented all disaggregated cost and outcomes to allow readers to identify costs and effects most relevant to their priorities.

The evaluation was conducted from the perspective of the LDC centre over an eight-week time horizon, consistent with the eight-week intervention length. This perspective was chosen as LDC centres will be the primary decision makers regarding adoption of the intervention, given that they are the budget holders in this sector. Food provision and staff wages are a core component of childcare centre budgets. Maximising operational and financial efficiencies is crucial for both individual centres and childcare service providers. Therefore, an understanding of whether an intervention is 'good value for money' is a key component of adoption.[209] Therefore, a BIA was also undertaken to assess the financial impact on existing budgets of the adoption of the intervention. A BIA focusses on the direct costs of resources needed to implement the intervention (such as training, menu cost and staff time).[211] This analysis as selected as it provides insights and identifies the implications of the intervention for the childcare centre budget.

The economic evaluation was guided by the *Recommendations for the Conduct, Methodological Practices, and Reporting of Cost-effectiveness Analyses: Second Panel on Cost-Effectiveness in Health and Medicine*, and the International Society for Pharmacoeconomics and Outcomes Research (now known as the Professional Society for Health Economics and Outcomes Research) (ISPOR) Task Force principles of good practice for a BIA.[191, 211] Reporting of the economic evaluation follows the CHEERS 2022 statement.[212]

Measurement and Valuation of Resources and Costs

Pathway analysis was used to identify the relevant resource use for intervention and comparison groups. Cost and resource use was measured from the centre perspective and was collected prospectively over the course of the intervention. Cost categories were defined as (1) cost of the centre menu (i.e. ingredients), (2) menu box delivery menu licence costs, (3) cook training and menu assessment costs, and (4) cook labour time (Table 2.5).

All costs were calculated and are reported in AUD for 2020/21. All time data were collected as minutes, or as hours and converted to minutes. The labour cost of time was valued using the midpoint of the *Australian Pay Guide for Children's Services Award*.[213] A 15% on-cost was applied to wage estimates to account for staff costs such as superannuation, payroll tax, workers compensation and fringe benefits tax using government sources.[214] As this study was a within-trial evaluation with a trial duration of less than a year, discounting was not applied. Cooks reported time in minutes or hours, and data were converted to minutes (if applicable).

To estimate menu costs, weekly menu order invoices and receipts were collected from centres over the eight-week intervention period. Cooks in the comparison group were provided with folders in which to collate their weekly invoices, and these were collected by the researcher at the end of the intervention period. Bulk or donated food item records were provided to record ingredients that were not purchased weekly, or that were donated. Non-menu items, such as staff provisions, were marked on the invoices by cooks, as is standard practice in centres. Menu box delivery costs, including produce and delivery fees, were determined from invoices provided by the supplier. Invoices were costed by the supplier to reflect standard practice, which means ingredient and delivery costs factored in supplier staff labour and time.

Individual food items on menu invoices were categorised by food groups outlined by the menu planning guidelines: (1) vegetables, (2) fruit, (3) cereals and breads, (4) dairy and alternatives and (5) meat and alternatives. Furthermore, ingredients were categorised as discretionary food and drinks, fats and oils, spices or ‘other’.[13, 141] Foods classified as ‘other’ were those that did not fit within the food groups outlined above (for example, baking soda or stock).

The menu box delivery service was underpinned by menus and recipes compliant with menu planning guidelines. Therefore, there may be costs for the supplier associated with acquiring and integrating such recipes and menus. The specific model of the service may be dependent on the stakeholders involved, and whether the recipe costs would be absorbed by the supplier as part of their service, or a cost incurred by childcare centres. For the purposes of this study, it was assumed that the menu box delivery supplier would pass on the costs associated with menu and recipe compliance to the consumer (i.e. childcare centres), which was deemed likely in a real-world scenario. Therefore, costs associated with the menu box delivery service included the cost of the menu licence that gave centres access to four-week menus and recipes designed by Nutrition Australia (Victoria) and tailored for the LDC setting. The cost of the menu licence was derived from the cost of the menu packs and recipes available online for LDC centres to purchase.[141] Cost was then calculated for the intervention period (i.e. eight weeks).

Cook labour time was measured as time associated with menu planning, which included (1) undertaking menu planning; (2) ordering (online); (3) shopping for ingredients (in person); and (4) receiving and packing away orders. Time data were self-reported by cooks via a specially designed, weekly structured five-item questionnaire administered as a phone interview by the PhD candidate throughout the eight-week intervention. Cooks were asked to report time spent on the four labour time domains for the week, plus any additional activities not captured by the questions.

Cook training and menu assessment costs in the comparison group were defined as the time taken to (1) complete the Online Cook Training; and (2) assess the centre menu using the online Menu Assessment Tool. These data were self-reported by cooks through the follow up-questionnaire (Section 2.3.5) as the total estimated time spent on the training (1 item) and using the Menu Assessment Tool (1 item) in minutes or hours. The Online Cook Training and Menu Assessment Tool were both free to access and use.

Table 2.5 Summary of costing assumptions and sources of unit costs

	Details and assumptions	Source of unit costs
Staff labour		
Time planning menu	Self-reported by cook via weekly phone interview	Wage rates, using midpoint of Child Services Award Rate, Level 1.1–5.4, $25.85 per hour, including 15% on-cost[214, 215]
Time placing menu order		
Time shopping in person		
Time packing food delivery		
Comparison centres		
Cook online training	Self-reported by cook via interview	
Menu Assessment Tool	Self-reported by cook via interview	
Intervention centres		
Menu pack and recipes (licence)	Cost of menu pack, menus and recipes, tailored to centre to meet guidelines	Reported by Nutrition Australia (Victoria)[216]
Menu costs		
Centre menu ingredient cost/week	Invoices corresponding to weekly centre menu	Exact costs from centres, prices at October–December 2020 in AUD
Menu cost/child/week	Intervention records	
Total cost/child/week		

Measurement of Outcomes

Key vegetable outcomes of this study—(1) menu compliance, (2) child dietary provision and (3) consumption at mealtimes—were used as the measure of benefit (Section 2.3.5). For the purposes of the economic analysis, menu compliance and child dietary provision and intake outcomes were broken down by the Victorian Menu Planning Guidelines food groups and by serves.[141]

Currency, Price Date and Conversion

Cost analysis was performed using AUD as current in October–December 2020. Menu invoices were collected from centres for October–December 2020 and staff time was converted to wage rates using the median of the Child Services Award Rate, Level 1.1–5.4, $25.85 per hour, including 15% on-cost.[214]

Analytics and Assumptions

The results of the cost-effectiveness analyses are presented as the incremental cost-effectiveness ratio (ICER). The ICER provides a ratio of the extra cost per extra unit of effect. The ICER was calculated by dividing the difference in total costs of the two groups (incremental cost) by the difference in the outcome measure (incremental effect), and was performed using the Excel tool provided by Briggs et al. (2002).[217] The CEA followed the recommendations of Sanders and

colleagues (2016).[191] A median-based ICER technique described by Bang and Zhao (2012) was used to calculate the ICER where appropriate.[218] The CCA allowed scope to compare the costs with multiple consequences (outcomes) for a range of outcomes. In this study, the CCA evaluated several outcomes including centre menu compliance, and child food group provision and consumption at mealtimes, for all core food groups.

A BIA was performed from the perspective of the service provider. The service provider involved in the study runs 25 LDC centres in metropolitan South Australia. A 12-month time horizon was selected for the BIA, to reflect usual annual budgeting periods for childcare settings. Two scenarios were estimated in the BIA. Scenario one assumed that the intervention centre 'menu planning' time reduced by 50% to account for a learning effect related to menu pack recipes. To account for a learning effect for the 12-month time horizon, a reduction of 25% in time using the online Menu Assessment Tool was applied. Scenario two assumed a greater reduction in comparison centre cook time when using the online Menu Assessment Tool; estimated as a reduction of 50%. Both scenarios applied an industry staff turnover rate (30%) to both intervention and comparison centres, which was reported by the service provider.

A cost-utility analysis, which measures outcome effects by both quality or quantity of life (such as DALY and QALY) was not selected for this analysis as it does not reflect the outcomes of the intervention. Furthermore, utility measures in children of this young age group require parent reports and are not particularly well validated.[219] Because of the short time horizon and within-intervention nature of the analysis, impacts on HRQoL measures were not expected.

Characterising Uncertainty (Sensitivity Analyses)

To account for uncertainty, a nonparametric bootstrapping analysis with 1,000 iterations was used when estimating cost-effectiveness.[217] A sensitivity analysis is used to assess the level of confidence that may be associated with the results of an economic evaluation. The menu box delivery supplier can be considered a premium brand that stocks produce at a premium price. Therefore, a sensitivity analysis was performed whereby intervention centre menus were costed with the same supplier as the comparison centre menus (a large supermarket chain). This allowed for a comparison of menu costs with a consistent supplier. The type and quantity of each individual food item on intervention invoices was costed using the online website of the supermarket chain. Items were costed by the closest matching ingredient or food item at the lowest price available. For example, if royal gala apples were supplied on the intervention invoice, royal gala apples were selected for costing even in the instance where a different apple variety may have been lower in cost. Where food packaging did not allow for an exact match in quantity, the closest match was selected. Catalogue sales were ignored and the usual (full price) of the food item was recorded. The Consumer Price Index (CPI) is the most widely used measure of inflation.[220] To account for changes in price from the time the intervention was delivered and costed (2020) to the time when

the menu costing was performed (2021) a CPI of 3.8% was applied to costing scenarios in all analyses.[221]

2.4 Chapter Summary

The food service model described embedded menu planning guidelines as part of a menu design and food procurement system. By streamlining these two components of the LDC food service system, a menu box delivery service may support centres to provide a centre menu compliant with menu planning guidelines. Through improving menu compliance, child provision and consumption of vegetables in centres may improve in a time and cost-effective manner. This chapter outlines the development of the menu box delivery service and summarised the methodology of a trial involving the menu box delivery service in LDCs. Results of this trial are presented in three evaluation chapters entitled Process Evaluation Results (Chapter 3), Outcome Evaluation Results (Chapter 4) and Economic Evaluation Results (Chapter 5). Each results chapter is concluded with a discussion and summary that pertains to each. A general discussion in Chapter 6 of this thesis triangulates and synthesises the three results chapters.

CHAPTER 3 PROCESS EVALUATION RESULTS

3.1 Chapter Overview

This chapter is the first of three presenting the outcomes of the trial described in Chapter 2. Each chapter addresses one of the thesis objectives. Chapter 3 reports the outcomes of the process evaluation, Chapter 4 reports the outcome evaluation results (dietary consumption) and Chapter 5 reports the economic evaluation outcomes. This chapter addresses the objective *to evaluate the feasibility and acceptability of a menu box delivery service straight to LDCs*. and reports on the process evaluation. Process evaluation measures were in two forms: (1) feasibility and fidelity, and (2) acceptability. As outlined in Chapter 2, feasibility and fidelity were measured by way of menu compliance, intervention participation and retention. Acceptability was measured by cook and director feedback from the (1) weekly cook interviews (intervention centres only) and, (2) follow-up cook interviews and director feedback (all centres).

3.2 Centre and Participant Flow Through the Study

Eight of the 11 LDC centres approached agreed to participate in the study (Figure 3.1). Three centres declined to participate because of either staff changes (n = 1) or lack of time (n = 2). All eight centres enrolled in the study completed baseline data collection. Four centres were randomised to the comparison group, and the remaining four to the intervention group. One cook from each centre participated in the study and completed both baseline and follow-up measures. One director from each centre provided feedback at follow up.

At baseline, data were collected for 252 children. Of these, 59 (23%) children were excluded as they were not present on all (measured) eating occasions. The final baseline sample included 103 children in the comparison group and 90 children in the intervention group.

At follow up, data were collected for 256 children. Thirty-two (13%) children were excluded from the follow-up stage because they were not present on all (measured) eating occasions. For 19 children with duplicate days of dietary intake, only one day (the first day) of eating was analysed for each. Complete dietary consumption data (data for all measured eating occasions including morning snack, lunch and afternoon snack) were collected for 224 children: 126 in the comparison group and 98 in the intervention group (Figure 3.1).

No parents opted out or withdrew their child from data collection at any centre at either time point. Among the 193 children with complete data at baseline and 224 children at follow up, 105 were present at both time points: 55 in the comparison group and 50 in the intervention group.

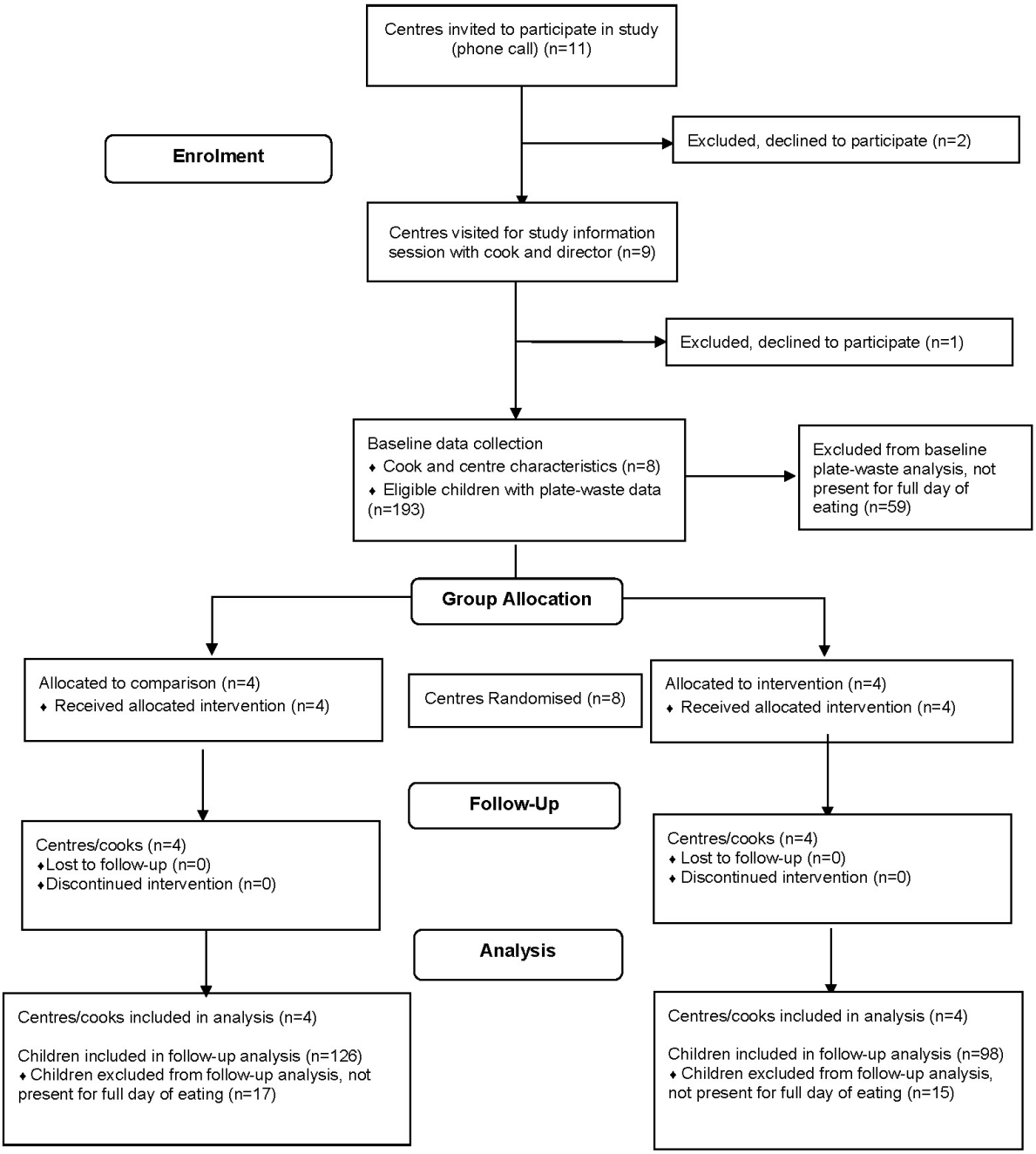

Figure 3.1 CONSORT flow diagram of centre and child flow through intervention.

3.3 Baseline Characteristics of Cooks

Cooks from eight childcare centres (*n* = 4 intervention centre cooks; *n* = 4 control centre cooks) were recruited for this study. Seven of the eight centres employed one cook, while one intervention centre employed two cooks. Where there were two cooks, the primary cook responsible for menu planning and preparation was included in the study. No centres employed a kitchen hand or assistant.

Table 3.1 describes baseline characteristics of centre cooks. Cooks were female with a mean age of 33.5 (standard deviation [SD] 3.0) years (comparison centres) or 32.8 (7.7) years (intervention centres). The level of experience in the current role for cooks was similar between the two groups: 3.1 (1.7) years in the comparison centres and 3.3 (1.4) years in the intervention centres. Mean experience as a cook in any setting was around 3.2 years longer in the intervention than the comparison group. Mean experience in the childcare sector for comparison centres was 8.3 (6.3) years, and for intervention centres. 9.5 (12.4) years.

At intervention centres, all four cooks held a certificate or diploma: two held a certificate or diploma in childcare; one held a certificate in each of food processing and education support; and one cook was a qualified chef (diploma in cookery). At comparison centres, one cook had no formal qualification and three held certificates: one held a childcare certificate; one, commercial cookery; and the third held certificates in both childcare and hospitality. All comparison centre cooks placed weekly orders with supermarket chain supplier for all menu items, which were delivered directly to centres. Each cook and centre placed one order per week, in-person shopping only occurred where ingredients were needed urgently.

Table 3.1 Baseline demographic characteristics of childcare centre cooks (*n* = 8)

Cook characteristics	**Comparison (*n* = 4)**	**Intervention (*n* = 4)**
Cook age, years, mean (SD)	33.5 (3.0)	32.8 (7.7)
Gender, *n*		
Female	4	4
Male	0	0
Years' experience, mean (SD)		
In current role	3.1 (1.7)	3.3 (1.4)
In childcare sector	8.3 (6.3)	9.5 (12.4)
As cook, all settings	3.9 (1.7)	7.1 (4.7)
Highest education/level of training, *n*		
Tertiary education (University)	0	0
Certificate or diploma	3	4
No formal qualifications (on the job training)	1	0
Hours worked per week, mean (SD)	27.5 (2.9)	26.1 (5.0)

3.4 Intervention Feasibility and Fidelity

3.4.1 Centre Compliance with Menu Planning Guidelines

All centres provided two weeks of their centre menu with full recipes to match to the research staff. It was up to the centre to decide which two weeks were provided. All menus were assessed

against the Victorian Menu Planning Guidelines using FoodChecker. Table 3.2 shows the number of centres meeting menu planning guidelines for all core food groups, and overall (5/5 food groups), based on the average serves provided on the menu.

No centres were compliant with menu planning guidelines for all food groups at baseline. No intervention centres were compliant with guidelines for meat and alternatives. All intervention centres (*n* = 4) were compliant with menu planning guidelines for fruit. Three centres were compliant with guidelines for cereals and breads, and two were compliant with guidelines for dairy and alternatives (Table 3.2). In comparison centres, one centre was compliant with guidelines for each of vegetables and legumes; dairy and alternatives; and meat and alternatives. All comparison centres (*n* = 4) met menu planning guidelines for fruit, and cereals and breads at baseline (Table 3.2).

At follow up, half of the intervention centres (*n* = 2) were compliant with menu planning guidelines for all food groups, and half (*n* = 2) with all except dairy and alternatives (Table 3.2). In comparison centres at follow up, only one centre met guidelines for vegetables and legumes; while all (*n* = 4) met guidelines for fruit, and cereals and breads; and two for dairy and alternatives. No comparison centres met guidelines for meat and alternatives at follow up (Table 3.2)

Table 3.2 Number of centres meeting or exceeding menu planning guidelines at baseline and follow up (*n* = 8)

	Comparison (*n* = 4)		Intervention (*n* = 4)	
Food Group, *n*	Baseline	Follow up	Baseline	Follow Up
Compliant for all food groups (5/5)	0	0	0	2
Compliance with:				
Vegetable and legumes	1	1	0	4
Fruit	4	4	4	4
Cereals and breads	4	4	3	4
Dairy and alternatives	1	2	2	2
Meat and alternatives	1	0	0	4

3.4.2 Menu Compliance as Food Group Serves on the Menu

Mean (SD) daily servings of individual food groups on the menu are presented in Table 3.3 as serves per child, per day. At intervention centres, mean serves of vegetables and legumes at follow up were 2.0 (±0.7) serves, exceeding the recommended target serves by 0.5–1 serve (Table 3.3). Mean serves of fruit on the menu were 1.1 (±0.1) serves, and mean serves of cereals and breads were 2.2 (±0.2) serves. Mean dairy and alternatives serves on the menu were slightly below the target of two serves per day, at 1.9 (±0.1) serves. Mean serves of meat and alternatives

were 1.3 (±0.2) serves for the intervention group, which met guideline target serves (Table 3.3). In comparison centres, mean serves of vegetables and legumes at follow up were 1.0 (±0.3) serves, meeting the recommended target serves of 1–1.5 serves (Table 3.3). Mean serves of fruit on the menu were 1.6 (±0.5) serves, and mean serves of cereals and breads were 2.3 (±0.3) serves. Mean dairy and alternatives serves on the menu exceeded the target of two serves per day, at 2.3 (±0.3) serves. Mean serves of meat and alternatives were below the target of one serve per day, at 0.6 (±0.0) serves (Table 3.3).

Table 3.3 Mean (SD) daily serves of individual food groups on the menu for participating centres at baseline and follow up (*n* = 8)

		Comparison (*n* = 4)		Intervention (*n* = 4)	
Food group	Target Serves	Baseline	Follow up	Baseline	Follow up
Vegetable and legumes*	1–1.5	0.9 (0.3)	1.0 (0.3)	0.8 (0.2)	2.0 (0.7)
Fruit	1	1.7 (0.3)	1.6 (0.5)	1.8 (0.7)	1.1 (0.1)
Cereals and breads	2	2.5 (0.6)	2.3 (0.3)	2.0 (0.4)	2.2 (0.2)
Dairy and alternatives	2	1.7 (0.3)	2.0 (0.4)	1.9 (0.3)	1.9 (0.1)
Meat and alternatives	1	0.7 (0.2)	0.6 (0.0)	0.8 (0.1)	1.3 (0.2)
*Vegetables and legumes target serves is 1–1.5 serves, however one serve minimum was considered to meet the target					

3.4.3 Fidelity of Intervention Material (Adoption and Use)

Intervention Centres

All menu boxes (*n* = 32) were delivered successfully. Cooks reported following recipes, although they made a number of minor/major recipe modifications each week. Recipe modifications were made to manage dietary requirements (e.g. dairy), changes in the presentation of meals or how meals were served (e.g. serving sauces separate from the pasta or modifying a baked recipe from muffins to a loaf to speed up the preparation process). No changes in the recipe ingredients or quantities were reported, but all centres reported left-over ingredients at the end of each week. Commonly reported left-over ingredients were apples, onions, carrots, flour, ricotta and eggs. Cooks reported adding ingredients to other meals or snacks; freezing or storing for use in later weeks; or staff taking left-over ingredients home.

Comparison Centres

Completion of Online Cook Training

Of the four cooks allocated to the comparison group, three completed the cook online training. One cook did not attempt the training due to a lack of time. Among cooks that attempted the training,

the mean time taken to complete it was 53 (±12) minutes. Three (of four) cooks completed the training while at work, with one being allocated time within their workload and two completing the training at work but not within their work hours (i.e. they completed it at work between tasks or stayed back to complete).

Menu Assessment Tool

All four comparison centre cooks attempted to assess their menu using the online Menu Assessment Tool, but no cooks assessed the entire menu (i.e. completed menu assessment). The number of menu days assessed ranged from two to five days (one week). Overall, the proportion of centre menus, or days of centre menus, assessed with the online Menu Assessment Tool was equivalent to 22% of total centre menus. The mean self-reported time taken to enter and assess menus was 150 (±104) minutes. Two cooks assessed their menu at work using time specifically allocated to the task, and two cooks their menu at work but were not formally allocated time to do so. Three of the four cooks attempted to make modifications to the centre menu after using the online Menu Assessment Tool. One cook reported making one change to their centre menu to substitute sausage mince with beef mince, and another reported adding 'somewhat more' vegetables to their cooking, but did not modify recipes per se. One cook trialled one week of recipes that met menu planning guidelines, but returned to their usual recipes and menus because of budget constraints. No cooks were familiar with the menu planning tool prior to participation.

Guideline Use and Risk of Study Contamination

At baseline, no centres were implementing menu guidelines prior to study participation and no cook in either group was familiar with the Victorian Menu Planning Guidelines. Five of eight cooks reported attending a training day organised by the service provider, for a different menu planning tool for LDCs. No cooks reporting using or implementing the tool at their centre. Three of four intervention centre cooks and one of four comparison centre cooks reported knowledge of the *Start Right–Eat Right* program, but no cooks had participated in the program.[140] One intervention centre cook and one comparison centre cook reported inheriting 'some' recipes from the program in their menu. At follow up, no cooks reported participating in additional training or engaging with additional resources during the intervention period.

3.5 Intervention Acceptability

3.5.1 Cook and Director Questionnaires and Interviews

Cook and Director Interviews at Follow Up

All cooks (*n* = 8) and directors (*n* = 8) participated in the follow-up interview. Due to the different data collection time points, comparison centre cook interviews were able to be completed in

person at the centre while cooks were on shift (*n* = 4), whereas interviews with intervention centre cooks (*n* = 4) were performed over the phone because by that time COVID-19 restrictions were in place. Most director interviews (7/8) were performed in person during follow-up data collection visits. One director interview (*n* = 1, comparison centre) was conducted over the phone due to cook time constraints.

Cook interviews used a mixture of multiple choice and short answer responses. Responses were transcribed and coded to identify themes. As one cook (intervention group) declined to be recorded, detailed notes were taken and coded in place of the transcription. Interviews were coded with a deductive approach, which evolved into an inductive approach as themes and codes were uncovered in the responses.

Weekly Interviews With Intervention Centre Cooks

All intervention centre cooks (*n* = 4) participated in the weekly phone check-in interview to provide feedback regarding the menu box delivery service. During these weekly interviews, feedback quotes and comments from cooks were collated. No weekly interviews were missed; therefore each cook completed eight interviews over the eight-week intervention period.

In the following sections, cook and director questionnaire responses are presented in tables, followed by themes and quotes from interview findings. Centre director feedback at follow up is presented first in Section 3.5.2, for both groups. Quotes and themes from follow-up interviews with intervention cooks are presented in Sections 3.5.3 and 3.5.4 (intervention centre and comparison centre, respectively). As intervention centre cooks participated in weekly interviews, comments from these interviews that correspond to themes identified at follow up are reported together in Section 3.5.3.

3.5.2 Centre Director Feedback at Follow Up

Director Feedback (Intervention Centres)

Directors responded positively to the menu box delivery service. The majority of feedback from directors was related to child, staff and parent observations. Most directors (3/4) provided positive feedback about the menu box delivery recipes. For example:

> Variety on recipes is good, changed staff and parent perception of the food and menu (Centre I5).

> Enjoyed by staff, stated recipes were healthy and nutritious (Centre I7).

Multiple directors reported that children were exposed to a variety of foods and observed them trying new foods:

> Trying new recipes gives parents and educators the opportunity to see that the children are willing to try new things (Centre I5).

> Children received exposure to new foods (which is good), some kids that refused foods, eventually tried it (Centre I6).

Most centre directors (3/4) commented on positive responses from parents about the menu box delivery service menu and its impact on children attending the centre:

> Parents have been providing positive feedback about the menus (Centre I4).

> Parents were reluctant at first, thought children would not eat the food, but at round two of the menu, parents were surprised children ate the meals (Centre I5).

> Menu was really liked by the parents, getting to see the recipes/ingredients displayed in the centre (Centre I7).

Most directors (3/4) commented that ingredient or produce delivery felt excessive in some instances. For example:

> Too much herbs and spices in recipes, children don't notice the difference. In the first [menu] rotation, children ate Bolognese with full amount of herbs, second rotation used half the amount of dried herbs and children still enjoyed it (Centre I4).

> Storage space was limited; ingredients were too much (more than usual practice) (Centre I5).

> There was too much food (Centre I6).

Directors (4/4) also commented on the effect of the menu box delivery recipes on preparation time. Some comments were related to the recipe lengths and suitability for the setting, whereas some were specifically related to the ingredients delivered by the supplier. For example, one centre director reported that whiting (fish) was delivered to the centre with bones, which is not suitable for the LDC setting and added time to the cook’s schedule to debone the fish:

> Long recipes, they are time consuming (Centre I4).

> The recipe preparation times were very long. For example, the casserole had to simmer for three hours, which is not appropriate for childcare setting (Centre I6).

> Whiting had bones, which is problematic for childcare setting and added time (Centre I7).

Most directors were satisfied with the supplier, including both the quality of produce and service:

> Good quality produce, happy with [supplier] service (Centre I4).

> Quality of produce was good. [Supplier] staff were friendly (Centre I5).

> [Supplier] delivery and driver was great (Centre I6)

Director Feedback (Comparison Centres)

Most comparison centre directors (3/4) reported little involvement or knowledge of the Online Cook Training and Menu Assessment Tool, but all reported that both the training and Menu Assessment Tool were time consuming. For example:

> It is not very suitable in terms of the time commitment. Childcare cooks have limited time so it's hard to fit something in (Centre C1).
>
> not necessarily realistic to use because of the time it would take to assess the whole menu (Centre C2).
>
> It is very time consuming and would need spare staff to cover the cook while training (Centre C8).

One director commented that staff absences affected time in the childcare setting, which impacted their ability to allocate appropriate time to tasks:

> In terms of timing in childcare, staff absence really affects this. Extra time would have been beneficial to be able to analyse the rest of menu that we did not have time to get to (Centre C1).

While one director (1/4) was pleased that the cook training and Menu Assessment Tool was not 'intrusive' for staff and children, another director commented on the lack of 'hands-on support', stating that:

> I have mixed thoughts regarding cook time, but happy it didn't intrude on staff and children (Centre C1).
>
> It would have been beneficial, and we may have implemented one-on-one support to help input menus (Centre C3).

Two directors (2/4) commented that the cook training and Menu Assessment Tool did provide an opportunity to learn about the guidelines or 'refresh' their memory of the dietary guidelines, although no centre cooks or directors reported they had been involved in training or implementation of the menu guidelines prior to participation in the study:

> It is a great tool and good to refresh our memories, but not necessarily realistic to use because of the time it would take to assess the whole menu (Centre C2).
>
> There was a lot of work, but we all gained knowledge about food preparation and menu (Centre C3).

Overall, intervention centre directors appreciated that the menu box delivery service provided exposure to a variety of foods for children in the centre. Most directors commented that there were excess ingredients compared with usual practice and that the time taken to prepare recipes was excessive. Comparison centre directors reported little involvement or knowledge about the Online Cook Training and Menu Assessment Tool. While some directors (3/4) commented that the tool could be useful, all (4/4) reported that use of both the training and Menu Assessment Tool was time consuming. The following sections report cook and director feedback about the menu box

delivery service and summarise themes identified from intervention cook follow-up questionnaires and interviews.

3.5.3 Intervention Centre

Cook and Director Satisfaction With Menu Box Delivery Service

Overall, all cooks (4/4) and directors (4/4) reported that they were satisfied with the menu box delivery processes (i.e. ordering, receiving orders and implementing menus). Table 3.4 summarises the number of directors and cooks that agreed or strongly disagreed with statements related to the menu box delivery service. All directors (4/4) agreed that they would continue to use the menu box delivery service if able to, whereas only two cooks (2/4) agreed that they would. No cooks (0/4) reported noticing an improvement in vegetable intake of children when using the menu box delivery service, while two directors (2/4) reported noticing an increase. All directors (4/4) believed that children benefitted from the menu box delivery service, whereas not all cooks agreed (2/4). Similarly, all directors (4/4) would recommend the menu box delivery service to other centres, whereas only one cook (1/4) agreed that they would.

Table 3.4 Overall acceptability and satisfaction with the menu box delivery service reported by intervention group centre cooks and directors at follow up (*n* = 8)

Number of responders that agreed or strongly agreed with the following statements, *n*	Directors (*n* = 4)	Cooks (*n* = 4)
If able to, my centre would continue to use the menu box delivery service.	4	2
I noticed an improvement in vegetable intake of children who attended the service when using the menu box delivery service.	2	0
I believe the children at the centre, benefitted from the menu box delivery service.	4	2
I would recommend the menu box delivery service to other centres.	4	1

Impact on Centre Menu Preparation

When asked how the menu box delivery service impacted centre menu preparation, three cooks (3/4) reported that it was ‘not very different to usual practice’ whereas one cook reported that it made it ‘more complicated than usual practice’. Three cooks (3/4) agreed that the menu box delivery service saved them time in planning their menu, and two cooks (2/4) agreed that it saved them time in ordering and implementing the menu.

Menu Pack User Guide and Order Form Satisfaction

Overall, all cooks (4/4) reported that they were somewhat or very satisfied with the menu pack user guide. All cooks (4/4) agreed or strongly agreed that the level of detail in the menu pack user guide

was appropriate, that the guide was useful, easy to use and visually appealing, and helped with the practical implementation of the menu boxes, including ordering and receiving menu boxes.

Most cooks (3/4) agreed that the user guide also helped with planning and preparing recipes. Overall, all cooks (4/4) were satisfied with the menu box delivery order process and use of the add-on order form. No cooks (0/4) reported having any difficulties using the order form.

Weekly Cook Satisfaction Scores

Mean cook satisfaction scores from weekly interviews are presented in Table 3.5. The mean score for overall satisfaction with 'the menu box this week' was 8.1 (±1.1) out of 10 (Table 3.5). Cooks rated their satisfaction with the quality of ingredients and timing of the boxes higher than 8 out of 10 for both. Recipe satisfaction was scored the lowest, at 7.7 (±0.7).

Table 3.5 Cook menu box delivery feedback via weekly phone interview (*n* = 4). Questions rated on a scale of 1–10 where 1 is least satisfied and 10 is most satisfied.

Question and mean score out of 10	Mean (SD)	Range
Overall, how satisfied were you with the menu box this week?	8.1 (1.1)	6–10
How satisfied were you with the quality of the ingredients you received this week?	8.8 (1.0)	6–10
How satisfied were you with the recipes (morning snack, lunch and afternoon snack) this week?	7.7 (0.7)	6–10
How satisfied were you with the timing of your menu box delivery this week?	8.5 (0.9)	5–10

Cook Interview Themes and Feedback

Follow-up interviews were transcribed and coded, and a total of 12 themes was identified overall. Themes from these interviews are summarised in Table 3.6, with the number of cook comments reported against each theme listed. The following sections describe each theme identified: menu pack user guide; order and delivery; time; recipes; food abundance/quantities; and waste. As themes identified from analysis of the follow-up interviews with cooks were similar to comments during weekly interviews with cooks, interview comments for both weekly and follow-up interviews are reported according to theme.

Table 3.6 Summary of intervention cook comments and responses to open-ended questions in follow-up feedback interviews (*n* = 4). Number of cooks with comments against theme and code are summarised.

Responses that were coded under the following themes (n)	Intervention centre cooks
Menu pack user guide	
Ease of use	3
Order and delivery	
Order process satisfaction	4
Lack of storage space	1
Time	
Time consuming	3
Recipes	
Suitability for setting	4
Recipe satisfaction	3
Adoption of recipes in usual practice	2
Learning effect	2
Adaptation of recipes	2
Food abundance/quantities	
Positive	2
Negative	2
Waste	
Food waste	1

Menu Pack User Guide, and Order and Delivery

Cook comments from weekly interviews

Throughout the eight-week intervention period, only one occasion of missing ingredients was reported by cooks. However, all missing ingredients were replaced by the supplier the same week. Cooks commented positively about the quality of ingredients and produce delivered:

> Very happy with delivery, it was good quality produce (Cook I7).

Only one cook (1/4) commented on an occasion where the quality of ingredients was below standard:

> Some weeks' fruit and vegetables were not as good as previous weeks (Cook I6).

Follow-up interview cook comments

At follow up, the majority of cooks expressed their satisfaction with the menu pack user guide, commenting on its ease of use (3/4) and their satisfaction with the order process (4/4):

> [The menu pack user guide] was helpful. It was straightforward and not too complicated, easy to read and it was easy for anyone to kind of walk in and read it (Cook 5).

> [The order process] was easy and straightforward—better than Coles Online (Cook I7).

Similar to comments from weekly cook interviews, one cook commented on a lack of storage space for the weekly menu box deliveries to the centre:

> And the storage as well, we're just not really equipped for what was coming, but I mean we could have lowered the numbers or lowered the amount of ingredients and things like that if we were to do it again (Cook I5).

Time

Weekly interview cook comments

During the weekly interviews, all cooks (4/4) commented more than once that the time taken to prepare recipes was longer than usual practice:

> Recipes are a lot of work. Take approximately four times the usual time taken (Cook I6).

Cooks attributed the longer preparation times to a number of factors, including 1) weighing ingredients, 2) cutting or peeling ingredients and 3) deboning or cutting meats. To mitigate the longer preparation times, two of four cooks reported receiving support in the kitchen from other staff:

> Preparation time is taking a long time often need two to three hours of extra hands in the kitchen (Cook I6).

One cook commented that recipes became easier to prepare during the second menu cycle, as they became more familiar with the menu:

> Learning to cope better with recipes, becoming more confident and easier as time goes on (Cook I4).

Similarly, during the later weeks of the intervention period, one cook (1/4) reported modifying the preparation process for recipes to speed up the preparation time. Examples of this included cutting meat into smaller pieces to help them cook faster or cooking risotto on the stovetop rather than the oven (to allow oven space for other meals).

Follow-up interview cook comments

At follow up, three of four intervention centre cooks commented that either following the recipes or packing away deliveries was time consuming:

> Interviewer: Thinking about the time it took to prepare the recipes, how did you find the time that it took?

> Cook I6: Excessive; what would normally take six hours, took at least eight, so it was just, there was too much to do in my short amount of time.

This suggests that time allocated to various tasks may have changed while using the menu box delivery service. Two cooks commented that although time was saved in some places, such as ordering, more time was spent elsewhere, such as food preparation or packing away deliveries. These comments are similar to those made by cooks during the weekly interviews, where all comments were attributed to the increases in recipe preparation time.

Recipes

Weekly interview cook comments

During the weekly interviews, cooks reported that some recipes were time consuming to prepare and some were not child or childcare friendly. Feedback related to the time-consuming nature of recipes was presented in Section 3.5.3.1.4.2. In addition to time, comments about the recipes were related to the complex flavours of some dishes that may have affected palatability for children and the suitability of the recipes for the LDC setting.

Cooks reported a mixture of both positive and negative feedback about the suitability of recipes and ingredients for children, such as including whiting on the menu would be considered a luxury ingredient. Cooks found that some spices or ingredients were not liked by children:

> Too many spices in Portuguese rice, wasn't very child friendly, so I used half the amount in the recipe (Cook I6).

> Kids are not familiar with the veggie platter and don't like it. Don't think kids like the recipes. The whole week was curry-style foods; this was too many (Cook I7).

However, some ingredients and recipes were liked by children, such as pita bread for morning snack, and casseroles and pasta dishes:

> Casserole and pasta dishes were popular with children (Cook I6).

Additionally, one cook commented that the recipes were clear and informative:

> Recipes are clear; as a chef, I am learning a lot of new things (Cook I6).

Comments about the suitability of the recipes for the setting included concerns that the preparation time was not suitable for a typical LDC setting:

> The morning tea [snack] recipes take too long for the time we have in the morning (Cook I4).

> Some days have time-intensive preparation for all three meals. It might be useful to balance days with longer preparation meals with faster meals (Cook I5).

Some cooks (2/4) felt that the recipes were more suited to a commercial kitchen, whereas their centre kitchen was more similar to that of a household:

> Seems like the recipes are designed for commercial kitchens; whereas we have household appliances (Cook I4).

One cook (1/4) reported difficulties in managing a large number of dairy-related requirements within their centres, especially as the menu box delivery recipes contained large amounts of dairy. For this reason, recipes were modified to serve dairy ingredients on the ‘side’ to ease preparation burden:

> Lots of dairy in the food, which is making it hard to manage dairy allergies … tweaking recipes so dairy ingredients are served on the side … using soy milk instead of cows’ milk in baked goods to make them allergy friendly (Cook I4).

Follow-up interview cook findings

As the most frequently occurring theme at follow up, cooks provided many comments about the recipes that underpinned the menu box delivery service. Sub-themes included recipe satisfaction; suitability for setting; adoption of recipes in usual practice; adaptation of recipes; and learning effect. These comments were consistent with those made during the weekly interviews. However, unlike the weekly interviews, more cooks expressed a level of satisfaction with recipes at follow up; for example, one cook commented on the meals as follows:

> It's beautiful meals and beautiful quality (Cook I5).

Two cooks (2/4) indicated that their centre would adopt a number of the menu box delivery recipes for their own menus when returning to usual practice at the end of the study. Similar to the weekly comments, all intervention centres cooks commented on the suitability of the recipes for the childcare setting. Specifically, all comments challenged or questioned the suitability of the recipes rather than complimented them. Some cooks (3/4) were critical of the suitability of the recipes for children:

> I don’t think some of the recipes were for young children, they were more adult-style recipes (Cook I4).

> Some recipes were not as good, seemed to be more adult recipes. Lots of spices in meals, and fish is not very child 'friendly' (Cook I7).

> Giving them whiting, that sort of thing; wasn’t something that the kids would eat (Cook I6).

Similar to weekly interviews comments, some cooks commented on the suitability from a preparation perspective, or integration into a LDC setting as a whole:

> I think just in this setting; things just were a bit too time consuming for what this is. I think the time frame that I'm in there for in the morning, kind of between morning tea [snack] and lunch time, some things were just a little bit time consuming (Cook I5).

The trial period was deliberately designed to span two menu cycles; thus providing centres and their cooks with two opportunities to trial the menu:

> Some of them [the recipes] were time consuming, but I think at the end of it we all got our heads around it (Cook I4).

Two cooks (2/4) stated that the second menu cycle was easier as a result of a learning effect. Two cooks indicated that they were adapting recipes to speed up processes, such as cooking time:

> I could, you know if I need to tweak it or put my own kind of, spin on it to make it easier (Cook I5).

Food Abundance/Quantities

Weekly interview cook comments

When asked if the quantity of ingredients received was sufficient, no cooks reported that there were insufficient ingredients on any occasion. In contrast, cooks often reported that the quantity of ingredients was much greater than they were used to. On some occasions, this led to difficulties in finding storage space for ingredients. Some cooks reported that storing such large quantities of ingredients was time consuming; for example:

> There is an overload of food, it is a struggle to find room for storage (Cook I6).

Some cooks also expressed difficulty fitting ingredients into cooking vessels:

> Too much food to fit in pots, but children are liking recipes (Cook 5).

Follow-up interview cook comments

Several cooks commented both positively (i.e. there being an abundance of food) and negatively, (i.e. there being too much food to manage) about the quantity of food and ingredients delivered to their centres. Two of four cooks found that the quantity of food, although meeting menu planning guidelines, was too much for children or for storage at the centre, which was consistent with comments made during weekly interviews:

> Interviewer: Are there any improvements you would make to the menu box delivery service?
>
> Cook I6: Look more at quantity of produce and also need to actually look at what the children eat as a whole.

However, at follow up, two cooks found the abundance of food to be a positive, reducing the need for additional shops for missing ingredients:

> We never ran out of food so that was brilliant (Cook I4).

Waste

Weekly interview cook comments

Two cooks (2/4) commented on food waste throughout the weekly interviews. One cook (1/4) commented overall about food waste attributed to children not liking recipes:

> There was lots of waste—children did not like the recipes (Cook I4).

One commented on children's dislike for certain vegetables:

> Lots of food waste for capsicum in platters as children did not like raw capsicum (Cook I5).

Follow-up interview cook comments

Despite the mixed feedback about the quantity of food delivered, only one cook (1/4) commented at follow up on occasional food wastage at their centre:

> Well, sometimes we had a lot of wastage (Cook I4).

Cooks reported satisfaction with the order process, delivery and quality of ingredients. Weekly interview cook comments were similar to themes identified in follow-up cook interviews. Overall, cooks liked the menu pack user guide, and the order and delivery processes. Key themes identified were time; recipes; food abundance/quantities; and waste. The following sections summarise findings pertaining to the Online Cook Training and Menu Assessment Tool acceptability.

Training and Menu Assessment Tool Acceptability

Online Cook Training

Two directors (2/4) and two cooks (2/4) reported that the training was acceptable, while only one director (1/4) and two cooks (2/4) would continue to use it to plan menus and recommend it to other centres. One director (1/4) and one cook (1/4) believed that children benefitted from the cook's use of the training (Table 3.7).

Table 3.7 Overall acceptability and satisfaction of the Online Cook Training service reported by comparison group centre cooks and directors at follow up

Number of responders that agreed or strongly agreed with the following statements, *n*	Directors (*n* = 4)	Cooks (*n* = 4)
Using the Online Cook Training is an acceptable training tool for cooks at this centre.	2	2
My centre would continue to use the Online Cook Training to plan menus.	1	2
I would recommend the Online Cook Training to other centres.	1	2
I believe the children at the centre, benefitted from the use of the Online Cook Training.	1	1

Menu Assessment Tool

Cook and director acceptability and satisfaction of the online Menu Assessment Tool responses are presented in Table 3.8. Two cooks (2/4) and one (1/4) director agreed that the Menu Assessment Tool is an acceptable method for assessing menu compliance against dietary guidelines. Only one cook (1/4) and one director (1/4) agreed that they would continue to use the Menu Assessment Tool to plan menus at their centre. Overall, two cooks (2/4) reported that they

were somewhat satisfied with the Menu Assessment Tool; the remaining two cooks (2/4) reported that they felt neutral or somewhat dissatisfied (not reported in table).

Table 3.8 Overall acceptability and satisfaction of the online Menu Assessment Tool reported by comparison group centre cooks and directors at follow up

Number of responders that agreed or strongly agreed with the following statements, *n*	Directors	Cooks
	(*n* = 4)	(*n* = 4)
Using the Menu Assessment Tool is an acceptable method for assessing our services menu compliance against the dietary guidelines.	1	2
My centre would continue to use the Menu Assessment Tool to plan menus.	1	1
I would recommend the Menu Assessment Tool to other centres.	1	2
I believe the children at the centre, benefitted from the use of Menu Assessment Tool.	1	1

Cook Interview Findings

Cooks' responses to open-ended questions are summarised in Table 3.9, with the number of cook comments reported against each theme. For ease of interpretation, themes are grouped under 'Menu Assessment Tool', 'Online Cook Training' or both. Below themes, sub-themes are presented where necessary. The following section describes each theme.

Table 3.9 Summary of comparison centre cook comments and responses to open-ended questions in follow-up feedback interviews. Number of cooks with comments against theme and code are summarised.

Responses coded under the following themes (*n*)	**Comparison centre cooks (*n* = 4)**
Online Cook Training	
Learning something new	3
Building knowledge of food group quantities	3
Satisfaction	2
Recommendation to other centres	2
Likelihood of continued use	1
Menu Assessment Tool	
Barriers to Use	
Difficulties using tool	2
Dietary restrictions not catered to	1
Both Online Cook Training *and* Menu Assessment Tool	
Barriers to Use	
Time consuming	4
Lack of time	4
Lack of access to resources	1
Changes	
Changes to menu/menu planning	4
Changes to children enrolled in service	2
Support	
Limited menu budget	4
Time allocation	4
Cook responsibilities	2
Support from centre families	2
Support from centre staff	1

Online Cook Training

Of the three cooks who attempted the training, two commented on their satisfaction with the training tool. All three cooks (3/3) commented that they had learned something new or valuable through completing the training. Furthermore, all three cooks (3/3) specifically reported that learning the food group quantities was a useful component of the training tool:

> I think it was helpful for knowing amounts that they should be having and whether it [the menu] actually follows that (Cook C8).

When asked if they would recommend the training to other centres, cooks were hesitant; however one did suggest the ‘one off’ nature of the training could be useful for new cooks:

> I guess the training is a one off, and you do the training and move on, I think long term maybe, if there's other cooks or moving to another centre or other things like that, it would be recommended to go with it (Cook C2).

Menu Assessment Tool

The key theme relating to the Menu Assessment Tool was barriers to use. Two sub-themes that sat below this theme include difficulties using the tool and dietary restrictions not catered to.

Barriers to Use

Two sub-themes were related to the Menu Assessment Tool, but all were grouped into the theme 'barriers to use'. As no cook assessed more than one week on their centre menu using the tool, these comments may provide further insight into the challenges cooks faced.

Difficulties using tool

Two cooks (2/4) commented on experiencing difficulties entering or estimating quantities into the online assessment tool. One difficulty reported was not knowing the quantities children would be offered:

> I don't know how many [children], everyday [is] different, before 8:30 every day, [there are a] different amount of kids coming and they don't [staff] tell me [how many children] and I don't know [for example] much Weetbix could be [served] (Cook C3).

Another cook commented on difficulties estimating small quantities of ingredients such as herbs and spices, which increased the time spent entering recipes into the tool:

> You need to input every recipe with every single ingredient, in regard to quantity, so even like my veg curry, it's got about five or six different spices in it; you had to put them each in individually and write down how many grams you used, so I was sitting there and I'm having to go through my cupboard and go 'okay that's six grams' (Cook C1).

Dietary restrictions not catered to

Although a niche theme, one cook (1/4) commented within the Menu Assessment Tool, dietary restrictions not catered to. More specifically this comment was related to accommodating children's dietary requirements while meeting guidelines. The example used by the cook was related to the provision of foods such as meat; in cases where the majority of children enrolled are vegetarian and may not be able to consume meat, the cook assumed that their menu would inherently not meet guidelines:

> Some of the requirements like the quantities of meat and types of you know dairy I'm not allowed to use. Just for my centre, as I've said just a culturally diverse centre, I can't serve beef twice a week without half my kids not being able to eat it (Cook C1)

Online Cook Training and Menu Assessment Tool

A large number of themes related to both the Online Cook Training and Menu Assessment Tool. These were categorised under barriers to use and support.

Barriers to Use

Although most themes could be interpreted as barriers or enablers, those grouped under 'barriers to use' are sub-themes that specifically highlight difficulties cooks experienced, particularly when trying to complete the online training or utilise the Menu Assessment Tool. These sub-themes are 1) time consuming, 2) lack of time and 3) lack of access to resources. All four comparison group cooks reported feedback against all themes, however 'time consuming' and 'lack of time' were coded as separate items, as they can be interpreted differently. A task can be time consuming but there may be appropriate allocated time to complete it. Alternatively, lack of time may be unrelated to the length of time a task may take and there is simply limited time.

Time consuming

The most common barrier to use of both the training and the tool reported by cooks was time, or lack thereof. Cooks reported that entering their menu into the Menu Assessment Tool was time consuming and that it was rare to find time to use the online tool during their workday:

> The only negative I'd say is just how time consuming [the Menu Assessment Tool] was (Cook C8).

Lack of time

The time-consuming nature of the tasks combined with a lack of time in their workday made it difficult for cooks to complete both the training and Menu Assessment Tool, along with ensuring there was enough time to review or revise their menu.

> Interviewer: 'And would you say you've had enough time to assess your menu?
>
> Cook C1: No (laughs), I think that was the other problem, if I'd been given actual time to sit down concentrate, then do it while I'm working, 'cos that's the other thing too, all fine to sit there you know, but if you're having to get up every five or ten minutes to do something … very disruptive.

Lack of access to resources

Only one cook (1/4) commented on lack of access to resources to support completing the cook training and using the Menu Assessment Tool. While the only resource required to complete both tasks was a computer, one cook highlighted that with only one computer for both educators and the cook to use at their centre, if it was in use, there was no alternative for the cook but to wait until it was available:

> We only have one computer, and if they're [educators] doing programming at the time, then I can't use it (Cook C8).

Changes

Cook comments related to changes at the centre as an impact of the training and Menu Assessment Tool, which included (1) changes affecting the menu/menu planning and (2) changes affecting children enrolled in the service. Changes to the menu/menu planning bring together comments related to changes to the cooks' own processes or the menu itself, whereas the latter relates to observations that seemed to imply a direct impact on children themselves.

Changes to menu/menu planning

All four comparison centre cooks (4/4) commented on changes to the menu or menu planning, which mostly related to a lack of change or limited changes:

> Interviewer: And did you end up changing or modifying your menu after using that?
>
> Cook C8: I think I changed a few days, but not much.
>
> Interviewer: Do you remember what things you may have changed?
>
> Cook C8: I think I added more of a certain vegetable and added more carbohydrate and less butter.

Changes affecting children enrolled in service

When asked about changes or impacts on children, only two cooks (2/4) commented against this theme, in relation to there being no perceived impact. As all cooks (4/4) reported making little to no changes to their menu, the impact on children attending the centre was also reported to be minimal:

> Interviewer: I believe the children at the centre benefitted from the use of the Online Cook Training.
>
> Cook C1: Disagree, but that's only because I didn't, I had finished the training, but I just didn't follow through with the menu planning process. It is not feasible, at all.

Support

The following sub-themes were grouped under support as they relate to the perceptions or processes in place that supported cooks to complete the cook training and use the Menu Assessment Tool to plan a menu according to menu planning guidelines. These themes are limited menu budget; time allocation; cook responsibilities; support from centre families; and support from centre staff.

Limited menu budget

A prominent theme across all cook interviews was a lack of menu budget to meet menu planning guidelines. As centres were recruited from the same LDC service provider, all cooks were working within a similar budget. All comparison centre cooks (4/4) highlighted the lack of a suitable budget to buy the types of foods or quantities of ingredients to meet menu planning guidelines:

> I'll put it this way, if I follow the Nutrition Australia guidelines, then I will definitely go over my budget every month (Cook C1).

> It's gone up a little bit [the budget], but you still can't serve them the best food with the budget you're given (Cook C8).

Cooks reported often needing to purchase ingredients based on budget rather than meeting guidelines:

> Some things we have to prioritise, and balance with what we can get; most recipes we have to bulk up with some rice and pasta and throw in some veggies (Cook C2).

One cook (1/4) adjusted their menu to meet guidelines, but after one week they were forced to return to usual centre recipes because of an insufficient menu budget:

> She [director] said it's okay for the first week you can order food in the amounts for that recipe … then our budget is going heaps up. And then she said after that no (Cook C3).

Overall, cooks did not find it feasible to plan menus to meet guidelines with their allocated budget:

> Centres such as mine, that have very low budgets and that are so culturally diverse … I mean I've spoken to cooks or childcare employees for that matter, companies, some companies have six, seven dollars a day budget per child. That's fair enough. That's easier to be able to do it, but when your budget is as low is what ours is, I mean basically I've got $500 a week [$2.10 per child, day] to do the shopping for the entire centre … I can't be going out and buying tofu and lentils and red meat for four meals a fortnight, you know what I mean it's just … it is not feasible at all, financially (Cook C1).

<u>Time allocation</u>

Staff time is required to complete the training, plan menus and use the Menu Assessment Tool, but no cook reported being allocated appropriate time to do so. Cooks that were allocated time to complete these tasks at work (2/4) reported that this was still not enough to complete the full breadth of the tasks. Those who were not allocated time (2/4) were forced to find time within their day or stay back after work:

> I did it after my shift, so I stayed back to do it (Cook C8).

Overall, cooks were positive about the training providing a refresher or understanding of food groups and serve sizes. However, most cooks found both the training and Menu Assessment Tool time consuming and difficult to incorporate into daily practice. Furthermore, the centre budget was perceived as a barrier to meeting menu planning guidelines as cooks could not purchase ingredients in the quantities required to meet guidelines. The following section reports findings

from the Theoretical Domains Framework Questionnaire conducted with both intervention and comparison centre cooks.

3.6 Theoretical Domains Framework

Table 3.10 summarises cook (*n* = 8) responses to the statements from the Theoretical Domains Framework Questionnaire.[169] Responses from cooks who agreed or strongly agreed with statements are presented in Table 3.10.

Overall, intervention centre cooks were more likely to be in agreement with statements than were comparison centre cooks. Although the menu box delivery service did not provide specific training for implementing the menu planning guidelines, intervention centre cooks were more likely to agree that they had the necessary knowledge and skill in relation to menu planning to meet guidelines. In particular, three of four intervention group cooks agreed that they 'know how to plan a menu according to the Menu Planning Guidelines [the Victorian Menu Planning Guidelines]' and all intervention cooks (4/4) agreed when presented with the statement, 'I have the skills needed to plan a menu according to the Menu Planning Guidelines'. Despite completing the Online Cook Training and being prompted to use menu planning tools to plan menus according to the guidelines, only one comparison centre cook (1/4) agreed with the statement 'I have the skills needed to plan a menu according to the Menu Planning Guidelines'.

Similar to the knowledge and skill domain, intervention centre cooks were more likely to respond in agreement with statements from the environmental context and resources domain of the questionnaire, where agreement indicates these domains as enablers. No comparison centre cooks (0/4) agreed with statements related to availability of necessary resources, support from management, sufficient time or sufficient budget to plan a menu according to the menu planning guidelines. However, two or three cooks in the intervention group agreed with each of these statements. Intervention group cooks were more likely to agree when asked if they felt supported by parents and staff at the centres in which they worked (3/4).

All intervention centre cooks (4/4) agreed that it was their responsibility to plan a menu according to the menu planning guidelines and that doing so would lead to benefits for the children at the centre. However, only one comparison centre cook agreed that this was their responsibility. Despite not actively planning menus in the intervention arm, all intervention cooks (4/4) agreed that they felt confident in planning menus according to the menu planning guidelines.

As mentioned, the intervention cooks were not actively involved in or prompted to plan and implement a menu according to the menu planning guidelines. However, these cooks responded with more agreement when asked if they had the skills, confidence, support and responsibility to

plan a menu according to guidelines. Nonetheless, it does suggest that cooks receiving the menu box delivery service may have had a heighted sense of confidence and support.

Table 3.10 Cook belief TDF barriers and enablers for implementing the Victorian Menu Planning Guidelines, reported by LDC cooks at follow up: number of cooks that agreed or strongly agreed with statements.

		Comparison (*n* = 4)	**Intervention (*n* = 4)**
TDF domain	**Statement**		
Knowledge	I am aware of the content of the (Victorian) Menu Planning Guidelines for Long Day Care.	3	3
	I know how to plan a menu according to the Menu Planning Guidelines.	1	3
Skills	I have the skills needed to plan a menu according to the Menu Planning Guidelines.	1	4
	I have been able to practice planning a menu according to the Menu Planning Guidelines.	0	1
Environmental context and resources	In the centre where I work, all necessary resources (e.g., computer) are available to plan a menu according to the Menu Planning Guidelines.	0	3
	I have support from the management of my centre to plan and implement a menu according to the Menu Planning Guidelines.	0	3
	I have support from other staff at my centre to plan and implement a menu according to the Menu Planning Guidelines.	2	3
	The centre where I work provides sufficient time for me to plan a menu according to the Menu Planning Guidelines.	0	3
	The centre where I work provides sufficient budget for me to plan a menu according to the Menu Planning Guidelines.	0	2
	Families of children attending the centre where I work are supportive of me planning a menu according to the Menu Planning Guidelines.	1	3
Beliefs about consequences	I believe planning a menu according to the Menu Planning Guidelines will lead to benefits for the children who attend the service.	2	4
	In my view, planning a menu according to the Menu Planning Guidelines is useful.	2	3
Social/professional role and identity	It is my responsibility to plan a menu according to the Menu Planning Guidelines.	1	4
	Planning a menu according to the Menu Planning Guidelines is part of my role	2	3
Beliefs about capabilities	I am confident that I can plan a menu according to the Menu Planning Guidelines.	2	4

3.7 Chapter Discussion

This chapter reports the process evaluation outcomes for the menu box delivery trial to improve menu compliance, through measurements of (1) feasibility and fidelity, and (2) acceptability. The results in this chapter relate to the objective: *to evaluate the feasibility and acceptability of a menu box delivery service straight to LDC centres.* Overall, all intervention centres (4/4) met the menu planning guidelines at follow up for four of the five food group: vegetable and legumes, fruit, cereals and breads, and meat and alternatives food groups. All comparison centres (4/4) met the menu planning guidelines at follow up only for two groups: fruit, and breads and cereals. Intervention centre directors and cooks were satisfied with the menu box delivery service order and delivery processes, ingredient quality and delivery times. However, they reported that the menu box delivery service recipes were not appropriate for the setting and were time consuming to prepare. Similarly, comparison centre cooks and directors found the Online Cook Training and Menu Assessment Tool time consuming and not feasible to integrate into the LDC setting.

The study sample included only female cooks. This is not dissimilar to other published interventions reporting centre cook sex, where the proportion of female cooks is greater than their male counterparts.[147, 178, 179]. Across both groups, cooks reported similar levels of experience in their current role (comparison: 3.1 ± 1.7, intervention: 3.3 ± 1.4 years). Cooks in the intervention group had greater experience as a cook in all settings (7.1 ± 4.7 years) than did comparison centre cooks (3.9 ± 1.7 years). In addition, one intervention centre cook was a trained chef.

At follow up, intervention centres were found to be more compliant with core food group guidelines than were comparison centres. No centre menus were compliant for all food groups at baseline.. At follow up, no comparison centres were compliant with all guidelines, while two intervention centres were. All intervention centres were compliant with four of five core food groups at follow up. Two centres did not meet guidelines for dairy and alternatives, likely because of inadequate provision of drinking milk. It was the responsibility of the individual centres to order and provide suitable amounts of drinking milk to children, and these centres may not have provided enough milk to meet guidelines. Overall, the intervention had a greater effect on menu compliance than did standard practice, in terms of in-house planning and preparation of meals (comparison centres).

Evaluations in the literature of childcare centre menu compliance against guidelines in Australia demonstrate that provision of vegetables and legumes, as well as meat and alternatives is consistently least likely to meet menu planning guidelines.[147, 149, 151, 156, 178] In the current trial, all intervention centres increased mean serves of vegetables and legumes on the menu from 0.8 ± 0.2 serves at baseline to 2.0 ± 0.7 serves at follow up, which exceeded the target of one serve. Similarly, the number of serves of meat and alternative foods on the menu increased from 0.8 ± 0.1 serves at baseline to 1.3 ± 0.2 serves at follow up, exceeding the target of one serve. At follow

up, all intervention centres (4/4) were meeting or exceeding the guidelines for both vegetables and legumes, and meat and alternatives. Intervention centres served twice the mean serves of vegetables and legumes (intervention: 2.0 ± 0.7 serves *v*. comparison: 1.0 ± 0.3 serves) and meat and alternatives (intervention: 1.3 ± 0.2 *v*. comparison: 0.6 ± 0.0 serves) on their menu at follow up compared with comparison centres. Although comparison centres' mean vegetable serves on the menu at follow up met the target of one serve (1.0 ± 0.3 serves), only one centre (1/4) was either meeting or exceeding the guidelines, and had done so at baseline. No comparison centres met compliance for meat and alternatives at follow up.

Improvements seen in vegetables, and meat and alternatives in this study are similar to those seen with past interventions aiming to improve menu compliance within the sector, where follow up menu assessments showed improvements in these food groups. For example, Bell et al. (2015) found a statistically significant increase in median serves of vegetables (baseline: 1.0 IQR 0.6–1.2, follow up: 1.4 IQR 1.1–1.8, $p < 0.001$) and meat (baseline: 0.8 IQR 0.6-0.9, follow up: 1.1 IQR 1.0–1.3, $p = 0.001$) food groups at follow up.[156] Similarly, Yoong et al. (2019) found a significant increase in mean serves of both vegetable ($p < 0.001$) and meat ($p < 0.001$) foods groups on centre menus after participation in a six month childcare food service intervention guided by the Theoretical Domains Framework to support menu complaince.[178] Evaluation of a web-based menu planning intervention by Grady et al. (2020) revealed minor improvements in provision of vegetable, fruit, cereal and bread, meat and alternatives, dairy and alternatives, and discretionary items (reduction) on the menu at a 12-month follow up.[176] However, only improvements in the provision of fruit and discretionary food groups showed statistical significance, and these changes were <0.2 serves. Increases in menu compliance following the menu box delivery service intervention in the current study are consistent with the results of previous Australian menu planning studies and led to increases in the number of mean serves of both vegetables (and legumes) and meat and alternatives on the menu.[138]

Literature relating to the childcare sectors illustrates that centres often meet guidelines for provision of both fruit, and cereals and breads, and in some cases tend towards over-provision.[152] This is often credited to the low cost and high palatability of these foods.[170] Although mean serves of fruit on the menu at intervention centres reduced at follow up (baseline: 1.8 ± 0.7 *v*. follow up: 1.1 ± 0.1 serves), all comparison and intervention centres were still meeting or exceeding guidelines for the fruit group at follow up. Similarly, at follow up, all centres were meeting or exceeding guidelines for breads and cereals. At follow up, mean serves of fruit on the intervention centre menus were lower than on comparison centre menus. This could be attributed to the intervention bringing centre menus closer to the guideline target (one serve), while comparison centres were providing almost double the number of target serves. However, over-provision of both fruits, and cereals and breads food groups may lead to displacement of other important food groups, such as vegetables, dairy,and meats.[152, 170] Comparison centre menus showed an over-

provision of fruit, and cereals and breads, and under-provision of meat and vegetables at follow up. Conversely, provision of fruit on intervention centre menus decreased and these centres were meeting guidelines or exceeding guidelines for all four food groups at follow up.

Although both intervention and comparison centre menus were assessed by the research team using recipes provided by centre cooks, the procurement of ingredients for recipes differed between groups. For intervention centres these recipes were the menu box delivery service recipes provided to centres. Menu assessment against these recipes assumed that centre cooks were following the recipes provided, as ingredients were delivered in the quantities listed in recipes. Similarly, it was assumed that comparison centres were following their own recipes provided for assessment. Measuring the congruence of centre menus against what is prepared and served in childcare centres is a resource-intensive task, particularly for multiple days or weeks. The limited literature on the topic suggests that centres often do not follow centre menus exactly. For example, Benjamin Neelon and colleagues' (2012) analysis of 84 childcare centre menus in North Carolina (USA) revealed only a 52% match between meals and snacks served, and what was indicated on the centre menu.[157] That study also found that foods such as vegetables were served less frequently than stated on the menu.[222] In another study, interviews with childcare cooks and staff indicated that centres may not always use prescribed recipes.[154] It is unclear if the centres in this study were preparing recipes and ingredients in the quantities reported.

Measurement of centre-level provision is one way to measure what is prepared for children at centres.[136] Intervention centres in this study received a prescribed quantity of ingredients each week, corresponding to recipes that met guidelines. It was assumed that the quantity of ingredients included in recipes was accurately provided to centres, as evidenced by the supplier invoices outlining the quantity of ingredients delivered. A tool using centre invoices to measure menu compliance within LDC centres has been developed, and may enable more accurate estimation of what was prepared than simply relying on recipes provided by cooks.[144] However, with this in consideration, cooks receiving the menu box delivery service still reported a surplus of some ingredients at the end of each week. As this was not quantified, it is unclear how precisely recipes were followed and where reductions were made.

Overall, all intervention centre directors indicated that they would use the menu box delivery service again, that children benefitted from the service and that they would recommend the service to other centres. However, only one cook (1/4) would recommend the menu box delivery service to other centres; two cooks (2/4) agreed that they would continue to use the service if they were able to and that children at their centre befitted from the service. When asked, no cooks agreed that they noticed an improvement in the vegetable intake of children attending the centre, whereas two directors agreed with this statement. In the evaluation by Grady et al. (2020) of a web-based menu planning intervention for childcare services across 25 centres, 92% of centre supervisors agreed

that the menu planning tool was useful, 88% agreed that children benefitted from the centres use of the tool and 88% would recommend the tool to other centres.[176] Although cook feedback was not reported, supervisors' responses showed high agreement with statements related to the acceptability of the tool.[149] Feedback regarding the menu box delivery in the current study indicated lower agreement among cooks than in other studies.

The more positive responses from the centre directors than the cooks in this study may also reflect differences in the responsibilities associated with these roles. Director roles are more child facing, which means they may have more exposure than do cooks to the children at mealtimes, and thus directly observe mealtime behaviours. Within the childcare industry many services such as the Healthy Eating Advisory Service highlight the importance of support from management to bring about long-lasting change.[193] Directors provided positive responses about the menu box delivery recipes, and their impacts on children and families. While cook acceptance is important, directors are generally in a position to approve the adoption of practices, such as a menu box delivery service. The positive impressions of the service for directors suggest it may be suitable for the LDC setting and could be adopted in individual centres. In contrast, most directors (3/4) from comparison centres reported little to no involvement or knowledge of the training and Menu Assessment Tool, and all commented that both tools were time consuming.

In terms of acceptability of the Online Cook Training and the Menu Assessment Tool, time was the most persistent theme. For comparison centres, directors found the Online Cook Training and Menu Assessment Tool 'unrealistic' for the LDC setting because of the time needed to complete them. Lack of time has been a recurring barrier identified for past interventions in the LDC setting.[164] All cooks involved in this study worked an average of part-time hours during the week (mean 5.3 ± 0.7 hours per day), which limits the dispensable time available to cooks when all responsibilities are taken into consideration, including ordering, receiving and packing orders, preparing recipes, and general cleaning and kitchen up-keep. One aim of the menu box delivery service was to save cooks time in ordering and planning recipes by streamlining these tasks. All four intervention cooks found the order process satisfactory (n = 4) and reflected that it was easy and straightforward, which provides evidence that the processes involved in the menu box delivery service met their intentions. However, intervention centre cooks found that the time required to prepare recipes was too long.

As this is one of the first studies to explore the concept of a menu box delivery service in a commercial setting, comparable literature is scarce. The cook feedback provides evidence that a particular focus may be required to ensure recipes are appropriate for the setting and facilities. For example, the LDC centres involved in the study did not have kitchen assistants or commercial grade kitchens and equipment, which may have affected cooks' capacity to prepare specific recipes.

Another key time-consuming task reported by intervention centre cooks was the time required to pack away ingredients. Centre cooks reported that the resources available to them were not sufficient for the quantities of ingredients delivered weekly. Again, as no centres involved in the study had commercial kitchens, storage may have been an issue if centres were not equipped to storing large deliveries of food. For example, all centres were using household grade pantries and refrigerators to store foods.

One of the strongest barriers faced by comparison centre cooks for implementing changes to their menu (to meet guidelines) was budget. These cooks reported that their menu budget was not adequate to provide foods in the quantities required to meet guidelines. Literature regarding food expenditure in the LDC setting is limited, but reports in Australian research have shown that lower food expenditure is associated with reduced menu compliance.[170] [170]

Cook beliefs using the TDF barriers and enablers for implementing the Victorian Menu Planning Guidelines are reported in Table 3.10.[167] Overall, intervention centre cooks showed greater agreement with statements than did comparison centre cooks, which indicates more perceived enablers amongst intervention cooks. Although comparison centre cooks were prompted to use online material to support planning menus according to the Victorian Menu Planning Guidelines only one cook agreed that they knew how to plan a menu according to these guidelines. In contrast, while intervention centre cooks did not receive training or support, three of the four agreed that they knew how to plan a menu according to the Victorian Menu Planning Guidelines. Similarly, all intervention cooks agreed with the statements, ‘I have the skills needed to plan a menu according to the Menu Planning Guidelines (Skills Domain)’ and ‘I am confident that I can plan a menu according to the Menu Planning Guidelines (Beliefs about capabilities domain)’ whereas in the comparison group only one and two cooks, respectively, agreed with these statements.

It is unclear why intervention cooks expressed more confidence in using menu planning guidelines despite the fact that, unlike the comparison centre cooks, they did not practise planning and implementing menus. Cooks within the intervention centres reported more experience as cooks (in general), which may have contributed to greater confidence. Cooks were not asked to explain the reasons for their responses. One reason might be that implementing menus that met menu planning guidelines through use of the menu box delivery services provided first-hard experience and confidence in applying the guidelines in practice. Furthermore, given that no comparison centre cook assessed their entire menu or planned a menu according to the menu planning guidelines during the intervention period, they may have perceived this as their inability to do so. Feedback from comparison centre cooks indicated a number of barriers to implementing guidelines, such as budget and time to plan the menu. Likewise, intervention centre cooks scored higher than comparison centre cooks for the environmental context and resources domain

statements, indicating greater enablers for intervention cooks within this domain. This may indicate that the intervention centre cooks generally felt more supported by their centre environment, especially considering that comparison centre directors expressed minimal knowledge of the Online Cook Training and Menu Assessment Tool their centre cooks were using. The small sample size should be considered when interpreting cook and director feedback as eight centres, with four cooks and directors in each group, may not be sufficient for confident interpretation of responses to the questionnaire

3.8 Chapter Summary

This chapter reports the outcomes of an evaluation of the feasibility and acceptability of a menu box delivery, compared with menu planning. The findings suggest that the menu box delivery service improved menu compliance in intervention centres relative to comparison centres. While the processes of the menu box delivery service (such as ordering and using the menu packs), were well received by centre cooks, the recipes were less well received because of time requirements and child palatability. Furthermore, cooks and directors using the Online Cook Training and Menu Assessment Tool found them unreasonable for the LDC setting and no cook completed an assessment of their menus. The next chapter reports the results of the outcome evaluation, where child-level provision, consumption and waste are compared between intervention and comparison centres.

CHAPTER 4 OUTCOME EVALUATION RESULTS

4.1 Chapter Overview

This results chapter addresses the objective *to evaluate the feasibility and acceptability of a menu box delivery service straight to LDC centres.* The hypotheses tested in this chapter are that (1) food provision to and consumption of vegetables will be greater for centres that receive and implement the menu box delivery service by half a serve compared with standard practice, and (2) food provision to and consumption of the five food groups will be greater in children attending centres that receive and implement the menu box delivery service compared with standard practice. The chapter begins by reporting child dietary intake and provision at mealtimes, and then continues on to exploring various dietary outcomes including nutrient and energy provision and consumption.

4.2 Results

4.2.1 Centre Characteristics at Baseline

Centre characteristics for both groups are reported in Table 4.1. Centre size and attendance was similar between the groups. No centres or cooks withdrew from the study before follow up.

Table 4.1 Baseline demographic characteristics of participating childcare services (*n* = 8)[a]

Service characteristics	Comparison (*n* = 4)	Intervention (*n* = 4)
Centre size (approved number of places)	103 (21)	102 (20)
Number of children attending each day	60 (14)	61 (20)
SES of centre location*		
Low SES	1	2
Mid-SES	1	1
High SES	2	1
Hours open per day	12 (0)	12 (0)
Total number of children of Aboriginal or Torres Strait Islander background enrolled at centre	8	4

[a]Data presented as mean (SD) or *n*

*Three Socio-economic status (SES) categories, low, mid and high, were formed using Socio-Economic Indexes for Areas determined by centre postcode. Indices of 1–3 were categorised as indicating 'low' SES, 4–7 as 'mid' and 8–10 as 'high'[195]

4.2.2 Child Characteristics

Characteristics of Children Included in Follow-up Plate Waste Analysis (*n* = 224)

The characteristics of the primary sample (*n* = 224)—that is, children included in the follow-up plate waste analysis—are described in Table 4.2. Among the total sample, 44% of children were from intervention centres (*n* = 98) and 66% from comparison centres (*n* = 126). The majority of children in the overall sample were male (128/224, 57%), as were most in both intervention (57/98, 58%) and comparison centres (71/126, 56%). Median age across both groups was 48 (39–56) months (i.e. ~4.0 [3.3–4.7] years) and children were predominantly (46%) in the kindergarten-aged room (4–5 years). In the intervention centres, 49% of children (*n* = 48) and in comparison centres, 44% of children (*n* = 56) of children were in the kindergarten-aged room. SES distribution of children in the sample was similar across the two groups. Overall, the majority of the sample was from high-SES area centres (44%), followed by low SES (38%) and then mid-SES (18%). Children from the intervention centres were predominantly from low-SES area centres (43%); a larger proportion of children from comparison centres was from high-SES area centres (49%) relative to intervention centres. One child (intervention centre) identified as Aboriginal or Torres Strait Islander background in this sample.

Table 4.2 Characteristics of children included in the follow-up plate waste analysis (*n* = 224)[a]

Characteristic	All Children (*n* = 224)	Comparison (*n* = 126)	Intervention (*n* = 98)
Gender*			
Female	96 (43)	55 (44)	41 (42)
Male	128 (57)	71 (56)	57 (58)
Age (months)	48 (39–56)	49 (40–55)	46 (33–57)
Number of children by room/age group			
Toddler (2–3 yrs)	40 (18)	19 (15)	21 (21)
Pre-kindergarten (3–4 yrs)	80 (36)	51 (41)	29 (30)
Kindergarten (4–5 yrs)	104 (46)	56 (44)	48 (49)
Number of children by SES of centre location**			
Low SES	84 (38)	42 (33)	42 (43)
Mid-SES	41 (18)	23 (18)	18 (18)
High SES	99 (44)	61 (49)	38 (39)
Number of children of Aboriginal or Torres Strait Islander background in sample	1 (0)	0 (0)	1 (1)

[a]Data presented as *n* (%) or median (IQR)

**n* = 3 missing in comparison centres (2.4%)

***Three socio-economic status (SES) categories, low, mid and high, were formed using Socio-Economic Indexes for Areas determined by centre postcode. Indices of 1–3 were categorised as indicating 'low' SES, 4–7 as 'mid' and 8–10 as 'high'[195]

Characteristics of Children Included in Paired Sample Analysis (*n* = 105)

The characteristics of the paired sample (*n* = 105) are described in Table 4.3. Of the total sample, 48% (*n* = 50) were from intervention centres and 52% (*n* = 55) from comparison centres. Overall, the majority of children were male (61/105, 58%). A greater proportion of children in the intervention centres were male (32/50, 64%), than that in the comparison centres (29/55, 53%). Median age for the sample was 43 (36–52) months (i.e. ~3.6 (3.0–4.3) years) and differed by one month between the groups. The proportions of children across age groups (room) and centre SES were similar for the two groups. The proportion of children in the pre-kindergarten-aged room was greater in the comparison (21/55, 38%) than intervention centres (17/50, 34%). Distribution of children across toddler (intervention: 28%, comparison: 26%) and kindergarten (intervention: 38%, comparison: 36%) aged rooms was similar for the intervention and comparison centres. The proportion of children from low-SES area centres in both intervention and comparison centres was 38% (*n* = 14 in both groups). The proportion of children from mid-SES area centres was 34% (*n* = 17) in intervention centres and 38% (*n* = 21) in comparison centres. The proportion of children from high-SES area centres in intervention centres (19/50, 38%) was similar to that in comparison centres (20/55, 36%)

Table 4.3 Baseline characteristics of children with plate waste data at baseline and follow up (*n* = 105)[a]

Characteristic	All children (*n* = 105)	Comparison (*n* = 55)	Intervention (*n* = 50)
Gender			
Female	44 (42)	26 (47)	18 (36)
Male	61 (58)	29 (53)	32 (64)
Age (months)	43 (36–52)	43 (35–51)	44 (36–54)
Number of children by room/age group			
Toddler (2–3 yrs)	28 (27)	14 (26)	14 (28)
Pre-kindergarten (3–4 yrs)	38 (36)	21 (38)	17 (34)
Kindergarten (4–5 yrs)	39 (37)	20 (36)	19 (38)
Number of children by SES of centre location*			
Low SES	40 (38)	21 (38)	19 (38)
Mid-SES	16 (15)	7 (13)	9 (18)
High SES	49 (47)	27 (49)	22 (44)
Number of children of Aboriginal or Torres Strait Islander background	1 (1.0)	0 (0.0)	1 (2.0)

[a]Data presented as *n* (%) or median (IQR)

*Three socio-economic status (SES categories), low, mid and high, were formed using Socio-Economic Indexes for Areas determined by centre postcode. Indices of 1–3 were categorised as indicating 'low' SES, 4–7 as 'mid' and 8–10 as 'high'[195]

4.2.3 Child Dietary Provision and Consumption at Follow Up (*n* = 224)

The following sections describe the dietary provision and consumption (including waste) of children in the primary sample (*n* = 224) at follow up (week 11 & 12), measured by plate waste. As measuring changes in vegetable provision and consumption were the primary aim of this study, results are presented for vegetable-specific outcomes first, then for all five core food groups, and discretionary food and drink.

Child Daily Provision and Consumption of Vegetables

The dietary data for vegetable provision and consumption at follow up, collected via the modified photography plate waste method (see Section 2.3.5) are displayed in Table 4.4. As described in Section 2.3.5, the primary outcomes of the study was measurement of child vegetable provision and consumption in the context of the provision and consumption of a healthy diet that includes the five AGHE food groups.[13] Median (IQR) child daily vegetable provision at follow up in the intervention centres was 0.9 (0.7–1.2) serves/day, compared with 0.8 (0.5–1.3) serves/day in the comparison centres. Child daily vegetable consumption was similar across the two groups, at 0.5 (0.2–0.8) serves/day in the intervention centres and 0.5 (0.3–0.9) serves/day in the comparison centres. Median (IQR) child daily vegetable waste at follow up was greater in the intervention centres, by around 0.2 serves: 0.2 (0.0–0.4) serves/day in the comparison centres compared with 0.4 (0.2–0.6) serves/day in the intervention centres (Table 4.5). This is equivalent to approximately 15 g of vegetables. Analysis of vegetable provision and consumption in grams revealed that median vegetable provision was around 8.4 g greater in the intervention (67.9, IQR 49.6–91.4 grams/day) than comparison centres (59.5, IQR 35.0–95.3) g/day) at follow up. Consumption was lower in the intervention centres, 34.4 (12.1–62.1) g/day, than in the comparison centres, 41.1 (18.8–69.4) g/day.

The linear mixed model results (in serves) are presented in Table 4.6, which shows the impact of the intervention on vegetable provision and consumption, where the comparison centre group is the reference. The linear mixed model adjusted for clustering of centres (random effect) and controlled for child age and gender, SES of centre location and centre size (fixed effects). Log-transformation was performed for variables that did not fit model assumptions. Estimates for transformed variables are reported as the ratio of geometric means, whereas non-transformed variables are reported as geometric means. For vegetables, the model showed a non-significant ($p > 0.05$) decrease in provision (geometric mean (95% CI): –0.2 (–0.1, 0.7), $p = 0.59$) and consumption (ratio of geometric mean (95% CI): 0.7 (0.2, 2.1), $p = 0.40$) at follow up.

Table 4.4 Daily food group consumption and provision to 2–5-year-old children at follow up as assessed by plate waste in serves (*n* = 224)

		Comparison (*n* = 126)		Intervention (*n* = 98)	
Food group, median (IQR)	**Target serves**	**Serves provided**	**Serves consumed**	**Serves provided**	**Serves consumed**
Vegetable	1–1.5	0.8 (0.5–1.3)	0.5 (0.3–0.9)	0.9 (0.7–1.2)	0.5 (0.2–0.8)
Beans and legumes*	–	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)
Fruit	1	1.5 (0.7–2.4)	1.0 (0.4–2.1)	0.6 (0.5–0.9)	0.4 (0.2–0.6)
Cereals and breads	2	2.0 (1.5–2.9)	1.6 (1.0–2.4)	1.2 (0.9–2.0)	0.9 (0.5–1.5)
Dairy and alternatives	2	0.7 (0.0–1.8)	0.6 (0.0–1.5)	0.9 (0.5–1.4)	0.7 (0.1–1.0)
Meat and alternatives	1	0.4 (0.0–0.7)	0.2 (0.0–0.5)	0.5 (0.3–0.9)	0.2 (0.1–0.6)
Unsaturated fats and oils	0–1	0.7 (0.2–2.1)	0.6 (0.2–1.7)	0.5 (0.2–0.6)	0.3 (0.1–0.5)
Discretionary	0	0.2 (0.0–0.6)	0.1 (0.0–0.4)	0.1 (0.0–0.1)	0.0 (0.0–0.1)
*Fits within the vegetable, and meat and alternatives groups, no specific target					

Child Daily Food Group Provision, Consumption and Waste at Mealtimes

The dietary data for all core foods groups, and discretionary food and drink, provided to and consumed by children in the comparison and intervention centres are presented in Table 4.4. Provision of core food groups—fruit, and cereals and bread—was approximately 0.8–0.9 serves/day lower in the intervention than comparison centres at follow up. Median (IQR) fruit serves in intervention centres, 0.6 (0.5–0.9) serves/day, were 0.9 serves/day lower than in comparison centres, 1.5 (0.7–2.4) serves/day. Cereals and breads provision was 0.8 serves/day lower in intervention centres, 1.2 (0.9–2.0) serves/day than in comparison centres, 2.0 (1.5–3.9) serves/day. Median serves of unsaturated fats and oils provided was also lower in the intervention centres (0.5, IQR 0.2–0.6), by around 0.1–0.2 serves/day compared with comparison centres (0.7, IQR 0.2–2.1). Median provision of dairy and alternative foods was slightly greater in the intervention (0.9, IQR 0.5–1.5) centres than in the comparison centres (0.7, IQR 0.0–1.8). Similarly, provision of meat and alternative foods was slightly greater in the intervention centres (0.5, IQR 0.3–0.9) than in the comparison centres (0.4, IQR 0.0–0.6). Daily serves of beans and legumes were no different between the groups at 0.0 (0.0–0.0) serves/day, which may reflect the limited number of food items from this group offered at all participating centres. Mixed model analysis revealed no statistically significant ($p > 0.05$) difference between intervention and comparison centres in child mealtime provision across all food groups follow up (Table 4.6).

Median consumption of all food groups, except meat and alternatives, was lower in intervention centres at follow up compared to comparison centres (Table 4.4). Although median provision of meat and alternatives was greater in the intervention centres by 0.1 serves, consumption of the meat and alternatives was 0.2 serves/day across both the comparison (IQR 0.0–0.5) and

intervention (IQR 0.1-0.6) groups. Provision of fats and oils and discretionary foods were lower in the intervention centres and remained lower for consumption. Similar to provision outcomes, the mixed model analysis revealed no statistically significant ($p > 0.05$) difference in food group consumption across all food groups between both intervention and comparison centres at follow up (Table 4.6).

The daily food group waste for all core foods groups, and discretionary food of children in the comparison and intervention centres is presented in Table 4.5. Vegetable, dairy and alternatives, and meat and alternatives waste was greater in the intervention centres, by around 0.2 serves. Median waste serves of unsaturated fats and oils foods were 0.1 serves greater in the intervention than comparison centres. However, median (IQR) serves of dairy and alternatives waste were 0.1 serves greater in comparison centres, at 0.3 (0.0–0.7) serves/day, than in intervention centres, at 0.2 (0.1–0.3) serves/day. Similarly, median serves of cereals and breads waste were greater by 0.1 serves in comparison centres, at 0.4 (0.0–0.7) serves/day, than in intervention centres, 0.3 (0.1–0.5) serves/day.

Table 4.5 Daily food group waste in 2–5-year-old children at follow up, as assessed by plate waste in serves (*n* = 224)

	Comparison (*n* = 126)	Intervention (*n* = 98)
Food group, median (IQR)	**Waste serves**	**Waste serves**
Vegetable	0.2 (0.0–0.4)	0.4 (0.2–0.6)
Beans and legumes*	0.0 (0.0–0.0)	0.0 (0.0–0.0)
Fruit	0.3 (0.0–0.7)	0.2 (0.1–0.3)
Cereals and breads	0.4 (0.0–0.7)	0.3 (0.1–0.5)
Dairy and alternatives	0.0 (0.0–0.2)	0.2 (0.0–0.5)
Meat and alternatives	0.0 (0.0–0.2)	0.2 (0.1–0.3)
Unsaturated fats and oils	0.0 (0.0–0.2)	0.1 (0.0–0.2)
Discretionary	0.0 (0.0–0.0)	0.0 (0.0–0.0)
*Fits within the vegetable, and meat and alternatives groups		

Table 4.6 Impact of intervention on differences in child food group provision and consumption in serves at follow up, linear mixed model outputs, in children present at follow up (*n* = 224)

Child provision			Child consumption		
Food group	**Estimate**	**95% CI**	**Food group**	**Estimate**	**95% CI**
Vegetable and legumes	–0.2	–1.0, 0.7	Vegetable and legumes*[1]	0.7	0.2, 2.1
Fruit[1]	0.5	0.1, 1.7	Fruit[1]	0.4	0.1, 1.4
Cereals and breads[1]	0.7	0.4, 1.5	Cereals and breads[1]	0.5	0.1, 2.0
Dairy and alternatives	1.1	–2.8, 5.0	Dairy and alternatives	–0.4	–3.0, 2.3
Meat and alternatives	0.1	–0.6, 0.8	Meat and alternatives	0.0	–0.6, 0.6
Unsaturated fats and oils[1]	0.7	0.1, 3.9	Unsaturated fats and oils[1]	0.4	0.1, 2.8
Discretionary[1]	0.5	0.0, 9.2	Discretionary[1,2]	0.3	0.0, 9.1
[1]Log-transformed data, exponentiated coefficients reported (ratio of geometric means) [2]Heteroscedasticity present in model					

Child Daily Vegetable Provision and Consumption by Meal Occasion

The Victorian Menu Planning Guidelines recommend provision of vegetables at both main meals and snacks in the LDC setting.[141] Median daily food group provision and consumption are presented in grams across meal occasion (main meal or snack) in Table 4.7 and 4.8, respectively. Median vegetable provision in the intervention centres was spread across the main meal (41.0, IQR 27.9–62.5 g) and snacks, (24.4, IQR 16.1–29.5 g), whereas at comparison centres, vegetables were only provided at the main meal, (52.1, IQR 35.0–90.4 g) and not at snack times (0.0, IQR 0.0–0.0 g). Although children in the intervention centres consumed vegetables at both main meals (15.4, IQR 3.3–37.4 g) and snacks (10.5, IQR 1.4–21.8 g), the overall quantity of vegetables consumed at both mealtimes combined was lower than the median consumption of vegetables at the main meal only in the comparison centres, at 38.0 (IQR 15.4–66.7) g. There was a higher frequency of opportunities for vegetable exposure across meals in the intervention centres than in comparison centres. However, consumption in the comparison centres was higher at the one mealtime, by around 12.1 g, or just below 0.2 serves.

Table 4.7 Daily food group provision (g) to 2–5-year-old children by meal occasion, main meal or snack, at follow up of eligible children in comparison and intervention centres assessed by plate waste, (*n* = 224)

	Comparison (*n* = 126)		Intervention (*n* = 98)	
Food group, median (IQR)	**Main meal**	**Snack**	**Main meal**	**Snack**
Vegetables	52.1 (35–90.4)	0.0 (0.0–0.0)	41.0 (27.9–62.5)	24.4 (16.1–29.5)
Beans and legumes	0.0 (0.0–2.4)	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)
Fruit	0.0 (0.0–0.0)	113.0 (55.8–171.0)	0.0 (0.0–0.0)	45.3 (35–64.9)
Cereals and breads	98.9 (62.0–141.3)	8.7 (0.0–25.4)	67.3 (36.3–107.2)	9.0 (0.9–18.9)
Dairy and alternatives	0.0 (0.0–10.8)	10.0 (0.0–68.5)	0.0 (0.0–8.1)	54.7 (31.7–87.9)
Meat and alternatives	9.9 (0.0–26.8)	0.0 (0.0–0.0)	15.4 (7.5–21)	4.9 (0.0–14.4)
Unsaturated fats and oils	2.6 (1.8–5.1)	2.8 (0.0–9.9)	2.9 (1.7–5.5)	0.0 (0.0–1.3)
Discretionary	2.5 (0.0–8.9)	0.0 (0.0–0.0)	0.0 (0.0–1.2)	1.3 (0.0–3.0)
*Fits within the vegetable, and meat and alternatives groups				

Table 4.8 Daily food group consumption (g) of 2–5-year-old children by meal occasion, main meal or snack, at follow up of eligible children in comparison and intervention centres assessed by plate waste, (*n* = 224)

	Comparison (*n* = 126)		Intervention (*n* = 98)	
Food group, median (IQR)	**Main meal**	**Snack**	**Main meal**	**Snack**
Vegetable	38.0 (15.4–66.7)	0.0 (0.0–0.0)	15.4 (3.3–37.4)	10.5 (1.4–21.8)
Beans and legumes	0.0 (0.0–1.1)	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)
Fruit	0.0 (0.0–0.0)	76.0 (32.5–122)	0.0 (0.0–0.0)	28.7 (11.7–46.4)
Cereals and breads	63.4 (39.0–122.9)	5.0 (0.0–25.4)	41.9 (15.2–95.1)	2.7 (0.0–10.9)
Dairy and alternatives	0.0 (0.0–9.1)	8.3 (0.0–60.5)	0.0 (0.0–1.6)	30.5 (9.2–80.3)
Meat and alternatives	2.2 (0.0–18.7)	0.0 (0.0–0.0)	5.6 (0.8–13.7)	0.0 (0.0–10.5)
Unsaturated fats and oils	2.6 (1.6–4.7)	1.8 (0.0–8.3)	1.9 (0.9–3.6)	0.0 (0.0–0.1)
Discretionary	1.5 (0.0–5.8)	0.0 (0.0–0.0)	0.0 (0.0–0.3)	0.4 (0.0–2.0)
*Fits within the vegetable, and meat and alternatives groups				

4.2.4 Daily Nutrient Provision and Consumption at Follow up (*n* = 224)

Nutrient provision and consumption at follow up are presented alongside the appropriate NRVs, where possible, in Table 4.9. As the menu planning guidelines are expected to provide at least half of a child's daily food group requirements, benchmarks for NRV were set at 50% of the mean requirements for children aged 2–5 years.[45, 141] At follow up, median energy provision in intervention centres (1,676, IQR 1,286–2,087 kJ/day) failed to meet the daily 50% energy

requirement of 2,100 kJ, unlike at comparison centres (2,351, IQR 1,762–3,130 kJ/day). However, median energy consumption at both intervention (1,198, IQR 700–1,602 kJ/day) and comparison (1,886, IQR 1,249–2,412) centres was below 50% of the mean estimated energy requirement range for children aged 2–5 years. Median energy provision and energy consumption, respectively, in intervention centres were 29% and 36% lower than in comparison centres. Sodium provision in the comparison centres was in excess of the daily benchmark of 600 mg at follow up. Provision and consumption of calcium fell below the benchmark of 50% of the NRV (220 mg/d) in both groups. Similarly, consumption of fibre was below the 50% benchmark of 8 g across both groups. Iron and vitamin C consumption were both in excess of the benchmark. Overall, provision and consumption of all nutrients was lower in the intervention centres than in the comparison centres.

Table 4.9 Daily nutrient provision and consumption of 2–5-year-old children at follow up as assessed by plate waste (*n* = 224)

	Benchmark 50% of NRV*	Comparison (*n* = 126)		Intervention (*n* = 98)	
Food group, median (IQR)		**Provision**	**Consumption**	**Provision**	**Consumption**
Energy (kJ)**	2,100	2,351 (1,762–3,130)	1,886 (1,249–2,412)	1,676 (1,286–2,087)	1,198 (700–1,602)
Fat (g)	–	17.8 (10.8–28.8)	13.6 (8.5–22.4)	11.0 (8.4–15.2)	6.8 (4.0–11.6)
Saturated fat (g)	–	6.6 (4.6–10.7)	5.5 (3.0–8.6)	3.9 (2.6–5.5)	2.2 (1.2–4.1)
Protein (g)	7	20.5 (15.7–26.3)	15.6 (11.1–22.0)	18.5 (14.1–22.8)	12.4 (7.8–17.5)
Carbohydrate (g)	–	68.8 (52.8–98.0)	54.1 (38.3–79.0)	50.9 (33.6–69.0)	34.4 (20.3–53.6)
Sugars (g)	–	24.2 (14.2–38.6)	16.9 (9.8–29.3)	14.4 (11.5–16.9)	4.4 (6.4–14.2)
Dietary Fibre (g)	8	8.4 (6.8–11.4)	6.2 (4.6–8.8)	6.7 (4.8–9.7)	4.4 (2.8–7.1)
Sodium (mg)	600[a]	623.3 (373.4–977.6)	486.1 (272.0–763.8)	459.4 (321.0–637.6)	325.8 (182.8–453.0)
Calcium (mg)	220	176.7 (95.2–289.6)	141.9 (66.1–236.7)	179.7 (150.9–246.9)	115.6 (74.4–194.5)
Iron (mg)	2	2.8 (2.1–3.7)	2.1 (1.4–3.0)	2.1 (1.7–2.8)	1.4 (0.8–2.2)
Vitamin C (mg)	12.5	32.8 (21.7–58.5)	23.0 (12.6–42.3)	16.4 (11–24.8)	7.7 (3.5–14.7)

*NRV, Nutrient Reference Value. Estimated average requirement (EAR) or adequate intake (AI) are presented where an EAR is not available. Upper limit (UL) used for sodium.

**Energy in Estimated Energy Requirement per day; Physical Activity Level of 1.2—equivalent to resting in bed—used as benchmark value[45]

[a]50% benchmark of UL

4.2.5 Covid-19 Methodology Modification Impact

Due to circumstances related to the COVID-19 pandemic in 2020, the follow-up data collection methodology was modified to incorporate a photography plate waste assessment. However, data collection at one centre occurred prior to these changes being actioned, and thus the initial (baseline) plate waste methodology at follow up was used. It is thus prudent to explore any potential implications for the dietary data at follow up, of combining the two methodologies.

Overall, 25 children in the comparison centres were measured using the primary plate waste methodology (i.e. not modified) at follow up (intervention centres, *n* = 0). The median age of this sample (*n* = 25) was 33 (IQR: 30–38) months, equivalent to around 2.8 years. Of this sample, 12 children were female (48%), 12 (48%) were of toddler age (2–3 years) and the remaining 13 children (52%) were of pre-kindergarten age (3–4 years). The SEIFA category for the postcode of the centre in question was classified as high SES and no children in this sample identified as Aboriginal or Torres Strait Islander People.

Descriptive data for the sensitivity analysis are presented for eligible children measured by the modified plate waste methodology *only* (*n* = 101) alongside those for children in the final comparison centre follow-up dataset (i.e. all children, *n* = 126) in Table 4.10. Comparison of descriptive data between these two scenarios revealed very similar patterns. Vegetable provision was 0.1 serves (~around 7.5 g, or 10% of target serve) lower in the comparison group with *n* = 25 children removed (*n* = 101) than in the comparison total sample (*n* = 126); and vegetable consumption was 0.1 serves greater in the comparison group with *n* = 25 children removed (*n* = 101) than in the comparison total sample (*n* = 126). Provision and consumption of unsaturated fats and oils was greater by around 0.5 serves in the comparison group with *n* = 25 children removed (*n* = 101) than in the comparison total sample (*n* = 126); provision of cereal and breads was 0.2 serves lower; and provision of meat and alternatives was 0.3 serves lower in the comparison group with *n* = 25 children removed (*n* = 101) that in the comparison total sample (*n* = 126). Overall the differences observed between these two datasets imply that the alteration in the method of photographing the food waste was likely to have a negligible influence on the child dietary provision or consumption results.

Table 4.10 Sensitivity analysis of comparison centres data at follow up, side-by-side comparison of follow-up dataset (*n* = 126) and follow-up dataset with child dietary data measured with non-modified plate waste data collection methodology (*n* = 25) removed (*n* = 101)

		Provision		Consumption	
Food group, median (IQR)	**Target serves**	**Comparison total sample (*n* = 126)**	**Comparison *n* = 25 removed** (*n* = 101)**	**Comparison total sample (*n* = 126)**	**Comparison *n* = 25 removed** (*n* = 101)**
Vegetable	1–1.5	0.8 (0.5–1.3)	0.7 (0.5–1.4)	0.5 (0.3–0.9)	0.6 (0.3–1.0)
Beans and Legumes*	–	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)
Fruit	1	1.5 (0.7–2.4)	1.4 (0.6–2.2)	1.0 (0.4–2.1)	1.0 (0.4–1.6)
Cereals and breads	2	2.0 (1.5–2.9)	1.8 (1.5–2.7)	1.6 (1.0–2.4)	1.5 (1.0–2.3)
Dairy and Alternatives	2	0.7 (0.0–1.8)	0.7 (0.0–1.9)	0.6 (0.0–1.5)	0.6 (0.0–1.5)
Meat and Alternatives	1	0.4 (0.0–0.7)	0.1 (0.0–0.5)	0.2 (0.0–0.5)	0.1 (0.0–0.4)
Unsaturated fats and Oils	0–1	0.7 (0.2–2.1)	1.2 (0.4–2.4)	0.6 (0.2–1.7)	1.0 (0.3–2.0)
Discretionary	0	0.2 (0.0–0.6)	0.2 (0.0–0.6)	0.1 (0.0–0.4)	0.1 (0.0–0.5)

*Fits within the vegetable, and meat and alternatives groups, no specific target

**Children with dietary data measured with non-modified plate waste data collection methodology (*n* = 25) removed from the dataset

4.2.6 Paired Sample Child Dietary Provision and Consumption (*n* = 105)

The paired sample included 105 children (comparison: *n* = 55, intervention: *n* = 50) who were present at both baseline and follow up for a full day of eating. Daily food group provision and consumption for children in this secondary sample (*n* = 105), for each time point, are presented in Table 4.11 and 4.12, respectively. Characteristics of this sample are presented in Table 4.3.

It should be highlighted that the plate waste methodologies used at each time point differed. As mentioned, because of circumstances related to the COVID-19 pandemic in 2020, the follow-up plate waste methodology was modified to accommodate restricted access to LDC centres at the time. In short, plate waste at baseline measured provision and waste, whereas at follow up, although waste was measured, provision was estimated using photos and reference portions that were measured and weighed. Both methodologies are described in detail in Section 2.3.5.

Table 4.11 Daily food group provision to 2–5-year-old children present at baseline and follow up as assessed by plate waste in serves for intervention and comparison centres, complete case analysis (*n* = 105)

		Comparison (*n* = 55)		Intervention (*n* = 50)	
Food group, median (IQR)	**Target serves**	**Baseline**	**Follow up**	**Baseline**	**Follow up**
Vegetable	1–1.5	0.7 (0.6–1.8)	0.9 (0.4–1.5)	1.2 (0.9–1.5)	1.0 (0.7–1.3)
Legumes*	–	0.0 (0.0–0.1)	0.0 (0.0–0.1)	0.0 (0.0–0.0)	0.0 (0.0–0.0)
Fruit	1	1.7 (0.8–2.7)	1.6 (0.8–4.5)	2.1 (1.2–3.1)	0.6 (0.5–0.9)
Cereals and breads	2	1.5 (0.8–2.2)	2.2 (1.6–3.2)	1.4 (0.8–2.0)	1.0 (0.8–1.4)
Dairy and alternatives	2	1.3 (0.8–2.4)	0.6 (0.0–1.4)	1.2 (0.8–2.4)	1.0 (0.5–1.5)
Meat and alternatives	1	0.4 (0.0–0.7)	0.5 (0.0–1.0)	0.7 (0.0–1.2)	0.6 (0.4–1.0)
Unsaturated fats and oils**	0–1	0.4 (0.2–0.5)	0.5 (0.2–1.7)	0.4 (0.0–0.9)	0.4 (0.2–0.6)
Discretionary	0	0.3 (0.0–1.3)	0.2 (0.0–0.4)	0.1 (0.0–1.0)	0.1 (0.0–0.1)

*Fits within the vegetable, and meat and alternatives groups, no specific targets

**No more than one serve per day

Table 4.12 Daily food group consumption by 2–5-year-old children present at baseline and follow up as assessed by plate waste in serves for intervention and comparison centres, complete case analysis (*n* = 105)

		Comparison (*n* = 55)		Intervention (*n* = 50)	
Food group, median (IQR)	**Target serves**	**Baseline**	**Follow up**	**Baseline**	**Follow up**
Vegetable	1–1.5	0.4 (0.2–0.8)	0.6 (0.3-1.1)	0.5 (0.3-0.8)	0.6 (0.2-0.9)
Legumes*	–	0.0 (0.0–0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)
Fruit	1	1.1 (0.5–1.6)	1.2 (0.4-3.1)	1.1 (0.8-1.9)	0.4 (0.2-0.7)
Cereals and breads	2	0.9 (0.5–1.8)	1.9 (1.3-2.5)	1.2 (0.5-1.9)	0.8 (0.4-1.3)
Dairy and alternatives	2	1.0 (0.5–1.4)	0.5 (0.0-1.1)	1.2 (0.6-2.2)	0.8 (0.2-1.3)
Meat and alternatives	1	0.3 (0.0–0.3)	0.2 (0.0-0.7)	0.2 (0.0-0.7)	0.3 (0.1-0.7)
Unsaturated fats and oils**	0–1	0.3 (0.0–0.5)	0.5 (0.2-1.6)	0.2 (0.0-0.5)	0.2 (0.1-0.5)
Discretionary	0	0.2 (0.0–1.0)	0.2 (0.0-0.4)	0.2 (0.0-0.9)	0.0 (0.0-0.1)

*Fits within the vegetable, and meat and alternatives groups, no specific targets

**No more than one serve per day

Child Daily Vegetable Provision and Consumption at Baseline and Follow Up

Despite an increase in 0.2 serves from baseline to follow up, vegetable provision at follow up was just below the minimum target of one serve in the comparison centres. Although median vegetable provision in the intervention centres decreased by 0.2 serves from baseline, 1.2 (0.9–1.5) serves, to follow up, 1.0 (0.7–1.3), it remained within the target range for vegetable serves (Table 4.11). Median vegetable consumption increased by 0.1–0.2 serves from baseline to follow up for both groups (intervention: baseline, 0.5 IQR 0.3–0.8, follow up: 0.6 IQR 0.2–0.9 *v*. comparison: baseline, 0.4 IQR 0.2–0.8, follow up: 0.6 IQR 0.3–1.1). There was no difference in consumption between the two groups at follow up (intervention: 0.6 IQR 0.2–0.9, comparison: 0.6 IQR 0.3–1.1) (Table 4.12)

Child Daily Food Group Provision and Consumption at Mealtimes

Child daily food group provision and consumption decreased or remained the same across core food groups (Table 4.11 and 4.12). In the intervention centres, median fruit provision decreased from over two serves to below one serve from baseline (1.1 IQR 0.8–1.9 serves) to follow up (0.4 IQR 0.2–0.7 serves). Fruit consumption also decreased from 1.1 (0.8 –1.9) serves at baseline to 0.4 (0.2–0.7) serves at follow up in intervention centres. Similarly, consumption of cereals and breads decreased by 0.4 serves in the intervention centres from baseline (1.2 IQR 0.5–1.9 serves) to follow up (0.8 IQR 0.2–1.3). Consumption of cereals and breads in the comparison centres increased by one serve from baseline (0.9 IQR 0.5–1.8 serves) to follow up (1.9 IQR 1.3–2.5). Provision and consumption of meat and alternatives, and fats and oils, remained similar across both time points and between both groups. Median consumption of discretionary foods reduced to 0.0 (0.0–0.1) serves at follow up in the intervention centres, whereas median consumption did not change in the comparison centres (baseline: 0.2 IQR 0.0–1.0 *v*. follow up: 0.2 IQR 0.0–0.4).

Child Daily Food Group Waste at Mealtimes

Median servings of waste at baseline and follow up for children present at both time points, by serves of AGHE food groups, for both comparison and intervention centres are presented in Table 4.13. Median serves of vegetable waste increased by 0.2 serves from baseline to follow up in both comparison and intervention centres. At follow up, serves of vegetable were 0.1 serves greater in intervention centres, at 0.4 (0.2–0.6) serves/day, and 0.3 (0.1–0.5) serves/day in comparison centres. Median serves of dairy, and cereals and breads waste was greater in the comparison centres than in the intervention centres. In intervention centres, the proportion of cereals and breads was unchanged from baseline; however, the proportion of fruit waste reduced from 0.7 (0.3–1.2) serves/day at baseline to 0.2 (0.1–0.3) serves/day at follow up. Dairy, meat, and unsaturated fats and oils waste was greater in the intervention centres at follow up than in the comparison centres, by around 0.1–0.2 serves.

Table 4.13 Daily food group waste of 2–5-year-old children present at baseline and follow up as assessed by plate waste in serves, complete case analysis (*n* = 105)

	Comparison (*n* = 55)		Intervention (*n* = 50)	
Food group, median (IQR)	**Baseline**	**Follow up**	**Baseline**	**Follow up**
Vegetable	0.1 (0.0–0.4)	0.3 (0.1–0.5)	0.2 (0.1–0.6)	0.4 (0.2–0.6)
Legumes*	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)
Fruit	0.2 (0.0–0.7)	0.3 (0.1–0.8)	0.7 (0.3–1.2)	0.2 (0.1–0.3)
Cereals and breads	0.2 (0.1–0.4)	0.4 (0.1–0.7)	0.2 (0.0–0.4)	0.2 (0.1–0.4)
Dairy and alternatives	0.1 (0.0–0.4)	0.0 (0.0–0.0)	0.0 (0.0–0.4)	0.2 (0.0–0.4)
Meat and alternatives	0.0 (0.0–0.1)	0.1 (0.0–0.4)	0.0 (0.0–0.2)	0.2 (0.1–0.3)
Unsaturated fats and oils**	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.1 (0.0–0.2)
Discretionary	0.0 (0.0–0.1)	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)

*Fits within the vegetable, and meat and alternatives groups, no specific targets
**No more than one serve per day

4.2.7 Proportion of Children Meeting or Exceeding Guidelines

The Victorian Menu Planning Guidelines outline the minimum number of children's serves from each food group that should be provided to children attending a centre.[141] The number and proportion of children meeting or exceeding guidelines, for children present at baseline and follow up, is presented in Table 4.14. At intervention centres, the proportion of children meeting or exceeding guidelines decreased between baseline and follow up, for both provision and consumption, across all food groups, with the exception of vegetable consumption.

The proportion of children meeting or exceeding guidelines in intervention centres for provision of vegetables decreased from baseline (64%) to follow up (50%). However, the proportion of children meeting or exceeding guidelines in intervention centres for consumption of vegetables increased from baseline (16%) to follow up (20%) (Table 4.14). The proportion of children meeting or exceeding guidelines in comparison centres, for both provision and consumption of vegetables, increased from baseline (provision: 47%, consumption: 22%) to follow up (provision 47%, consumption: 27%). The proportion of children meeting or exceeding guidelines for provision of vegetables was similar between intervention (50%) and comparison centres (47%) at follow up. The proportion of children meeting or exceeding guidelines for vegetable serves consumed was greater in comparison centres (27%) than in intervention centres (20%) at follow up.

Table 4.14 Proportion of 2–5-year-old children meeting or exceeding menu planning guideline food group recommendations for provision at baseline and follow up as assessed by plate waste in serves, complete case analysis (*n* = 105)

		Comparison (*n* = 55)				Intervention (*n* = 50)			
		Provision		Consumption		Provision		Consumption	
Food group, *n* (%)	**Target serves**	**Baseline**	**Follow up**	**Baseline**	**Follow up**	**Baseline**	**Follow up**	**Baseline**	**Follow up**
Vegetables and legumes	1–1.5	23 (42)	26 (47)	12 (22)	15 (27)	32 (64)	25 (50)	8 (16)	10 (20)
Fruit	1	38 (69)	34 (62)	31 (56)	30 (55)	47 (94)	8 (16)	27 (54)	5 (10)
Cereals and breads	2	19 (35)	34 (62)	10 (18)	25 (46)	13 (26)	5 (10)	10 (20)	4 (8)
Dairy and alternatives	2	19 (35)	8 (15)	4 (7)	6 (11)	16 (32)	4 (8)	14 (28)	3 (6)
Meat and alternatives	1	8 (15)	14 (26)	1 (2)	6 (11)	16 (32)	11 (22)	9 (18)	6 (12)
Unsaturated fats and oils**	0–1	4 (7)	21 (38)	1 (2)	20 (36)	7 (14)	3 (6)	2 (4)	1 (2)
Discretionary	0	17 (31)	8 (15)	18 (33)	8 (15)	11 (22)	6 (12)	11 (22)	10 (20)
*No more than one serve per day									

4.3 Discussion

This chapter reports the child dietary provision and consumption outcomes of the menu box delivery trial to improve menu compliance, and child provision and consumption of vegetables and core food groups in LDC centres, described in Chapter 3. The results presented in this chapter relate to the aim of evaluating the impact of the menu box delivery service on the provision and consumption of vegetables and core food groups in children aged 2–5 years through testing two hypotheses: (1) that food provision to and consumption of vegetables will be greater for centres that receive and implement the menu box delivery service by half a serve compared with standard practice, and (2) food provision to and consumption of five food groups will be greater in children attending centres that receive and implement the menu box delivery service compared with standard practice.

Menu compliance target serves were used as the reference for child provision and consumption targets.[141] However, this was based on the assumption that menu compliance targets are a proxy for recommendations for child provision and consumption while in care, which provides approximately half of their daily requirements. Findings show that at follow up, median serves of vegetables provided to children at mealtimes was at the lower end of the menu compliance targets (comparison: 0.8 IQR 0.5–1.3, intervention 0.9 IQR 0.7–1.2), and was not statistically significant different between groups ($p > 0.05$). By comparison, median serves of fruit provided to children at mealtimes in intervention centres was half a serve below the target serve (0.6 IQR 0.5–0.9),

whereas the comparison centres provided half a serve above the target of one serve per day (1.5 IQR 0.7–2.4). Provision of cereals and breads in intervention centres was 0.8 serves below the target of two serves per day, at a median of 1.2 (IQR 0.9–2.0) serves, compared with comparison centres, 2.0 (IQR 1.5–2.0) serves, where the median serves met the target serves for the food group. Neither group provided serves close to the target of two serves per day for dairy and alternatives, and meat and alternatives foods: both were only approximately half the target daily serve of one serve. Overall, there was no statistically significant difference in provision between intervention and comparison centres for either of these food groups (dairy and alternatives, and meat and alternatives) at mealtimes. Furthermore, there was no meaningful difference in vegetable provision at mealtimes between groups (0.1 serve at follow up). In addition, there was greater vegetable waste at follow up. Compared to baseline, child vegetable waste at mealtimes was greater at follow up across both comparison (baseline: 0.1 IQR 0.0–0.4 *v*. follow up: 0.3 IQR 0.1–0.5 serves) and intervention centres (baseline: 0.2 IQR 0.1–0.6 *v*. follow up: 0.4 IQR 0.2–0.6 serves).

Similar patterns were observed for consumption as for provision at follow up. Vegetable and meat consumption was the same for the comparison and intervention centres; whereas cereal, fruit and dairy food consumption was greater in the comparison than the intervention centres. There were no statistically significant differences between the centre groups in child consumption at mealtimes for any food group ($p > 0.05$). Overall, provision and consumption were consistently low across both groups. Similarly, Bell et al.'s (2015) evaluation of the *Start Right–Eat Right* program revealed no statistically significant improvements in median child mealtime vegetable consumption from baseline to follow up (0.4 IQR 0.0–0.9 *v*. follow up: 0.5 IQR 0.0–1.0 serves, $p = 0.08$).[156]

Matwiejczyk et al. (2018) recommended intervention periods of >12 months (ideally two to four years) for interventions to promote healthy eating in childcare settings.[156, 171, 176-178, 223] The follow-up period of the current intervention was short compared with recommendations and similar interventions in LDC settings.[156, 171, 176-178, 223] For example, Yoong et al.'s study published in 2020 explored child-level outcomes of a web-based menu intervention and whether a long-term implementation period (>12 months) would be effective in sustaining improvements in child dietary provision and consumption.[175] Outcomes of that study revealed improvements of <0.1 serve in child vegetable consumption at 12-month follow up, which was not statistically significant. Although changes across fruit, dairy, and discretionary food and drink groups showed statistical significance at 12 months, these were not meaningful (~0.1 serve improvements).[175] These findings were similar to the differences between intervention and comparison centres presented in this thesis. Child mealtime consumption across all food groups was neither statistically significant nor meaningful.

Energy provision (in kilojoules) in the intervention centres was lower than that in the comparison centres. In addition, consumption in the intervention centres met 40% of the benchmark (50% of daily requirements, i.e. 2,100 kJ). This may be because some nutritious foods (such as vegetables) provide lower energy than do high-energy, low-nutrient foods such as discretionary items.[224] If child food provision and consumption were meeting food group provision recommendations, energy provision and consumption should be near the 50% energy benchmark.[44] This is reflected in lower provision of key nutrients, all of which were below benchmark, with the exception of iron and vitamin C in intervention centres. This might suggest that children in the comparison centres were served more food than those in the intervention centres.

The Victorian Menu Planning Guidelines provide half (50%) of a child's daily food group requirements, based on the *Australian Dietary Guidelines*.[13, 42, 141] As the development of the *Australian Dietary Guidelines* was underpinned by the NRV, it is assumed that by consuming the recommended serves of each food group, nutrient requirements will be met.[13, 42, 45] At follow up, median energy provision in comparison centres exceeded the 50% benchmark, while food group provision did not meet menu planning guidelines for all food groups. This may reflect the over-provision of fruits, and breads and cereals at centres, driving the energy density of the meal, despite failing to meet recommendations across all food groups. Provision and consumption of discretionary foods was 0.1 serves greater in the comparison centres. Discretionary foods are characterised by their high-energy, nutrient-poor properties, which may have been another factor in the greater energy provision within comparison centres, despite food provision falling below menu guideline targets for many core food groups. Intervention centre food group provision at meals largely did not meet guidelines and child nutrient provision did not meet the 50% benchmark for most nutrients.

The Victorian Menu Planning Guidelines recommend provision of vegetables across both snacks and meals across the day.[141] At follow up, comparison centres provided no vegetables at snacks but did provide a median of 52.1 g (IQR 35.0–90.4 g) at the main meal. Intervention centres provided a median of 41.0 g (IQR 277.9–62.5 g) at the main meal and 24.4 g (16.1–29.5 g) at snacks. Consumption of vegetables at the main meal in the comparison centres was at a median level of 38.0 g (IQR 15.4–66.7 g); while the combined consumption in the intervention centres was 25.9 g: 15.4 (3.3–37.4 g) at the main meal and 10.5 g (1.4–21.8 g) at snacks. Provision of vegetables was spread across meals and snacks in the intervention centres. There is evidence for a positive impact of providing vegetables at both snacks and main meals in centres on child acceptance of vegetables; however in practice, this is poorly observed.[222, 225, 226] Copeland (2013) described snacks in childcare as an opportunity for consumption of nutrients and highlighted that there is a need for exposure to a variety of foods (including vegetables) at these times.[225] While provision and consumption of vegetables was similar at the intervention and comparison centres at

follow up, intervention centres provided a greater spread of vegetables across the day, thus providing more opportunities for child exposure to vegetables.The methodology used to measure plate waste was different from baseline and follow up because of COVID-19 restrictions. The differences in data collection methods at the two time points may have affected estimates of child provision and consumption. In the follow-up sample, *n* = 25 children from one centre (comparison centre) were measured using the baseline methodology (as restrictions had not been in place). To assess the impact of this difference on outcomes, a comparison was performed of the total comparison sample (*n* = 126) with the comparison sample for the centre at which the baseline methodology was used (*n* = 25 children) excluded (*n* = 101). Estimates of serve sizes differed by only 0.1–0.2 serves. The strength of the adapted photography methodology was that child waste was still weighed by researchers on site, a checklist was used to cross-check, the researcher was on site for support, and a ruler was used in images for reference. Some limitations include the reliance on educators for taking photos, without researcher input during the meal, and the fact that the camera was not stationary.

A strength of the modified plate waste photography methodology used to measure child dietary provision and waste was the actual weighed waste measure. Waste is not commonly reported in evaluations of child dietary outcomes. Comparing waste between comparison and interventions centres showed waste at intervention centres was greater for most food groups except fruit, and cereals and breads. This is likely because of the over-provision of these food groups at comparison centres, as discussed earlier. Furthermore, estimates of energy provision and consumption revealed a smaller quantity of food being provided to intervention centre children. However, a limitation of this method, as mentioned above, surround the reliance on educators for taking photos without a researcher present at the mealtime to support staff. Furthermore, appropriate baseline to follow up comparison of dietary intake could not be made due to the nature of measuring intake at baseline and follow up

In summary, child dietary provision and consumption was similar at the intervention and comparison centres, for most food groups. Although median provision of vegetables was greater in the intervention centres (by 0.1 serves), consumption in both intervention and comparison centres was the same (0.5 serves). While children in the intervention centres were served more vegetables than their counterparts in comparison centres, more vegetable waste was measured for these children. Overall, meaningful improvements in child dietary provision and consumption were not observed in this sample.

4.4 Chapter Summary

This chapter reports the impact of the menu box delivery service on the dietary outcomes of child provision, and consumption of vegetables and core food groups, compared with menu planning.

The findings of this chapter show overall low provision and consumption of all food groups (compared with target serves from guidelines) and no significant differences between the comparison and intervention centres ($p > 0.05$). Intervention centres provided more vegetables at meals and snacks across the day: the comparison centres provided vegetables only at the main meal. The next chapter reports the results of an economic evaluation of the menu box delivery service in comparison with the cook training and menu planning tools.

CHAPTER 5 ECONOMIC EVALUATION RESULTS

5.1 Chapter Overview

This chapter presents the results of the economic evaluation of the menu box delivery service. Results inform the third objective, *to compare the cost-effectiveness of the menu box delivery intervention to standard practice (i.e. menu planning) in LDC centres*. The research question addressed is: Is an 8-week menu box delivery service cost effective (in terms of cost per vegetable serve menu compliance, serves of vegetables provided to and consumed by children at mealtimes), compared to an online menu planning tool from a childcare centre perspective?

First, the results of the within-trial CEA (Section 5.3), and CCA (Section 5.4) are reported from the centre perspective.[191] Finally, Section 5.5 reports the results of a BIA over a one-year time horizon from the service perspective, guided by the ISPOR Task Force principles of good practice for BIA.[211]

5.2 Cost and Effectiveness Outcomes

5.2.1 Missing Data

Overall, the proportion of missing data was 8%, all of which was missing menu invoices from cooks in the comparison centres. The intervention centre invoices were collected directly from the supplier whereas the comparison centres cooks were asked to keep a record of their weekly menu invoices and receipts for the eight-week intervention period, to be collected by the PhD candidate. Time data were collected weekly during phone interviews, and all interviews were completed with no missing data.

The proportion of missing data, 8%, is close to the acceptable range in the literature for quantitative data of 5–10%.[227-229] Missing invoices were assumed to be non-biased and missing completely at random (MCAR) as the issue resulted from cooks misplacing invoices.[229] As the proportion of missing data was within an acceptable range and menu costs did not vary significantly week to week in the LDC setting, average costs were calculated exclusive of missing invoices.[227]

5.2.2 Effectiveness Outcomes

The effectiveness outcomes used for the cost-effectiveness evaluation were defined as menu vegetable compliance, and child dietary vegetable provision and consumption. The effectiveness outcomes for the CCA were menu compliance, and child provision and consumption for all core food groups including vegetables. The methods for estimating intervention effectiveness are

detailed in Chapter 2. Results of the effectiveness are presented in full in Chapter 3 and 4 (Table 3.3 in Section 3.4.2 and 4.4 in Section 4.2.3). In brief, mean serves of vegetables were one serve greater in intervention (2.0 ± 0.7 serves) than in comparison centres (1.0 ± 0.3 serves) at follow up (Table 3.3). Median child vegetable provision at mealtimes was slightly greater in intervention centres, by 0.1 serves (0.9 IQR 0.7–1.2 serves) than in comparison centres (0.9 IQR 0.5–1.3 serves) at follow up (Table 4.4). Median serves of vegetables consumed by children was 0.5 serves across both intervention (0.5 IQR 0.2–0.8 serves), and comparison centres (0.5 IQR 0.3–0.9 serves; Table 4.4).

5.2.3 Resource Use and Costs

This section outlines the costs associated with delivering the menu box delivery service, including menu and ingredient costs, delivery costs and labour costs. Table 5.1 presents an overview of the mean total costs for comparison and intervention centres over the eight-week intervention period. Table 5.2 provides an overview of the itemised unit costs, reference source, and mean time and costs for each group. Finally, Table 5.3 summarises both mean centre menu and intervention costs per child per day.

Table 5.1. Overview of the mean total costs for comparison and intervention centres over the eight-week intervention period (AUD, 2020)

	Comparison (*n* = 4)		Intervention (*n* = 4)	
	Mean (95% CI)	**Proportion of total cost**	**Mean (95% CI)**	**Proportion of total cost**
Online Cook Training (time)*	$26 ($25, $27)	0.5%	–	–
Menu Assessment Tool (time)*	$74 ($65, $82)	1%	–	–
Menu licence**	–	–	$123 ($123, $123)	0.9%
Cook labour cost	$363 ($345, $380)	6%	$325 ($318, $333)	2%
Menu ingredient cost	$5,133 ($4,974, $5,275)	92%	$13,321 ($12,541, $14,065)	97%
Total cost	$5,589 ($5,440, $5,728)	–	$13,755 ($12,992, $14,477)	–

*Comparison centres only

**Intervention centres only

All labour (time) costs include 15% on-cost[214]

Table 5.2 Summary of unit costs, reference source, time and bootstrapped means and 95% confidence interval for time (minutes) and cost (AUD, 2020) itemised for each cost input

	Unit cost	**Reference source**	Mean time in minutes (95% CI)		Mean cost in AUD (95% CI)	
			Comparison	**Intervention**	**Comparison**	**Intervention**
Cook labour						
Time planning menu	$25.85 per/hr	Wage rates, using median of Child Services Award Rate, Level 1.1–5.4, $25.85 per hour, plus 15% on-costs [214, 215]	22 (20, 25)	121 (102,142)	$11 ($10, $12)	$60 ($50, $70)
Time placing menu order	$25.85 per/hr		360 (337, 385)	53 (50, 57)	$178 ($166, $190)	$26 ($25, $28)
Time shopping in person	$25.85 per/hr		34 (20, 28)	15 (13, 17)	$12 ($9, $14)	$7 ($7, $8)
Time packing food delivery	$25.85 per/hr		236 (306, 348)	468 (447, 489)	$161 ($151, $172)	$232 ($221, $241)
Time undertaking Cook Online Training (comparison centres)	$25.85 per/hr	Wage rates, using median of Child Services Award Rate, Level 1.1–5.4, $25.85 per hour, plus 15% on-costs[214, 215]	53 (52, 55)	–	$26 ($25, $27)	–
Time using Menu Assessment Tool (comparison centres)	$25.85 per/hr		150 (132, 168)	–	$74 ($65, $82)	–
Intervention centre costs						
Menu pack and recipes (licence) (intervention centres)	$399 per season	Reported by Nutrition Australia (Victoria)[216]	–	–	–	$123 ($123, $123)
Menu costs						
Centre menu ingredients	Varies	Invoice prices, prices October–December 2020 in AUD Chain supermarket	–	–	$5,331 ($5,169, $5,485)	$13,821 ($13,024, $14,554)
Supermarket costing (sensitivity analysis)	Varies	Invoice prices, converted to chain supermarket prices in 2021 in AUD	–	–	–	$10,030 ($9,488, $10,584)

Table 5.3 Bootstrapped means and 95% confidence intervals of centre menu and intervention costs per child, per day (AUD, 2020)

Costing AUD, Mean (95% CI)	Comparison (*n* = 4)	Intervention (*n* = 4)
Menu cost per child per day	$2.28 ($2.27, $2.30)	$4.62 ($4.58, $4.67)
Total intervention cost per child per day	$2.38 ($2.33, $2.42)	$4.96 ($4.95, $4.96)

Intervention Centre Resource Use and Costs

The total mean cost of the menu box delivery service over the eight-week intervention period was $13,755 (95% CI $12,992, $14,477) per centre (Table 5.1). This is equivalent to around $4.96 (95% CI $4.95, $4.96) mean cost per child per day (Table 5.3)**.** Weekly ingredient costs included the costs of all the ingredients delivered to centres to prepare the menu. In total, 32 invoices were provided by the supplier over the eight-week intervention period (one invoice per centre per week of the intervention). The mean total cost of the ingredients for intervention centres over the eight-week intervention period was $13,321 (95% CI $12,541, $14,065; Table 5.1). This equated to approximately $4.62 (95% CI $4.58, $4.67) mean cost per child per day (Table 5.3). No centres paid delivery fees as invoices met the weekly minimum threshold for free delivery, and none reported receiving food donations during the intervention period.

Cook labour (daily activities) for the intervention centres consisted of time planning the menu (such as reading through recipes), placing the menu order (for additional ingredients), packing away ingredient deliveries during the cook shift, and shopping (in person) for extra ingredients during the week. Cook labour was converted to cost using the median hourly Child Services Award Rate of $25.85 with the addition of an overhead adjustment of 15%.[214, 230] Overall mean labour time per centre over the intervention period was 657 (95% CI 643, 678) minutes. This is equivalent to a cost of $325 (95% CI $318, $333) per centre over the eight-week intervention period in intervention centres (Table 5.1). Mean time spent planning the menu was 121 minutes (95% CI 102,142), which is equivalent to a mean cost per centre of $60 (95% CI $50, $70) (Table 5.2). This was primarily time spent reading over menu pack information. Mean time placing the menu order over the intervention period was 53 minutes (95% CI 50, 57), equivalent to mean cost per centre of $26 (95% CI $25, $28). Mean time shopping in person for additional ingredients over the intervention period was 15 minutes (95% CI 13, 17), equivalent to mean cost per centre of $7 (95% CI $7, $8). Mean time packing away ingredients on delivery over the intervention period was 468 minutes (95% CI 447, 489), equivalent to mean cost per centre of $232 (95% CI $221, $241). The only additional cost associated with the implementation of the menu box delivery service was the cost of the menu licence, which was estimated at $123 (95% CI $123, $123) per centre for the eight-week intervention period (Table 5.1).[216]

Comparison Centre Resource Use and Mean Total Cost

The total mean comparison centre cost over the eight-week intervention period was $5,589 (95% CI $5,440, $5,728) per centre (Table 5.1). This is equivalent to approximately $2.38 (95% CI $2.33, $2.42) mean cost per child per day (Table 5.3)**.** Weekly ingredient costs included the costs of all the ingredients delivered to centres to prepare the menu only. Ingredients were costed using invoices provided by centre cooks. A total of 29 invoices was collected from comparison centres (out of a possible 34). Two of four centres were missing invoices: one was missing one invoice (seven of eight invoices provided) and the other, four (four of eight invoices provided). The total mean cost of the menu was $5,133 (95% CI $4,974, $5,728) per centre over the eight-week intervention period (Table 5.1). This equated to around $2.28 (95% CI $2.27, $2.30) mean cost per child per day (Table 5.3). No centres paid delivery fees as invoices met the weekly minimum threshold for free delivery. No centres reported receiving food donations during the intervention period.

Cooks also spent time planning the menu, placing the menu order, packing away ingredient deliveries and shopping for extra ingredients (in person). Cook labour time was converted to cost using the median hourly Child Services Award Rate of $25.85 with the addition of an overhead adjustment of 15%.[214, 230] Overall mean labour time per centre over the intervention period was 733 (95% CI 697, 768) minutes. This is equivalent to a mean labour cost of $363 (95%CI $345, $380) over the eight-week intervention period (Table 5.1). Mean time spent planning the menu was 22 minutes (95% CI 20, 25), which is equivalent to a mean cost per centre of $11 (95% CI $10, $12) (Table 5.2). Mean time placing the menu order over the intervention period was 360 minutes (95% CI 337, 385), equivalent to mean cost per centre of $178 (95% CI $166, $190). Mean time shopping in person for additional ingredients over the intervention period was 34 minutes (95% CI 20, 28), equivalent to mean cost per centre of $12 (95% CI $9, $14). Mean time packing away ingredients on delivery over the intervention period was 236 minutes (95% CI 306, 348), equivalent to mean cost per centre of $161 (95% CI $151, $172).

Cooks were asked to complete the Online Cook Training, and then review and revise their centre menu using an online menu planning tool. Both the online training and the menu planning tool were free to access (i.e. no cost). Three out of four cooks completed the Online Cook Training (75%); the other did not attempt the training because of time constraints. Mean time taken to complete the Online Cook Training per centre was 52 minutes (95% CI 52, 55), equivalent to $26 (95% CI $25, $27) in labour (excluding n = 1 cook that did not attempt training).[230] All comparison centre cooks attempted to use the online Menu Assessment Tool (n = 4). Over the intervention period, cooks assessed a mean of four days of the menu using the online Menu Assessment Tool, equivalent to approximately 22% of a four-week menu. Mean total time spent using the Menu

Assessment Tool was 150 minutes (95% CI 132, 168) per centre, equivalent to $74 (95% CI $65, $82) in labour (Table 5.1).[231]

Mean Total Costs, Intervention *v*. Comparison Centres

Mean total cost per centre was higher for intervention ($13,3755, 95% CI $12,992, $14,065) than comparison centres ($5,133, 95% CI $5,440, $5,728) over the eight-week intervention (Table 5.1). Cooks in the comparison centres reported 76 minutes more labour time than did cooks in the intervention centres, equating to an additional $38 in labour cost. The mean total menu cost was higher in the intervention ($13,321 per centre, 95% CI $12,541, $14,065) than comparison centres ($5,133 per centre, 95% CI $4,974, $5,275). Comparison centres were guided by menu budgets set by service provider upper management, which was outside of the cooks' and individual centres' jurisdiction. For this reason, cooks were only able to purchase goods within this budget. Cooks in the comparison centres reported a menu budget of $2.03 (±$0.05) per child per day (Chapter 4). This budget is reflected in the weekly mean menu cost of $2.28 (95% CI $2.27, $2.30) per child per day (Table 5.3). Intervention centres were not subject to centre menu budgets set by management as menus costs were subsidised by the research project. Mean menu ingredient costs for intervention centres were $4.62 (95% CI $4.58, $4.67) per child per day, compared with $2.28 (95% CI $2.27, $2.30) per child per day in the comparison centres (Table 5.3). The incremental cost difference between the intervention and comparison was $2.34 (95% CI $2.29, $2.39).

Total menu expenditure categorised by food group is summarised in table 5.4. Overall, the proportion of menu expenditure on vegetables and legumes was 14% in comparison centres ($603 95% CI $571, $363) (Figure 5.1), compared to 22% in intervention centres ($2,935 95% CI $2,768, $3,093) (Figure 5.2). Proportionally, fruit expenditure was greater in comparison centres ($1,177 95% CI $1,069, $1,275) at 27% of total menu expenditure, compared to 12% in intervention centres ($1,593 95% CI $1,508, $1,679). Total proportional discretionary food expenditure was 10% greater in comparison centres ($503 95% CI $478, $532) at 12% of total costs, compared to 2% in intervention centres ($22 95% CI $213, $230).

Table 5.4 Mean total weekly centre menu expenditure by food group, bootstrapped means and 95% confidence interval for cost (AUD, 2020)

	Comparison		Intervention		Difference	
	Mean	**95%CI**	**Mean**	**95%CI**	**Mean**	**95%CI**
Vegetable and legumes	$603	($571, $636)	$2,935	($2,768, $3,093)	$2,332	($2,166, $2,497)
Fruit	$1,177	($1,069, $1,275)	$1,593	($1,508, $1,679)	$416	($285, $555)
Cereals and breads	$663	($618, $711)	$2670	($2,504, $2,837)	$2,007	($1,835, $2,182)
Dairy and alternatives	$626	($587, $665)	$2,041	($1,902, $2,182)	$1,415	($1,271, $1,562)
Meat and alternatives	$548	($513, $585)	$2,388	($2,249, $2,524)	$1,840	($1,697, $1,981)
Fats and oils	$44	($41, $46)	$328	($304, $354)	$284	($259, $310)
Discretionary	$503	($478, $532)	$221	($213, $230)	-$282	(-$311, -$256)
Herbs and Spices	$26	($22, $31)	$340	($323, $356)	$314	($296, $331)
Other	$112	($107, $118)	$801	($756, $842)	$689	($642, $731)

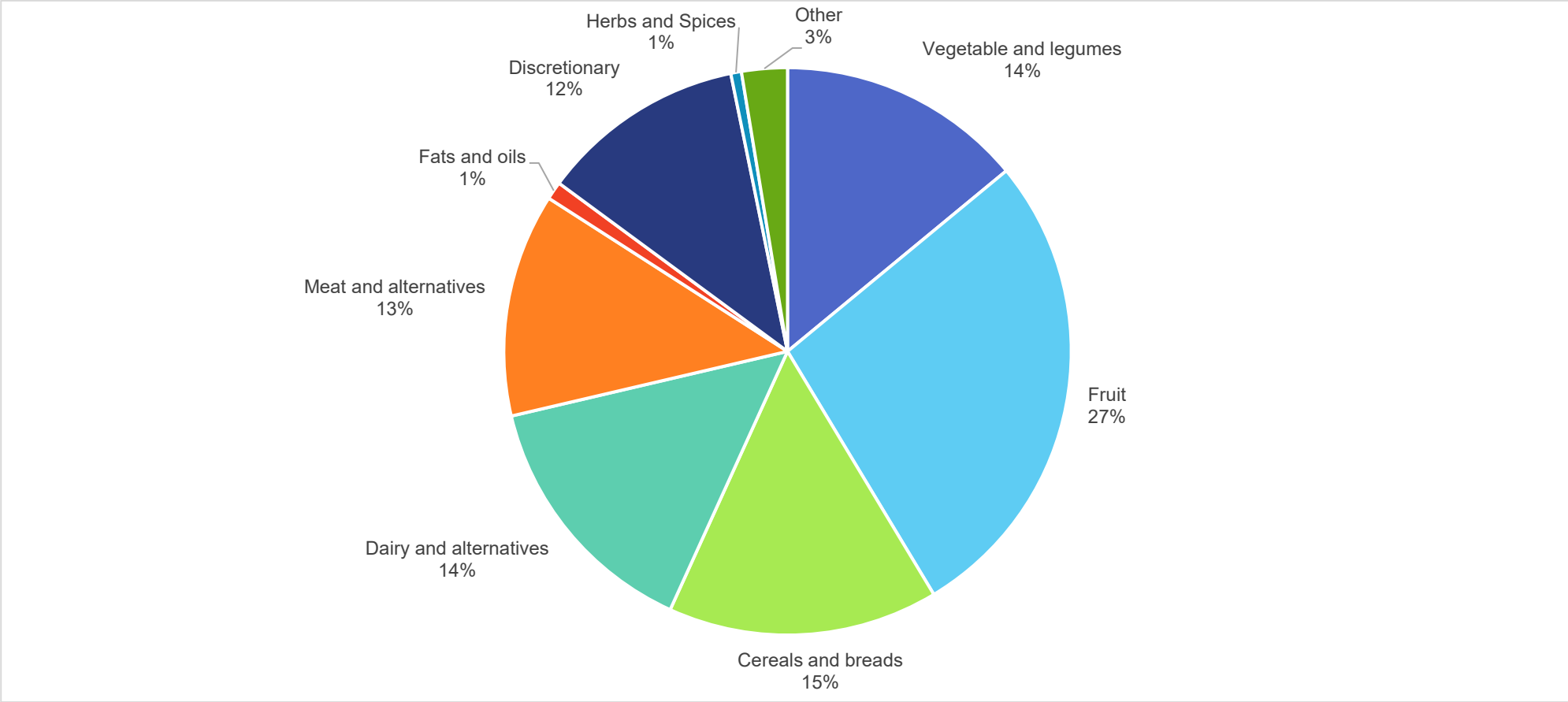

Figure 5.1 Total comparison centre menu expenditure proportions by food group

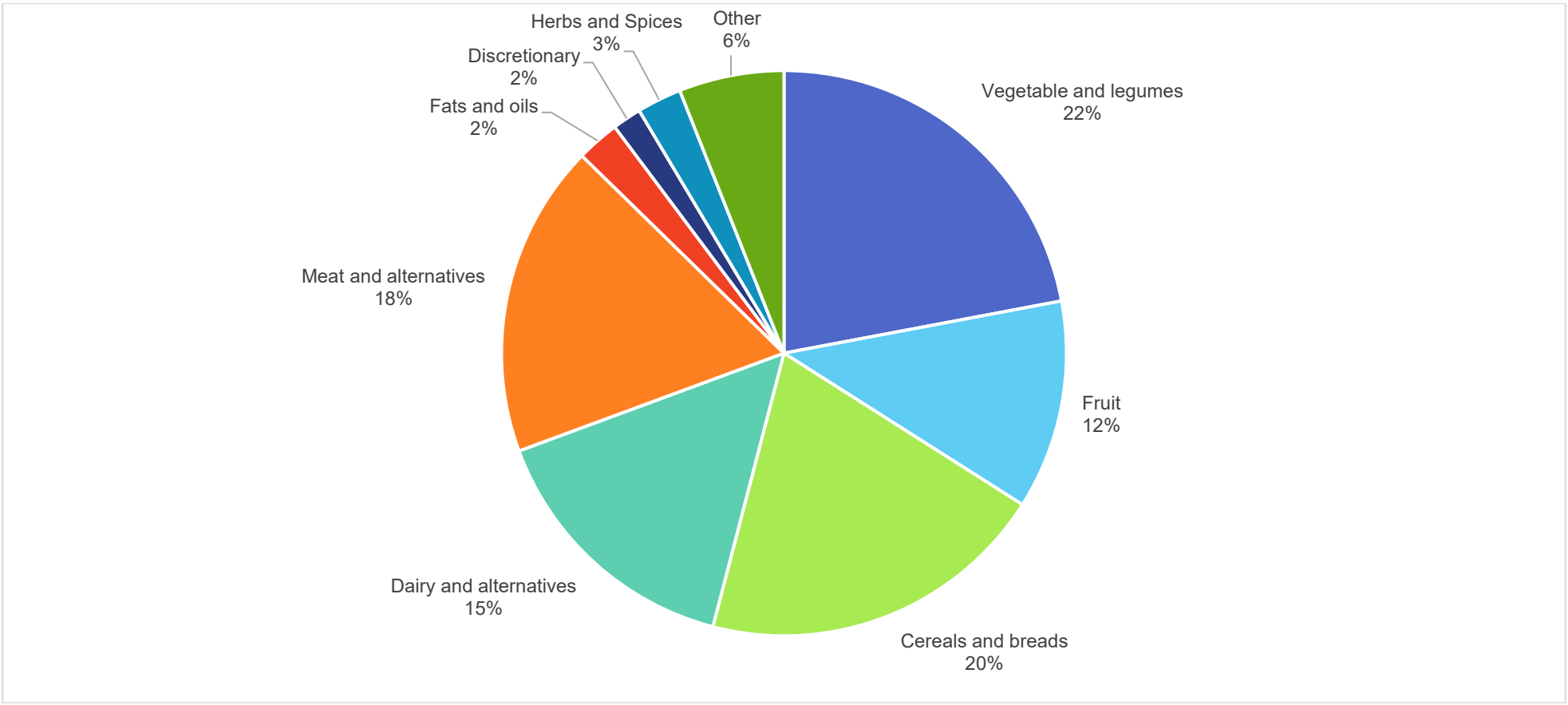

Figure 5.2 Total intervention centre menu expenditure proportions by food group

5.3 Results of the Cost-effectiveness Analysis

Total costs and effectiveness outcomes (menu vegetable compliance, and child vegetable provision and consumption) were compared between the intervention and comparison centres. ICERs were estimated from the net difference in costs divided by the net difference in outcomes. Inputs used in the CEA are summarised in Table 5.5. Each ICER presents the incremental costs associated with increasing menu vegetable compliance, provision or consumption by one serve (equivalent to 75 g of vegetables or legumes).[13] Results are presented as mean cost per centre over the eight-week intervention period, in 2020 AUD.

Table 5.5. Summary of bootstrapped intervention cost and outcome measures inputs with bootstrapped ICER outputs

	Comparison	Intervention	**ICER**	**95% CI**
Intervention cost	$5,805.12	$14,282.62	–	
Outcome measure				
Mean serves of vegetables and legumes provided on menu	1.0 (0.9,1.0)	2.3 (2.3,2.3)	$5,996	$4,697, $7,264
Median child vegetable provision at follow up (in serves)	0.9 (0.8,0.9)	0.8 (0.8,0.9)	$56,864	–$69,911, $70,314*
Median child vegetable consumption at follow up (in serves)	0.6 (0.5,0.6)	0.4 (0.4,0.5)	–$73,439	–$853,057, $389,478*
*Re-ordered 95% confidence intervals reported using Bang and Zhao (2012) method[218]				

5.3.1 Results of the Cost-effectiveness Analysis of Menu Vegetable Compliance

Analysis revealed an ICER of $5,996 (95% CI $4,697, $7,264) per additional serve of the vegetable and legume food group that centres provided on the centre menu. The bootstrapped replicates (*n* = 1,000) are represented graphically on the cost-effectiveness plane in Figure 5.3. In this analysis, all replicates lie in the north-east quadrant (100%) of the cost-effectiveness plane. Observations falling in this quadrant represent the intervention both costing more than the comparator and conferring greater benefits than the comparator.

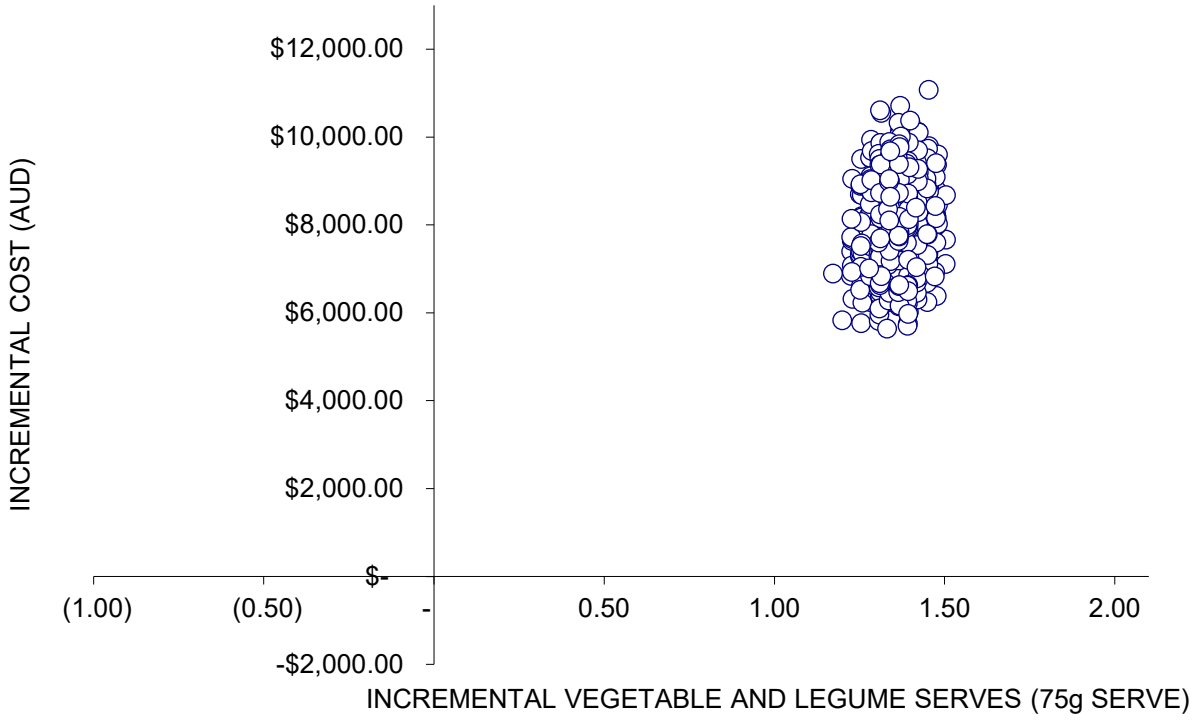

Figure 5.3 Cost-effectiveness plane for serves of vegetable and legume food group centres provided on the centre menu (*n* = 1,000 iterations)

5.3.2 Results of the Cost-effectiveness Analysis of Child Vegetable Provision

A median-based ICER technique described by Bang and Zhao (2012) was used to calculate an ICER of $56,864 (95% CI –$69,911, $70,314) for each additional serve of vegetable and legume foods provided to children.[218] The bootstrapped replicates are represented graphically on the cost-effectiveness plane in Figure 5.4. Replicates lie across the north-west (49%) and north-east (51%) quadrant of the cost-effectiveness plane. Replicates falling in the north-west quadrant indicate that the intervention incurs more cost and is less effective than the comparator (i.e. the intervention is 'dominated'). Replicates that lie in the north-east quadrant incur more cost, but provide greater benefits than the comparator.

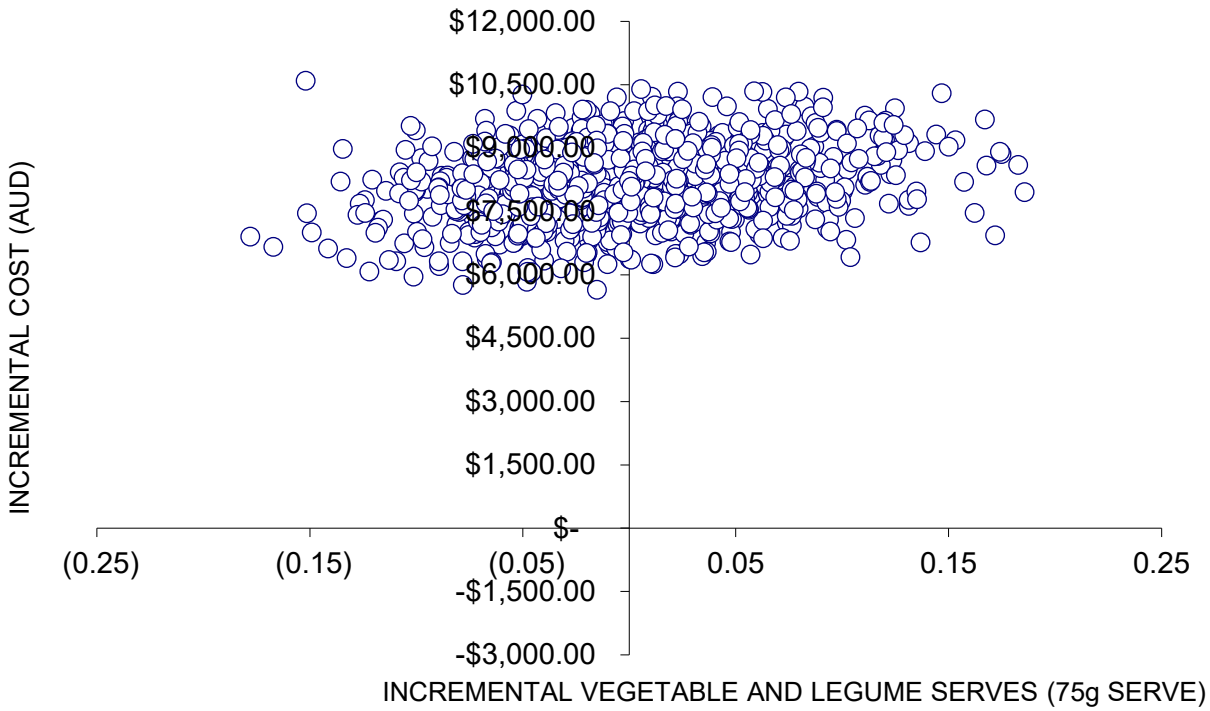

Figure 5.4 Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for child provision of vegetable and legume serves, intervention *v*. comparison (usual practice) centres

5.3.3 Results of the Cost-effectiveness Analysis of Child Vegetable Consumption

A median-based ICER was calculated for consumption as this outcome was not normally distributed.[218] The ICER for each additional serve of vegetables consumed by children was −$73,439 (95% CI −$853,057, $389,478). The bootstrapped replicates are represented graphically on the cost-effectiveness plane in Figure 5.5. Replicates lie across the north-west and north-east quadrants of the cost-effectiveness plane. As described above, observations falling in the north-west quadrant (95%) indicate the intervention incurs a cost but provides fewer benefits than the comparator (i.e. the intervention is 'dominated'). Replicates that lie in the north-east (5%) quadrant incur a cost but provide greater benefits than the comparator.

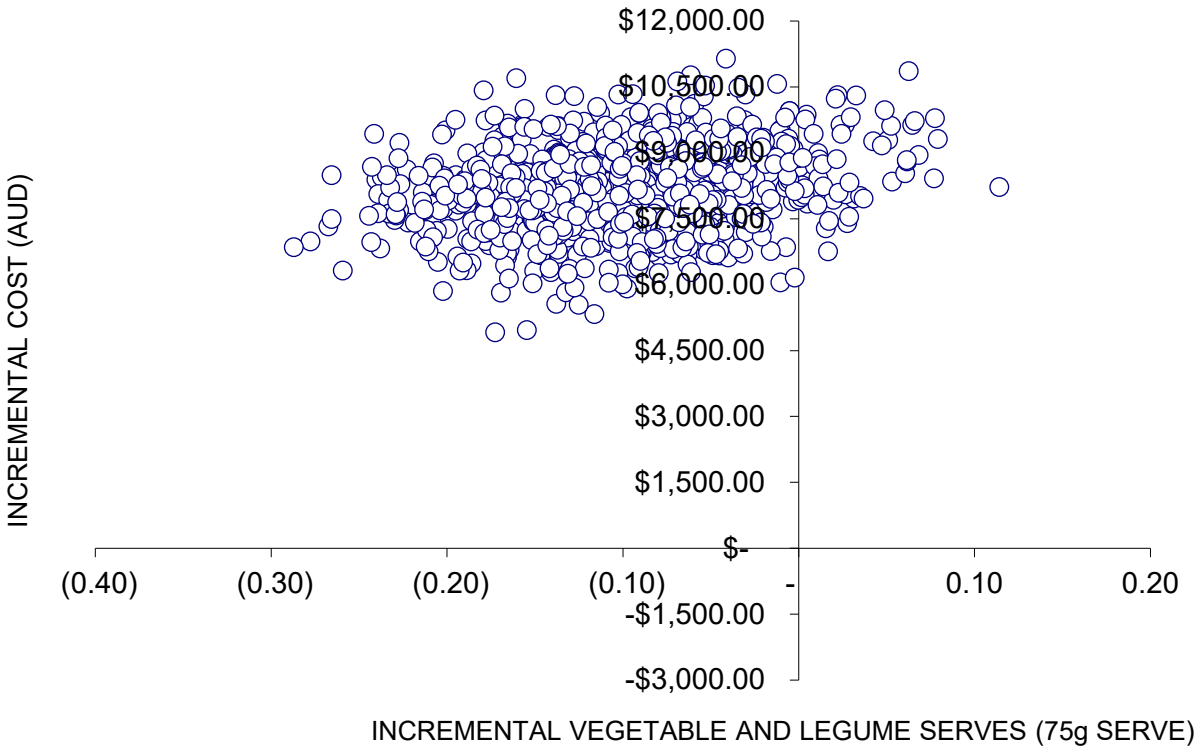

Figure 5.5 Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for child consumption of vegetable and legume serves, intervention *v*. comparison (usual practice) centres

5.3.4 Results of the Sensitivity Analysis for Cost-Effectiveness

A sensitivity analyses was performed to cost all centre menus using the same chain supplier for comparison and intervention centres. This is the same supplier used by the comparison centres, therefore no modifications were required for comparison centre menus. A summary of the resulting changes in menu ingredient costs and total cost is presented in Table 5.5. As a result of the changes, mean menu cost per child per day (per centre) decreased by $1.01 in the intervention centres; from $4.62 (95% CI $4.58, $4.67) to $3.61 (95% CI $3.61, $3.62). Total cost of the intervention per child per day decreased by $1.17 in the intervention centres; from $4.96 (95% CI $4.95, 4.96) to $3.79 (95% CI $3.78, $3.79). There was no meaningful impact of CPI on costs.

Table 5.5 Mean menu and total costs for comparison and intervention centres over eight-week intervention period, sensitivity analysis using the same supplier (AUD)

	Comparison (*n* = 4)	Intervention (*n* = 4)
	Mean cost (95% CI)	Mean cost (95% CI)
Menu ingredient cost	$5,331 ($5,169, $5,485) (No change from base case)	$10,039 ($9,483, $10,566) (Reduction of $4,233 from base case)
Total cost	$5,803 (95% CI $5,651, $5,950) (No change from base case)	$10,471 ($9,893, $11,050) (Reduction of $3,785 from base case)

5.3.4.1 Cost-effectiveness Analysis

The ICER reduced from $5,983 to $3,443 for each additional serve of vegetables and legumes that food centres provided on the centre menu. For median child vegetable provision, the ICER for the adjusted menu costing was –$51,932 compared with –$90,244, and child vegetable consumption was –$28,824.00 compared with –$44,751. The distributions of bootstrap samples on the cost-effectiveness plane are presented in Appendix 13; they showed no marked changes.

5.4 Results of the Cost-consequence Analysis

The results of the CCA are reported in Table 5.7. Costs associated with the intervention and comparison centres are presented as mean costs with 95% confidence intervals derived from 1,000 bootstrapped samples. Consequences were included for menu compliance, mealtime provision and consumption in eligible children present at follow up (*n* = 224) for all AGHE food groups (Chapter 4). Menu compliance results are reported as bootstrapped means, and food centre provision and compliance are reported as median, as data were not normally distributed. All outcomes are presented with 95% confidence intervals.

5.4.1 Results of the Sensitivity Analysis for Cost Consequence

A sensitivity analyses for menu costing was performed for cost-consequence analyses. Mean menu cost decreased by approximately $3,782 or 27% from $13,321 (95% CI $12,541, $14,065) to $10,481 (95% CI $9,930, $11,025). Mean difference between intervention and comparison was $4,887 (95% CI $4,314, $5,460). Results of the CPI sensitivity analysis did not show any meaningful differences. Outcomes are presented in Appendix 14 (Table A2).

Table 5.7 CCA of eight-week intervention period, base case analysis[a]

		Comparison		Intervention		Difference	
	Target serves	**Mean**	**95%CI**	**Mean**	**95%CI**	**Mean**	**95%CI**
Cost							
Intervention cost*	-	$74	($65, $83)	$123	($123, $123)	$48	($40, $57)
Cook labour cost**	-	$363	($345, $380)	$325	($318, $333)	–$37	(–$56, –$17)
Menu ingredient cost	-	$5,133	($4,974, $5,275)	$13,321	($12,541, $14,065)	$8,490	($7,401, $9,938)
Total cost	-	$5,589	($5,440 $5,728)	$13,755	($12,992, $14,477)	$8,164	($7,375, $8,882)
Consequence							
Menu compliance, mean serves							
Vegetable and legumes	1–1.5	1.0	(0.9, 1.0)	2.3	(2.3, 2.3)	1.3	(1.3, 1.4)
Fruit	1	1.6	(1.5, 1.7)	1.1	(1.1, 1.1)	–0.5	(–0.6, –0.4)
Cereals and breads	2	2.3	(2.3, 2.4)	2.3	(2.3, 2.3)	0.0	(–0.1, 0.0)
Dairy and alternatives	2	2.0	(2.0, 2.1)	1.9	(1.9, 1.9)	–0.1	(–0.2, –0.0)
Meat and alternatives	1	0.6	(0.6, 0.6)	1.4	(1.4, 1.4)	0.8	(0.8, 0.8)
Food centres provision at follow up, median serves							
Vegetable and legumes	1–1.5	0.9	(0.8, 0.9)	0.8	(0.8,0.9)	0.0	(0.0, 0.1)
Fruit	1	2.2	(1.0, 2.5)	0.6	(0.6, 0.6)	–1.6	(–1.9, –1.3)
Cereals and breads	2	2.0	(1.9, 2.0)	1.2	(1.2, 1.2)	–0.8	(–0.8, –0.7)
Dairy and alternatives	2	1.0	(0.8, 1.1)	1.0	(1.0, 1.1)	0.1	(–0.1, 0.3)
Meat and alternatives	1	0.3	(0.3, 0.4)	0.6	(0.5, 0.6)	0.2	(0.1, 0.3)
Food centre consumption at follow up, median serves							
Vegetable and legumes	1–1.5	0.6	(0.5, 0.6)	0.5	(0.4, 0.5)	–0.1	(–0.2, 0.0)
Fruit	1	1.1	(1.1, 1.2)	0.4	(0.4, 0.4)	–0.8	(–0.8, –0.7)
Cereals and breads	2	1.5	(1.5, 1.5)	0.9	(0.9, 1.0)	–0.6	(–0.6, –0.6)
Dairy and alternatives	2	0.9	(0.7, 1.0)	0.7	(0.6, 0.8)	–0.2	(–0.3, 0.0)
Meat and alternatives	1	0.2	(0.2, 0.3)	0.3	(0.3, 0.3)	0.1	(0.0, 0.1)

[a]Data presented as mean and 95% confidence intervals
* Intervention cost: cost of Online Cook Training and Menu Assessment Tool in comparison centres, cost of menu licence in intervention groups (*n* = 1 centre cooks did not complete cook training, excluded from cost estimations)
**Not including labour to complete Online Cook Training and use Menu Assessment Tool (comparison centres only)

5.5 Results of the Budget Impact Analysis

The results of the BIA are reported in Table 5.7. They reveal that implementation of the menu box delivery service intervention across all franchise childcare centres (*n* = 25) would have a significant budget impact. Scenario 1 assumed that the intervention centre 'menu planning' time reduced by 50%, and a reduction of 25% in time using the online Menu Assessment Tool in comparison centres. Scenario 2 assumed a 50% reduction in intervention centre menu planning time and a 50% comparison centre cook time using the online Menu Assessment Tool. Both scenarios applied an industry staff turnover rate of 30%. Scenario 1 estimates the cost of the menu box delivery intervention to the service provider, as $2,233,528 over one year, compared with $1,086,200 for the comparison (Table 5.8). Scenario 2 estimates the cost of the comparison (standard practice), as $1,066,363 over one year. Results from Scenario 1 suggest an additional cost to the LDC service provider of $1,147,328 should the menu box delivery intervention be implemented, compared with the comparison. Results from Scenario 2 suggest an additional cost to the service provider of $1,167,167 (Table 5.8).

Table 5.8. BIA of comparison centres *v*. intervention centres for one-year time horizon in AUD

Cost scenario	Comparison		Intervention	
	Centre (*n* = 1)	Whole of service (*n* = 25)	Centre (*n* = 1)	Whole of service (*n* = 25)
Scenario 1*	$43,448	$1,086,200	$89,341	$2,233,528
Scenario 2**	$42,654	$1,066,363	$89,341[a]	$2,233,528[a]
*Cost Scenario 1 assumptions: menu planning time reduction of 50% (intervention group), Menu Assessment Tool time reduction of 25% (comparison group), 30% staff turnover (both groups) **Cost Scenario 2 assumptions: menu planning time reduction of 50% (intervention group), Menu Assessment Tool time reduction of 50% (comparison group), 30% staff turnover (both groups) [a]No change for intervention centres in Scenario 2				

5.5.1 Results of the Sensitivity Analysis for Budget Impact

A sensitivity analysis was performed to assess the impact the premium cost of the menu box delivery service may have on the childcare service. The sensitivity analysis costed all centre menus using the same large supermarket chain supplier, and the results suggest that the cost of the intervention to the service provider would reduce by approximately $531,662. The whole of service intervention cost was $2,233,528 (Scenario 1), which reduced to $1,701,866 (menu costing scenario).

5.6 Results for the Sensitivity Analysis Including Consumer Price Index

There was no meaningful impact of CPI on the results. The results for each scenario with the CPI applied are provided in Appendices 11 to 13.

5.7 Discussion

This chapter aimed to address the third thesis objective: *to compare the cost-effectiveness of the menu box delivery intervention with standard practice (i.e. menu planning) in LDC centres*. To address this objective, a within-trial CEA and CCA, and a BIA, were undertaken. Overall, the total mean cost of the menu box delivery service per centre over the eight-week intervention period was $13,755 (95% CI $12,992, $14,477). The total mean cost for the comparison centres over the eight-week intervention period was $5,589 (95% CI $5,440, $5,728) per centre. The menu ingredients were the most expensive component for each group. In comparison centres, the menu ingredients cost ($5,133, 95% CI $4,974, $5,275) was 92% of the total cost over the time horizon. In intervention centres, the menu ingredients cost ($13,321, 95% CI $12,541, $14,065) was 97% of the total cost over the time horizon.

The menu ingredients cost of the menu box delivery service was $4.62 (95%CI $4.58, $4.67) per child per day; compared with $2.28 (95% CI $2.27, $2.30) per child per day for standard practice in the comparison centres. This cost included the ingredients for morning and afternoon snack, lunch and any breakfast and late snack foods. Sambell et al. (2020) reported that LDC menu budgets in Western Australia ranged from $1.17 to $4.03 across three meals (morning and afternoon snack, lunch) and averaged $2.00 per child per day. The cost of the ingredients in the menu box delivery service exceeded the upper range reported for that study.

When costing the menu ingredients for the menu box delivery service using a consistent supplier (large supermarket chain) in a sensitivity analysis, the menu ingredient costs reduced by $1.01 to $3.61 per child per day. This still exceeded the average cost reported by Sambell et al. (2020), but was within the range of $1.17–4.03 per child per day.[170]

While intervention centres were not obliged to adhere to a menu budget during participation in the intervention. All centres involved in the study were subject to the same centre budget ($2.05 per child per day) as required by the centre service provider. This was reflected in the menu cost of $2.28 per child per day in comparison centres over the intervention period. An analysis of centre menus and budgets in Western Australian centres suggested that centres with reduced menu expenditure are less likely to be compliant with guidelines.[170] Cost modelling by Sambell and colleagues (2020) found that increasing food expenditure in centres by $0.50 per child per day would increase compliance guideline recommendations for four or more core food groups.[170] The findings of their analysis might suggest the need for greater menu expenditure to meet guidelines. Increasing expenditure on core foods, or ‘healthier foods’ can be complicated, particularly considering the belief that healthy foods cost more.[232] Further, the belief that healthy foods are less palatable to children and therefore lead to greater waste poses an additional barrier to their inclusion in childcare centre menus.[153, 170, 232]

Proportional expenditure across foods groups including dairy and alternatives, meat and alternatives, cereals and breads, fats and oils and herbs and 'other' were similar between intervention and comparison centres. Proportionally, menu expenditure on vegetables and legumes was greater in intervention centres compared to comparison centres. However, comparison centres spent a greater proportion of menu expenditure on fruit (Comparison: 27% *v.* Intervention: 12%) and discretionary foods (Comparison: 12% *v.* Intervention: 2%). While intervention centres overall menu expenditure was greater than comparison centres, the greatest difference in expenditure was evident in vegetable and legumes foods. Intervention centres were spending approximately 380% more on vegetables and legumes than comparison centres (Mean difference $2,332 95% CI $2,166, $2,497). This was closely followed by cereals and breads (Mean difference $2,007 95% CI $1,835, $2,182) and meat and alternatives (Mean difference $1,840 95% CI $1,697, 1,981). These food groups, might be key drivers of increased menu expenditure within intervention centres.

A study of Polish childcare centres indicated that the centre budget influenced menu expenditure and the types of foods that centres were able to purchase.[233] Gerritsen et al.'s (2017) evaluation of childcare menus in New Zealand found that services that provided lunch and at least two other meals or snacks daily had a median spend per child per day of NZ$3.68 (mean $5.06 ±$3.09; range $0.90–16.00).[148] Furthermore, Gerritsen et al. (2017) found that menu expenditure was not associated with menu compliance.[148] Reductions in the menu cost could have been achieved through strategies such as purchasing local foods at bulk or discounted prices, growing fruit and vegetables on site or donations from families. No centres in the current study received food donations during the intervention period, but this might be a strategy to support reduction in the cost of the centre menu.

Overall, key impacts on cost differences between comparison and intervention centres was the cost of the ingredients. This is likely related to firstly, the pricing of the local produce supplier, which is priced higher than chain supermarkets for similar ingredients. The quantity of ingredients delivered to intervention centres may have been greater than comparison centres. Furthermore, the quality or type of ingredients may have cost more in intervention centres, for example higher quality meats or fresh produce.

As the research topic of this thesis is an under-explored area, there is little economic evidence that would enable a comparison to be drawn between the outcomes of this intervention and other studies. Reeves et al. (2021) recently published an economic evaluation of a web-based menu planning intervention to improve childcare menu compliance with guidelines.[210] Their Australian study compared a 12-month intervention implementing a web-based menu planning and decision support tool as well as online resources for LDC centres, with a control group. The evaluation included both a CCA and CEA. The effectiveness outcomes measured included menu compliance

and individual food group compliance scores, as well as mean serves of each food group on the menu. However, comparison between the results of the current study and that of Reeves et al. (2021) is difficult as the cost parameters differed as a result of differences in methodologies (e.g. time horizon, perspective and outcomes).[210] Reeves et al. (2021) presented both a health sector and a modified societal perspective, whereas the current study adopted a centre and service perspective.[234] The published 12-month trial found an increase in menu and food group compliance. While menu compliance outcomes were not statistically significant, intervention costs estimated by Reeves et al. (2021) were lower, by $482 (95% Unit Interval $859, $56; AUD 2017/18) than those for usual practice, predominantly because of ingredient costs; although labour costs (menu planning and reviewing) also reduced.[234] The findings of their study suggest that the mean average cost per centre of the intervention would be $482 less per year than usual practice. In contrast, the menu box delivery service trialled in the current study would represent a greater cost than standard practice for centres. However, it should be considered that, first, the menu box delivery intervention was compared with 'standard practice', whereas Reeves et al. (2021) compared the intervention to 'usual practice' (i.e. no additional support). Furthermore, the proportion of missing data (37%) at follow up was greater in Reeves et al.'s (2021) study than for the menu box delivery service evaluation (8% of comparison centre invoices).[234]

A benefit of the centre perspective presented by the current study is the assumption that implementation is self-sustainable. Rather than a government-implemented intervention, which requires implementation staff or associated costs that need to be government funded, the menu box delivery service is designed to be self-funded by centres. The results of this evaluation indicate key areas where costs are high: cost of ingredients and displacement of time from ordering to packing away ingredients. While time was saved 'ordering' ingredients, packing away times increased. Identifying areas for improvement to reduce costs may provide a framework for future opportunities to refine the menu box delivery service. Refinement of the menu box delivery service, through improvements to menus and recipes as well as cost in particular, may support the development of a viable food service model for adoption by LDC centres.

Finally, economic evaluations assess the efficiency and allocation of resources to interventions aiming to improve health outcomes. The Hodder et al. (2021) review of interventions for increasing fruit and vegetable consumption in children aged 5 years and under identified no studies that reported costs or conducted an economic evaluation.[14] Similar findings were identified in the narrative review of the current study, reported in Chapter 1. No interventions supporting menu compliance in childcare centres reported cost or cost-effectiveness, in the reviewed literature. The need to measure cost-Effectiveness was further emphasised by recommendations from an umbrella review of interventions to promote diet quality in childcare centres published by Matwiejczyk et al. (2018). Reviews included in this umbrella review recommended that cost-effectiveness studies be undertaken. This PhD study makes a contribution to economic

evaluations of interventions in childcare settings and establishes a reference for future trials, as one of very few economic evaluations of interventions conducted in childcare settings. The results will help to inform the design of food service models for the sector, and provide important information for providers and academics working in the field.

5.8 Chapter Summary

This chapter presents an economic evaluation of the menu box delivery service in comparison with menu planning in the LDC setting. The findings show an overall higher cost of the menu box delivery service compared with menu planning, mostly because of the higher cost of the menu box ingredients. Chapter 6 provides an overall discussion of the trial outcomes and triangulates the three results chapters to provide a deeper understanding of the outcomes of the menu box delivery trial and the relationships between child dietary outcomes, menu compliance, feasibility and fidelity, acceptability and satisfaction and finally, cost-effectiveness.

CHAPTER 6 DISCUSSION AND CONCLUSION

6.1 Overview

The aim of this study was to develop, implement and evaluate the impact of a menu box delivery service tailored for the LDC setting, on the food provision and intake of children aged 2–5 years. Of particular interest was whether such an intervention could improve dietary provision and consumption—particularly vegetable intake—in children aged 2–5 years. To achieve this aim, four key objectives were addressed: (1) to evaluate the feasibility and acceptability of a menu box delivery service straight to LDC centres (Chapter 3), (2) to evaluate the impact of a menu box delivery service on food provision and consumption, in children aged 2–5 years while in care (Chapter 4), and (3) to compare the cost-effectiveness of the menu box delivery intervention with standard practice (i.e. menu planning) in LDC centres (Chapter 5). In addition to describing the study methods, Chapter 2 described the development of the menu box delivery service.

Each of the results chapters discussed the findings of the relevant objective in isolation. In this chapter, the thesis findings and interpretation, spanning process evaluation, outcome evaluation and economic evaluation are explored collectively. This final chapter reiterates the main findings of the thesis before summarising strengths, limitations and future directions of this body of research. Section 6.2 summarises the key findings and original contribution to knowledge. Section 6.3 presents a triangulation and synthesis of the three results chapters. Section 6.4 provides a summary and synthesis of the thesis strengths and limitations of the thesis. Implications for future research and practice are addressed in Section 6.5. Section 6.6 concludes this chapter and thus, the thesis.

6.2 Summary of Thesis Findings

6.2.1 Process Evaluation

Chapter 3 reported findings of the process evaluation addressing objective one, *to evaluate the feasibility and acceptability of a menu box delivery service straight to LDC centres.* Key findings are summarised according to three key components: (1) feasibility and fidelity, (2) acceptability, and (3) the TDFQ barriers and facilitators to implementation.[167]

Evaluation of centre menus revealed that no centre menus were compliant at baseline for all food groups. At follow up, intervention centres showed greater compliance with menu planning guidelines; their menus were largely compliant with all food groups at follow up. Intervention centres had the recommended serves of vegetables on their menu. In contrast, no comparison centres were compliant with all guidelines and only one met vegetable food group guidelines. Two intervention centre menu food groups—vegetables and legumes, and meat and alternatives—

increased by around one serve and were in line with the recommended 1–1.5, and one serve, respectively.

Adherence to and use of the Cook Online Training and Menu Assessment Tool was low among cooks from comparison centres. Three of four completed the training, but no cook reported assessing more than one menu week, of the four-week menus, using the Menu Assessment Tool. Intervention centre cooks reported modifying recipes to speed up preparation times, and serving meals to children in ways they believed to be more preferable. An example of this was pasta and pasta sauce being served separately. No cooks reported stopping use of the menu box delivery service or recipes.

Overall, cook satisfaction and acceptability was low across intervention centres. Director satisfaction was greater than that of cooks. Intervention centre directors agreed that they would use the menu box delivery service again, that children benefitted from the service and that they would recommend the service to other centres. Although two cooks agreed that they would continue to use the service if they were able to, and that children at their centre befitted from the service, only one cook agreed they would recommend the menu box delivery service to other centres. Cooks were satisfied with the menu box delivery order process, but feedback suggested that refinements to recipes were required to ensure they are appropriate for the setting and facilities.

A thematic analysis of cook interviews revealed time as the most persistent theme and barrier for both study groups. Comparison centre directors found the both the training and Menu Assessment Tool ‘unrealistic’ given the time taken to complete it alongside cooks’ regular duties. One of the greatest barriers faced by comparison centre cooks was budget. More specifically, cooks indicated that their centre budget prevented them meeting menu planning guidelines and that doing so would force their menu expenditure to exceed their budget.

Intervention centre cooks and directors rated the menu box delivery service order and delivery process highly. However, cooks considered that the recipes were not suitable in terms of child preferences and the overall preparation time required. Overall, key findings relating to the barriers and enablers for guideline implementation showed that intervention centre cooks had greater agreement with statements of enablers to implementation that did comparison centre cooks (via the TDFQ), indicating a perception of more enablers, or less barriers to implementing menu planning guidelines.[167] Intervention centre cooks reported greater agreement with statements for the domains of skills; environmental context and resources; social/professional role and identity; and beliefs about capabilities, suggesting these domains act as enablers for these cooks. Results indicated that intervention centre cooks agreed with the statements ‘I have the skills needed to plan a menu according to the Menu Planning Guidelines’ (skills domain) and ‘I am confident that I can plan a menu according to the Menu Planning Guidelines’ (beliefs about capabilities domain),

while less than half of the comparison centre cooks agreed with this statement, despite undergoing training. Furthermore, only one comparison centre cook agreed that it was the cook's 'responsibility to plan a menu according to the Menu Planning Guidelines' (social/professional role and identity), whereas all intervention cooks agreed. While cooks in the intervention centres were not specifically introduced to the menu planning guidelines and did not complete the training, unlike comparison cooks, they reported fewer perceived barriers to implementing guidelines than did comparison centre cooks. Relative to intervention centre cooks, comparison centres cooks were likely to express more barriers to implementing menu planning guidelines within their centre. This could be related to heightened awareness of gaps in their capabilities after completing the cook training. While intervention centre cooks may not be aware of such gaps in their knowledge.

6.2.2 Outcome Evaluation

Chapter 4 reported the findings of the outcome evaluation addressing Objective 2, *to evaluate the impact of a menu box delivery service on food provision and consumption, in children aged 2–5 years while in care.* Key findings are summarised here. The study utilised data from 224 children present at follow up—126 children in the comparison centres and 98 in the intervention centres. Median age in both groups was around 4.0 (IQR 3.3–4.7) years and 46% of children were kindergarten aged (4–5 years). Findings showed that, at follow up, serves of vegetables provided to children at mealtimes were at the lower end of menu compliance targets (median, IQR, comparison: 0.8 (0.5–1.3), intervention: 0.9 (0.7–1.2), target of 1–1.5 serves), and were not statistically significant between groups ($p > 0.05$). Serves of fruit provided in the intervention centres were 0.5 serves lower than the target serves, whereas the comparison centres provided 0.5 serves above the target. Breads and cereals were 0.8 serves below the target in the intervention centres, whereas comparison centres met the target of 2.0 serves. Provision of fruit was approximately 0.9 serves lower in the intervention centres than in comparison centres. Neither group provided serves of dairy and alternatives close to the target of two serves per day. Meat and alternatives provision was also low for both groups, around half the target serves.

Consumption of all food groups was lower in the intervention than the comparison centres at follow up. Consumption of vegetables was similar between groups, at 0.5 (0.2–0.8) serves/day in the intervention centres and 0.5 (0.3–0.9) serves/day in the comparison centres. Provision and consumption was consistently low across both groups for most food groups. However, intervention centres provided a greater spread of vegetables at both snack and main meals, in contrast to comparison centres that only provided vegetables at the main meal. Intervention centres served around 41.0 (27.9–62.5) g/child of vegetables at main meals and 24.4 (16.1–29.5) g/child at snacks, whereas comparison centres only served vegetables at main meals, with a median provision of 52.1 (35.0–90.4) g/child.

Waste, which was weighed rather than estimated, was generally greater in the intervention centres compared with the comparison centres. Median (IQR) child daily vegetable waste was greater in the intervention centres, by around 0.2 serves, at 0.2 (0.0–0.4) serves/day in the comparison centres and 0.4 (0.2–0.6) serves/day in the intervention centres. This difference in waste between centres was equivalent to around 15 g of vegetables.

Energy provision in the intervention centres was 40% of NRV for energy (which was set at 50%, 2,100 kJ), which may reflect the impact of reduced provision at mealtimes. This might be related to the lower provision of fruit, and cereals and breads in the intervention group in particular. This was based on the assumption that child energy provision and consumption should reflect the 50% energy benchmark, if food group provision and consumption are meeting menu planning guidelines.

6.2.3 Economic Evaluation

Chapter 5 reported findings of the economic evaluation addressing Objective 3, t*o compare the cost-effectiveness of the menu box delivery intervention to standard practice (i.e. menu planning) in LDC centres.* To achieve this, three analyses were performed, 1) CEA, 2) CCA and 3) BIA. All analyses were performed from the perspective of the LDC centre or—service provider, in the case of the BIA. All costs are presented in AUD. Key findings are summarised below.

Overall, total cost over the eight-week intervention period was $13,755 (95% CI $12,992, $14,477) per intervention centre and $5,589 (95% CI $5,440, $5,728) per comparison centre. The mean menu cost was higher in the intervention ($13,321, 95% CI $12,541, $14,065) than the comparison centres ($5,133, 95% CI $4,974, $5,275). This was the equivalent to menu costs of $4.62 (95% CI $4.58, $4.67) per child per day in intervention centres and $2.28 (95% CI $2.27, $2.30) per child per day in comparison centres. A key driver of the cost difference between groups was ingredient costs, which were a function of (1) the pricing by the produce supplier, (2) greater quantities of foods delivered to centres, as menus complied with menu planning guidelines, (3) the types of foods provided may be more expensive than comparison centre menu budgets allow for (such as meat and fish).

A sensitivity analysis was performed on cost centre menus using the same large supermarket chain as the supplier across comparison and intervention centres. The menu cost per child, per day decreased by $1.01, from $4.62 (95% CI $4.58, $4.67) to $3.61 (95% CI $3.61, $3.62) in the intervention centres when the supermarket supplier was used. This indicates that the differences in costs between the comparison centre and intervention centre menus may likely be related to the quantities and types of ingredients that resulted in the intervention centre menus being more costly.

Overall, the menu box delivery service resulted in less cook labour time in the intervention centres than the comparison centres. Total staff labour costs were $38 more (equivalent to approximately 75 minutes) in the comparison (Total labour cost: $363, 95% CI $345, $380) than intervention centres (total labour cost: $325 95% CI $318, $333). Intervention centre cooks spent less time placing menu orders than did comparison centre cooks (intervention: 53, 95% CI 50, 57 minutes *v*. comparison: 360, 95% CI 337, 385) minutes). Intervention centre cooks spent more time packing away food than did comparison centre cooks (mean time 468, 95% CI 447, 489 minutes *v*. 236 95% CI 306, 348 minutes). This was likely because of the larger quantities of foods delivered to centres: as reported by cooks, this was something they were not used to previously.

These results showed that the intervention led to 'displacement' in cook time and costs. Furthermore, the cost of the menu licence for intervention centre cooks was similar to the labour time costs stemming from cooks using the Online Cook Training and Menu Assessment Tool. Costs saved on the training and menu assessment time were spent on the menu licence. However, no comparison centre cooks assessed a full menu using the assessment tool.

A CEA was conducted for three key vegetable outcomes: mean serves of the vegetables and legumes food group provided on the menu; median child vegetable provision at follow up; and median child vegetable consumption at follow up. Analysis revealed an ICER of $5,996 (95% CI $4,697, $7,264) for each serve of the vegetables and legumes food group provided on the centre menu. ICERs for median child vegetable provision at follow up were $56,864 (95% CI –$69,911, $70,314) and consumption at follow up was –$73,439 (95% CI –$33,904, $333,800). The BIA of comparison centres *v*. intervention centres for a one-year time horizon suggested that the menu box delivery cost would be more than double the cost of standard practice for whole of service adoption (n = 25) (Scenario 1, comparison: $1,086,200, intervention: $2,233,528).

6.3 Triangulation of Findings

This thesis describes the pilot work for development, implementation and evaluation of a menu box delivery service for LDC centres in Australia. Through a partnership with a menu provider, produce supplier and local LDC centres, a novel food service model was trialled for the childcare setting. Despite reports of altering recipes or modifying how meals were served, intervention centre cooks did not report straying from the intervention menu and recipes. However, comparison centre cooks struggled to find time to complete the training and menu assessment built into the study design. While comparison centre cooks completed the training, they had difficulties when attempting to review their menus using the Menu Assessment Tool. The general consensus among comparison centre cooks and directors was the unrealistic time commitment required to complete the online assessment tool.

Overall, findings show that the menu box delivery order and delivery process was liked by both centre cooks and directors. However, cooks and directors reported that the recipes were not child friendly or suitable for the LDC setting given the preparation times. While intervention centre menus showed greater compliance with guidelines at follow up, child dietary provision and consumption was not significantly different between intervention and comparison groups; in particular, vegetable consumption was the same for both. Although the intervention reduced time taken to order the centre menu, cost savings were overshadowed by the time spent packing away ingredients and the high costs of menu ingredients. Pricing the intervention menu ingredients using the same supplier across both groups did reduce the cost of the menu box delivery ingredients. However, costs were still higher than comparison centres because of the larger quantities of ingredients included in the menu box delivery service (to meet menu planning guidelines).

Exposure is a well-established strategy to improve vegetable consumption in children aged under 5 years.[90-92, 173, 235] The childcare menu can be a tool to modify accessibility and exposure to core foods, including vegetables, in a child's environment.[171] Increasing vegetable availability in the LDC setting by way of increasing the amount, variety or frequency of vegetables on the menu has been recommended in the literature and previous reviews.[106, 226] Assessment of intervention centre menus that used the menu box delivery service found improvements in the provision of all core food groups, particularly for vegetables.

Intervention centres in this study provided a greater number of serves of vegetables on the centre menu (2.0 ± 0.7 serves), exceeding guideline recommendations of 1–1.5 serves;[141] while comparison centres provided a mean of only 1.3 ± 0.2 serves of vegetable and legumes on the menu. Serves of vegetables on intervention menus were equivalent to 200% of minimum recommendations, but mealtime provision fell to 90% of recommendations and children were only consuming 50%. Mealtime provision (<1 serve) and consumption (0.5 serves) remained the same for both intervention and comparison centres. Similar outcomes were observed by Bell et al. (2015) whose evaluation of the *Start Right–Eat Right* program revealed increases in serves of vegetables on the menu, yet children still only consumed around 50% of recommendations. Furthermore, Grady et al. (2020a) reported a mean 2.04 ± 0.97 serves of vegetables at 12-month follow up of a web-based menu planning intervention; however child-level outcomes reported in a sub-sample of centres found consumption remained below recommendations, at 0.73 ± 0.72 serves per child.

Child vegetable provision, consumption and waste data showed that children in the intervention centres may not have been served the full extent of what was provided on the menu. While two serves of vegetables, per child, per day were available on the menu, child provision was below one serve. However, it was unclear if intervention centre cooks were not following recipes, or if children were being served smaller proportions. The quantity of food provided to children in the intervention centres was lower in energy (kilojoules) compared with that in comparison centres. This is likely to

reflect the smaller quantity of foods provided to intervention centre children. Centre level waste was not measured, and therefore the impact of under-serving is unclear. Sambell et al. (2019) described a process of data collection for the measurement of food provision and food waste at a service level.[136] In this sample, weekly cook interviews indicated a small amount of left-over ingredients at the end of each week. Cooks reported either adding excess ingredients to other meals, or breakfast or late snack recipes where possible. However, this was not quantified or measured. Measuring centre-level waste would facilitate assessment of service compliance with guidelines.[136]

Interventions that implemented cook training features to improve menu guideline adherence reported both improvements in menu compliance and child dietary outcomes.[175, 178] Menus in comparison centres where cooks participated in the Online Cook Training and Menu Assessment Tool remained largely unchanged from baseline to follow up, and did not meet guidelines. Conversely, the menu box delivery service showed improvement in menu compliance and centres meeting or exceeding guidelines (Chapter 3), but child dietary provision and consumption were no different across groups ($p > 0.05$) (Chapter 4). Improvements in menu compliance alone may not guarantee an impact on child dietary provision and consumption at meal times.

Overall, menu compliance for all food groups (except dairy) improved in the intervention centres. As intervention centres were provided with weekly delivery of ingredients, it is likely that quantities were meeting guidelines. The menu box delivery service improved compliance with vegetable and meat food groups. The number of serves in the fruit, and cereals and breads food groups on centre menus reduced in the intervention centres (although still meeting/exceeding guidelines), in contrast with comparison centres, which remained high. This is congruent with findings by Sambell et al. (2020) that centres involved in their study exceeded the recommendations for the same two core food groups.[170] Similar to cooks within this study, studies report that cooks often identify child preferences, food waste and cost as barriers to providing compliant menus.[236]

Centres provide children with meals, adhering to centre budgets for food provision. From a business perspective, food waste in LDC centres is not cost effective. Centres may be less likely to provide foods that are less preferable (resulting in food waste) and/or that are perceived as more expensive. This can promote the provision of palatable foods to children as these are more likely to be consumed than foods such as vegetables, which are perceived as both expensive and less preferred by children.[136]

Ultimately, LDC centres, particularly privately owned and operated services, are a business. As the key stakeholder for centres is parents, food provision in centres is driven by parent satisfaction with how their child is being fed. Lynch and Batal (2011) reported that centres often felt pressured by parents to ensure their children were eating sufficient quantities of food. These pressures can drive centres to prioritise consumption, to ensure children under their care are eating, and thus

provide foods that children are more likely to eat.[153] Furthermore, while more comparison centres were located in areas that were classed as high socioeconomic status, menu budgets and expenditure per child, per day was the same across all centres.

Centre-based childcare settings work with per child, per day budgets for menu expenditure. In this trial, the cost of the menu box delivery service was considerably higher than that of the comparison centre standard practice. The mean cost of the menu box delivery service ingredients per child per day was $4.62 (95% CI $4.58, $4.67)—or $3.79 (95% CI $3.78, $3.79) when costed at large chain supermarket prices. Both costs were considerably greater than the mean menu expenditure of $2.28 ± $0.10 for comparison centres. In this trial, all comparison centre cooks reported budget impacting their ability to meet guidelines. One cook attempted to follow a menu and recipes to meet guidelines for a week but was forced to stop after substantially exceeding the centre food budget. Interviews with Victorian LDC cooks in a 2022 study by Kempler et al. recorded similar comments, and that using the Menu Assessment Tool made it more difficult to adhere to centre budgets; for example, it was 'easy to exceed our budget and buy food materials'.[237] Intervention centres were spending approximately 380% more on vegetables and legumes than comparison centres, which might reflect a significant driver of higher costs. It could, therefore, be worthwhile considering whether the current state of menu expenditure for centres inherently prevents cooks from meeting guidelines—especially because costing menus with the same supplier for both intervention and comparison centres in this study still exceeded centre budgets by >$1.50 per child per day for ingredients.

There is little literature exploring the cost of childcare menus and their association with menu compliance or diet quality. International studies have identified a relationship between centre budget and the types or quality of food served to children in centres. Lynch and Batal (2011) identified budget restrictions as one of the determining factors in choosing foods in childcares.[153] Himberg-Sundtet et al. (2019) found the economic environment in Norwegian childcares to be positively associated with the vegetables served and eaten in those centres.[238] Similarly, Lloyd-Williams et al. (2011) revealed that centre budget in Liverpool, United Kingdom, childcares was related to the quality of the ingredients used and what foods were purchased.[239] A more recent Australian study by Sambell et al. (2020) explored the cost of food provided to children in Western Australian LDC centres in comparison with menu compliance. The findings suggested an increase in average food expenditure of $0.50 per child per day was required to significantly improve menu compliance with core food groups.[170]

In contrast, Gerritsen et al. (2017) revealed that menu expenditure was not associated with menu compliance in New Zealand childcare settings. Although Sambell et al. (2020) reported a positive association between food expenditure and menu compliance, Gerritsen et al. (2017) found that centres with lower food budgets still achieved high menu compliance scores.[148, 170] The experience

and training of centre cooks in their study was highly variable. However, there is literature to suggest the investment in hiring trained and experienced child care cooks can reduce the cost of the menu in the long term through engagement in more 'from scratch' cooking, and efficient menu planning and meal preparation practices.[232] Cooks in the current study reported managing menu budgets by 'bulking up meals' with both affordable and liked foods such as grains, which may contribute to over-provision of some food groups.

Another key challenge identified by cooks in this trial was the balance of time and budget, including both paid employment hours and food expenditure budgets. This issue has two components, as cooks reported challenges related to menu expenditure to meet guidelines, as well as having enough paid time to carry out tasks. Interviews with South Australian LDC cooks identified both the menu budget and having adequate paid time to complete all of their tasks as significant challenges in their field.[155] Evident across both the intervention and comparison centre cooks in the current study was the time-poor nature of their work schedule. Cooks involved in this trial worked part-time hours, which averaged five to six hours per day (Chapter 3). This is consistent with previous studies.[155] A recent qualitative exploration of cooks' use of a web-based menu planning tool in Victorian childcare centres identified similar themes around time.[237] Interviews with cooks (*n* = 30) and directors (*n* = 34) in the current study revealed that time was a barrier to use of the online menu planning tool. One cook reported that among competing priorities and tasks during their limited work hours, using a menu planning tool was at the bottom of the list.[237] Use of the tool was described by one director as 'very time consuming', which aligns with similar comments from this sample, considering the following director comment: 'It is a great tool and good to refresh our memories, but not necessarily realistic to use because of the time it would take to assess the whole menu' (Director 2).[237] Thus, time and cost remains a considerable issue in the practicality of adopting the new intervention in childcare settings.

The lack of legislative requirement for centres to provide specific amounts of nutrient requirements to children in care and the development of differing menu planning guidelines across various states and territories across Australia may be serving as barrier to the implementation of guidelines within centres.[143] While cooks and centres are required to provide healthy and nutritious meals to children, requirements to implement these guidelines vague, especially considering states such as South Australia do not have menu planning guidelines for LDC.[135, 143] Furthermore, cooks report a lack of knowledge and support to understand and implement such guidelines.[155] Comparison centre cooks involved in this study reported that the centre budget was a key barrier to implementing menu planning guidelines as the budget restricted their ability to buy foods in suitable quantities. Implementation of legislative or policy requirements may provide centres the incentive to implement guidelines more consistently within centres. However, this must go hand in hand with adequate financial support and cook training for centres to achieve this.

Both intervention centre cooks and directors responded positively to the order and delivery process of the menu box delivery service and the quality of ingredients. However, cook feedback about the menu box delivery recipes and quantities of ingredients was poor. In this study, intervention centre cooks did not feel that their facilities supported the menu box delivery service recipes. Interviews with centre staff in the Puget Sound region of Washington State (USA) identified the importance of the facilities for influencing food service decisions in the childcare setting.[232] In particular, staff reported that aspects of space, kitchen equipment and food storage were important in facilitating meal preparation, especially in large quantities.[232] This is not dissimilar to comments made by intervention centre cooks involved in this trial, which was highlighted by one cook asking if the recipes were designed for commercial kitchens rather than the domestic kitchen with which their centres were equipped. Another cook commented that some of the meals simply would not fit into their pots. Congruent with Otten et al. (2017), this highlights the influence of equipment in facilitating the adoption of new menus or recipes.[232]

In Australia, most jurisdictional guidelines for menu planning are designed to provide around half (50%) of a child's daily requirements over one meal and two snacks per day. Recent research has highlighted the lack of knowledge or perceived value of menu planning guidelines with centre-based care.[154, 155] Cooks often use their own knowledge or out-dated guidelines to determine the nutritional quality of meals provided to children.[154] Across both intervention and comparison centres, cooks in this study commented that the quantities of foods required by menu planning guidelines were unrealistic, and were more than what children typically eat. This raises the question of whether aligning children's consumption with quantities outlined by guidelines is feasible. In evaluations of children's dietary consumption internationally, both parents and childcares were unable to provide children with enough vegetables to meet guidelines.[52, 78, 240] In interviews by Spence et al. (2020) with childhood nutrition experts, 92% (*n* = 45) agreed that at least 50% of the *Australian Dietary Guidelines* five food groups' serve recommendations should be provided at childcare centres.[143] Despite this, weighed plate waste revealed 0.1–0.2 serves more food waste in the intervention than comparison centres.

Because of the short study period of eight weeks, child exposure to meals may not have been adequate to achieve a change in acceptance and consumption. Interventions in LDC settings have shown that a minimum of eight to ten exposures is required to achieve an increase in consumption of a disliked or unfamiliar vegetable.[173] While a childcare menu can be used as a tool for exposure, it is unclear how many exposures to a menu are sufficient to achieve improvements in child acceptance and consumption. Of course, mixed meal exposure will differ from repeated exposure, where foods are often provided in isolation. Flavour–flavour learning, where unfamiliar foods (such as vegetables) are paired with a familiar or liked food to increase preference for the unfamiliar food have been proven to be effective in this age group.[241] This is consistent with recommendations to provide vegetables in meals rather than in isolation.[31]

Improving menu compliance alone may not be sufficient to improve child dietary provision and consumption. Effective interventions to promote healthy eating in children within the age group attending ECEC settings (2–5 years) have been found to be those that target both environmental and individual-level factors through multicomponent interventions.[171] This is not to say that improving environmental-level factors such as the centre menu should be disregarded. Interventions with the greatest impact on child-level outcomes have focussed on environmental changes including menu modifications and food policy within multicomponent interventions.[171] Use of step-based approaches to the development of individual intervention elements is a recommended strategy to refine elements of a multicomponent intervention.[16] As the menu box delivery service has the potential to improve the centre food environment through alignment with menu compliance guidelines, combining it with child-level factors could be an effective approach to improving child consumption.[171]

6.4 Thesis Strengths and Limitations

The strengths and limitations of each thesis component are discussed in the relevant chapters. In this section, strengths and limitations relating to the overall body of research are discussed.

6.4.1 Strengths

The cluster RCT study design was a strength of this trial. Centres were stratified to intervention groups by centre size (large or small) and SES (low, mid and high). This was further strengthened by the use of an active control group provided with a 'standard' practice intervention rather than no intervention at all. Furthermore, this study showed high engagement of centres and cooks involved in the trial. No participating centres or cooks dropped out of the study throughout the duration of the intervention. All intervention centres continued to use the menu box delivery service (i.e. no centres reported reverting back to usual practice). All centres participated in follow-up data collection.

A further strength of this study was its minimal missing cost and staff feedback data. The rigorous data collection methods and use of interviewer-administered questionnaires resulted in completeness of cook and director feedback, including through both follow-up interviews and weekly check-ins. Furthermore, only 8% of menu invoices were missing, and these were MCAR. While there is no established cut off for the acceptable percentage of missing data for statistical analysis, most literature places the range at 5–10%.[228] With this in mind, the overall proportion of missing data in this sample was acceptable.

A key strength of this thesis is its development and application of a contemporary food service model in the LDC setting. This is the first known study exploring a menu box delivery concept outside the commercial household environment of a modern meal kit subscription service. This trial

developed and assessed a model that was self-sufficient, without the need for researcher involvement. That is, the menu development, food delivery and centre-level application of the menu box delivery occurred independent of researcher involvement; the research team was simply a facilitator of the concept. As a RCT, this allowed replication to be as close to a real-world experience as possible.

Another unique feature and strength of the menu box delivery service trial was the alignment of the menu to existing evidence-based guidelines for LDC centres. That is, the menu and recipes used in this trial were adopted from existing resources specifically tailored for the LDC setting, developed by experienced dietitians and nutritionists. At this time, existing meal kit subscription service food models on which this intervention was modelled do not aim to meet particular nutrition guidelines.

Among interventions to improve menu compliance and child dietary consumption, very few, if any, have measured multiple levels of outcome. The narrative review presented in Chapter 1 demonstrated heterogeneity in the types of outcome reported for childcare menu compliance in intervention trials. This thesis reports outcomes at a variety of levels including menu compliance; cook and director feedback; child dietary provision and intake; and cost-effectiveness. This approach allowed for a comprehensive examination of the impacts of the menu box delivery service in a real-world centre dynamic. This has provided a deeper understanding of the intervention, focussing on specific areas that require improvements.

None of the interventions identified in the narrative review undertaken to inform this study (Chapter 1) reported cost or cost-effectiveness outcomes. While a cost analysis can provide useful information for stakeholders on the costs of an intervention, an analysis of both the costs and consequences of an intervention is required to best inform resource allocation decisions. A significant strength of this study was the conduct of three analyses designed to provide evidence for decision makers on the economic credentials of the intervention: CEA, CCA and BIA. Findings from three levels of analysis provide a comprehensive overview of the economic implications of the intervention, incorporating information on the range of outcomes and potential budgetary impacts. Sensitivity analyses were also conducted to estimate the impact of varying key input parameters on the overall results. Costing the intervention menu with the same supplier as used by comparison centres provided yet another level of comparison, demonstrating the impact on cost-effectiveness of variation in the supply chain of the intervention. Given the scarcity of economic evaluations of childcare interventions, and menu interventions in particular, the outcomes of this thesis contribute to filling this gap and building this body of literature.

6.4.2 Limitations

As a pilot project, the study's budget for providing food meant that recruitment was limited to a total of eight centres. This meant that with one cook and director per centre, there were four cooks and four directors in each group. Not unlike the majority of studies, this study was subject to the constraints of the study budget to maintain the menu box delivery service over the intervention period. To increase the number of centres involved, a trade-off would have been to reduce the duration of the menu box delivery service. This was not preferable because of the desire to repeat the menu at least once to aid both staff and child familiarity with the menu. Therefore, recruitment for this study prioritised the minimum number of centres required to achieve the target child sample size of 180 children.

The primary aim of the study was to develop and implement a menu box delivery service and evaluate its impact on child dietary provision and consumption. Priority was given to recruiting a sample size powered for child-level outcomes and the opportunity to develop the new food model. Given the context of the LDC setting, anything less than two menu cycles could be perceived as inadequate. First, as cooks would not have the opportunity to increase their familiarity with menus and recipes, and second, as child exposure to meals may not have been adequate given the variability in day-to-day child attendance in care.

The sample size should be considered when interpreting the cook feedback in this study. While a sample size of >200 children was achieved, the number of cooks and centres involved in the study was limited to four in each group. This is a smaller size than in studies in the LDC setting that have collected cook or director feedback through questionnaires or interviews.[149, 154, 155, 169] Future trials should focus on achieving a larger sample size of cooks to achieve richer feedback.

The methodology used for plate waste differed between baseline and follow up because of COVID-19 restrictions. This affected the capacity to draw a direct comparison between baseline and follow up and may have also impacted the reliability of the plate waste measures, as both provision and consumption were estimated from photographs. The short time between introduction of restrictions and the opportunity to conduct follow-up data collection placed significant time pressure on formulation and adoption of a modified plate waste methodology. However, a strength of this limitation was the flexibility of the trial to continue data collection despite interruptions related to COVID-19 restrictions at the time. This was particularly thanks to high engagement and strong rapport with the service provider (head office), individual centres and the produce supplier. This led to a collaborative effort between the research staff, service provider, centres and supplier to ensure completion of the intervention trial.

The modified methodology was based on a validated digital photography method described by Williamson et al. (2013), which was found to be feasible in LDC settings.[201, 202] While evaluations of

this methodology have shown good reliability between weighed and estimated food portions, it uses stationary cameras and marked placemats to photograph meals. Because of time constraints and restrictions for research staff on site, photos were taken by educators using tablets. This led to some loss of data as a result of missing or blurry photos. However, this limitation was foreseen, and to minimise the potential impact of these measures, a checklist (described in Section 2.3.5) was employed to keep track of the number of serves each child received.

In the follow-up sample, *n* = 25 children from one centre (comparison centre) were measured using the baseline methodology (as restrictions had not yet been put in place). To assess the impact of this group on outcomes, a comparison was performed between the total comparison sample (*n* = 126) and the comparison sample with the sample of 25 excluded (*n* = 101), which revealed differences in only 0.1–0.2 serves. Furthermore, waste was weighed by the researchers on site once plates had been taken out of the child rooms.

Although individual child-level plate waste was measured to estimate consumption, centre-level food provision and waste was not measured due to time constraints. This hindered the ability to estimate centre adherence to recipes within the intervention group, as well as the impact of educator-led servings on child food provision. As educators were responsible for serving food to children at mealtimes, plate waste only measured what was provided individually to children. Without estimates of centre-level provision and waste, it is unclear how much food was provided to each room and what was *not* served to children. Furthermore, cook interviews were performed prior to completion of child dietary outcomes and menu compliance data collection and analysis, which hindered the opportunity to discuss differences between menu compliance and mealtime provision with centre cooks and directors.

A suitable methodology to measure centre-level food provision and waste was described by Sambell et al. (2019).[136] Sambell and colleagues (2019) outlined the process of data collection for the measurement and auditing of food waste. There is an urgent need to ensure that food provision at a service level complies with current dietary guidelines and is accurately assessed. Employing a standardised method of data collection will allow for a more accurate comparison between studies and allow changes to be monitored more accurately over time, to guide decision makers.[136] As discussed earlier, child exposure to meals may not have been adequate to achieve a change in acceptance and consumption in this study, particularly given the variability in day-to-day child attendance in care. The recommendations for childcare healthy eating interventions by Matwiejczyk et al. (2019) suggest a minimum intervention duration of 12 months, or ideally two to four years.[171]

As discussed in Chapter 5, economic evaluation of obesity interventions is an expanding area of research. As a within-trial analysis, a CEA did not provide a sense of long-term costs and consequences of the intervention, particularly considering the short intervention duration.

Furthermore, because of the nature of the trial, the outcome measures reported in the economic evaluation of this thesis—menu compliance, and child dietary provision and consumption—were clinical in nature. This hinders the comparability of cost-effectiveness with other studies that used different outcomes measures. While a modelled economic evaluation was beyond the scope of the study, future interventions could explore the long-term costs and potential health (dietary provision and consumption) benefits.

6.5 Implications for Future Research and Practice

A key outcome of this study was the successful development and application of a menu box delivery service for LDC settings. While past menu interventions in childcare settings identified outcomes that proved their effectiveness for improving menu compliance or child dietary consumption, the current intervention was unique as it did not rely on cooks' knowledge or training. Furthermore, the intervention presented a food model that did not rely on implementation staff to facilitate and monitor the provision of the training and resources. However key areas that can benefit from improvement are identified in the next section.

6.5.1 Recommendations for Improvement of the Menu Box Delivery Service

First, the intervention led to small changes in child mealtime dietary provision or consumption, compared with the comparison centres (standard practice). Pertinent for childcare nutrition promotion interventions is the application of a multilevel and multicomponent approach. These recommendations suggest that both individuals and environments should be targeted through a combination of practices including policy, food provision (i.e. centre menu), staff training, staff knowledge and feeding practices, curriculum, sensory education and role modelling.[171, 242] The intervention examined in this thesis concentrated on the food environment, or the centre menu in isolation. Combining this intervention with components that target the individual level, such as mealtime practices or curriculum, might be pertinent to translating what is on the centre menu to improvements in child provision and acceptance.[243]

As the main user of the menu box delivery service, cook acceptability was low. The key element of the menu box delivery service with which cooks expressed dissatisfaction was the recipes. Although the menu and recipes used in this intervention were developed specifically for the LDC setting, cook feedback indicated considerable areas for improvement. Specifically, feedback was related to the time taken to prepare recipes, such as long cooking or preparation times, and the suitability of the recipes for the LDC setting and for children in general.

Future iterations of the menu box delivery service should take into consideration these issues identified by cooks to develop a menu that fits the needs of the setting. Key recommendations pertaining to the menu or recipes identified through cook interviews are (1) reducing the need for

peeling and cutting food items, (2) minimising cooking time of morning snack meals to accommodate the lack of preparation time in the morning, (3) balancing meals that have longer preparation or cooking time meals with meals that are quicker to prepare throughout the day, and (4) eliminating delivery of meat products that require de-boning, a key responsibility of the supplier.

Childcare settings manage rigorous budgets across all centre operations. Centre food menu and staff expenditure is often governed by strict budgets, so any changes in expenditure need to be justified. The cost of the menu box delivery service per child per day was twice that of the comparison centre standard practice food provision (mean cost: intervention $4.62 (95% CI $4.58, $4.57) *v*. comparison $2.28 (95% CI $2.27, $2.30) per child per day). This is greater than mean costs reported for other states, such as Western Australia, which was $2.00 per child per day for morning snack, lunch and afternoon snack.[170] Exploring ways to reduce costs will aid in increasing the fit of the menu box delivery service with centre practices. Costing of the menu with chain supermarket pricing reduced the intervention menu cost by $1.01–3.61 (95% CI $3.61, $3.62) per child per day. Comparison centre cooks participating in this study reported that their menu budgets did not allow scope to purchase foods in the quantities to meet guidelines. Other avenues could be explored to reduce menu expenditure that does not sacrifice guideline compliance. For example, two intervention centre cooks commented that the whiting (fish) on the menu would be considered a luxury food item due to cost. Considering substituting with more cost-effective options, such as frozen or thawed white fish (for example, Basa) might a nutritionally suitable alternative to save costs.

6.5.2 Recommendations for Future Research

Outcomes of this study include an evaluation of the various elements of the menu box delivery service and highlight areas for improvement. Future research should implement a full trial of the menu box delivery service following improvements to the food service model, as informed by the outcomes of this trial, such as incorporating feedback from cooks about the menu and recipes. As the gold standard approach for intervention evaluation, maintaining the RCT design for a larger sample size of centres would offer richer feedback from a larger sample of cooks and directors. A larger sample size of centres will also allow scope to analyse an even larger sample of children's dietary intake and consumption. Recommendations for childcare nutrition interventions have consistently recommended longer follow-up periods to measure long-term effectiveness. A longer follow-up period for a menu intervention may also provide a greater opportunity to measure the impact of behaviour change in both cooks and children at centres, as familiarity with recipes will grow over time. Additionally, measuring centre-level waste will help to understand the provision of vegetables and core food groups within centres, not only at mealtimes.

As mentioned earlier, combining the menu box delivery service as part of a multicomponent intervention consistent with recommendations in the literature may bring improvements in child

dietary provision and consumption of vegetables and core food groups. Future evaluations of the menu box delivery service may benefit from exploring its role in multicomponent interventions. Although a RCT is considered the gold standard for evaluating interventions, it does not account for the relationships between individual components. A novel methodology to explore relationships between components and the effectiveness of an intervention is the multiphase optimisation strategy. This strategy, although ultimately resulting in a RCT in its final stage, uses a multiphase experimental design to identity the most effective combination of multicomponent behavioural interventions. An example of the application of this strategy for a childcare nutrition intervention was described by Zarnowiecki et al. (2021).[243] Their study protocol outlined the development and evaluation of three initiatives aiming to (1) increase vegetable provision at mealtimes, (2) deliver a vegetable-focussed sensory curriculum and (3) use supportive mealtime practices encouraging children's tasting of vegetables, to identify the optimum combination of initiatives to improve child vegetable consumption.[50]

6.6 Conclusion

Dietary consumption, particularly for vegetables, across Australian adults and children is poor. Despite the known health benefits associated with vegetable consumption, Australian data demonstrate poor vegetable consumption among children. Children under 5 years of age are at a stage in development where food and health behaviours are beginning to form. In Australia, children spend a considerable time in ECEC settings, and such environments have been identified as key influences in shaping early dietary behaviours. LDC centres that provide meals to children have a responsibility to serve nutritious and healthy meals. Many jurisdictions provide their own evidence-based, best practice guidelines to support centre menus in lieu of any national overarching guidelines. Despite the availability of guidelines, centre menus often fail to meet recommendations. Common barriers that impede guideline implementation identified by cooks include a lack of time and knowledge. To address these gaps, this study aimed to develop, implement and evaluate the impact of a menu box delivery service tailored for the LDC setting on dietary provision and consumption—particularly vegetable consumption—in children aged 2–5 years.

In conclusion, a menu box delivery service for childcare proved to be a novel and applicable food service model in the LDC setting. Despite no significant differences in vegetable and core food provision and consumption in children attending intervention centres compared with standard practice, evaluation of menus revealed improvements in menu compliance across almost every food group, including full menu compliance for vegetables. Cook and director feedback provided valuable insights to identify key areas for refinement to improve acceptability in the sector. Intervention centre cooks that implemented the menu box delivery service showed greater agreement with enablers to implement the menu planning guidelines using the Theoretical

Domains Framework, including skills; environmental context and resources; social/professional role and identity; and beliefs about capabilities. Finally, the application of a within-trial economic evaluation contributes to filling the large gap in the preventative, ECEC interventions literature. Suggested refinements to the study have been identified throughout, including improvements to recipes to enhance suitability for the setting and cook acceptance.

Future trials following refinement should recruit larger samples of centre cooks and directors to ensure in-depth feedback and explore opportunities to integrate the menu box delivery service into multicomponent interventions that address both environmental and individual-level outcomes. Future research and policy needs to continue to find ways to overcome the barriers faced by cooks and childcare centres to support children's nutrition. Application of legislative requirements for LDC to implement menu planning guidelines may support provision of healthy, nutritious meals within centres. While food service innovation will be important, additional investment in the food budget will also be needed to ensure all children are nourished in the important first years of life.

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APPENDIX 1 MENU BOX DELIVERY DETAILS FORM

Menu Box Delivery Details Form

Centre Name						
Centre Director	Centre Cook					
Delivery Address	Phone					
Email	ABN					
For each day of the week enter number of:	**M**	**T**	**W**	**TH**	**F**	
Children requiring the standard menu						
Child requiring the vegetarian menu (minimum 5 per day)						

Please use the space below to list the breakfast foods your centre offers.

You will be able to make weekly order for the quantities you need for each of these foods to add to your weekly menu box delivery.

Please use the space below to list the late snack foods your centre offers.

You will be able to make weekly order for the quantities you need for each of these foods to add to your weekly menu box delivery.

APPENDIX 2 CENTRE EXTRA INGREDIENT ORDER FORM (EXAMPLES)

DATE: 6/10/2020

DIETARY REQUIREMENTS ORDER FORM							
ITEM	**BRAND**	**QTY**	**ORDER**	**ITEM**	**BRAND**	**QTY**	**ORDER**
GLUTEN FREE PANTRY				**MEAT ALTERNATIVES**			
Plain flour (GF)	Yes You Can	500g	X1	Tofu (firm)	TLY	300g	
Self-raising flour (GF)	Yes You Can	500G	X1	Tofu (silken)	TLY	300g	
Puff Pastry (3-sheets) (GF)	Heaven's	600g		Eggs (1 dozen)	Hens on the Range	700g	
Fettuccine pasta (GF)	Le Venziane Pasta	250g	X2	Lentils (canned)	Capriccio	400g	
Penne pasta (GF)	Le Venziane Pasta	250g		Chickpeas (canned)	Capriccio	400g	
Spiral pasta (GF)	Le Venziane Pasta	250g	X2	Kidney beans (canned)	Capriccio	400g	
Rice breadcrumbs (GF)	Orgran	300g		Cannellini beans (canned)	Capriccio	400g	
White rice	Sunrice	1kg		Tuna (in spring water)	Sirena	425g	
Brown rice	Sunrice	1kg		**DAIRY ALTERNATIVES**			
Brown rice crackers		100g		Coconut milk (reduced fat)	Trident	400ml	
Brown rice cakes	Ceres	110g		Coconut yoghurt (natural)	Born Cultured	500g	X3
VEGAN DIPS				Soy milk	Milk Lab	1L	X2
Hommus (GF)	Dianne's Dips	200g		Lactose Free Milk	Australia's Own	1L	
Eggplant (GF)	Dianne's Dips	200g		Lactose Free Yoghurt Plain (contains dairy)	Liddell's	4 x 140g	
Please check manufacturer labelling to ensure suitability of items							

Please remember to complete and email your order form to Tony & Marks (details in menu pack) on Monday.

BREAKFAST ORDER FORM		
ITEM	QTY	ORDER
BREAKFAST CEREAL		
Weetbix (Sanitarium)	750g	X1 pack
GLUTEN FREE Weetbix (Sanitarium)	375g	X1 pack
BREAD		
Wholemeal bread	Loaf	X
Gluten Free Bread	Loaf	X2 loaf
Fruit bread	Loaf	
OTHER		
Vegemite	380g	X2
Spread (Margarine)	500g	X2
Cream Cheese Spread (Philadelphia)	250g	X2
Rice Milk	1Ltr	X3 Ltrs
Sweet Potato	1Kg	X1
Pumpkin	1Kg	X2

LATE SNACK ORDER FORM	
ITEM	**ORDER**
Brown Rice Crackers (100g pack)	X3 packets
Reduced Fat Tasty Cheese (500g)	X1 block
Sultanas (450g pack)	X2 packets
Mum Mum Biscuits for Babies*	X2 packets
Arrowroot Biscuits*	X3 packets

Use this milk order form for drinking milk orders. If a recipe requires milk, this will be included in your weekly menu box delivery.

MILK ORDER FORM	
ITEM	**ORDER**
Full Cream Milk	X 4
Skim Milk	X 4
Lactose Free Milk	
For non-dairy milk, refer to dietary requirements order form.	

APPENDIX 3 STUDY DELIVERY CALENDAR

October 2020

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Menu starts on a Monday *Centres to send order forms for items to be added to Friday's delivery.*			1	2 *Delivery on Friday of produce to be used the next week for Monday start*	**NOTE:** – Menu starts on a Monday – All your ingredients will arrive the Friday before menu start – Order forms need to be sent the Monday before the Friday delivery for: dietary requirements, breakfast and late snack add on.	
5 **PUBLIC HOLIDAY**	6 Send your order forms for **week 1** to Tony & Marks for Friday's delivery.	7	8	9 *Reminder: Phone check in!* **WEEK 1** MENU BOX DELIVERED TODAY		
WEEK 1 MENU STARTS 12 Send your order form for **week 2** to T&M for Friday's delivery.	13	14	15	16 *Reminder: Phone check in!* **WEEK 2** MENU BOX DELIVERED TODAY	17	18
WEEK 2 MENU STARTS 19 Send your order for **week 3** to T&M for Friday's delivery.	20	21	22	23 *Reminder: Phone check in!* **WEEK 3** MENU BOX DELIVERED TODAY	24	25
WEEK 3 MENU STARTS 26 Send your order form for **week 4** to T&M for Friday's delivery.	27	28	29	30 *Reminder: Phone check in!* **WEEK 4** MENU BOX DELIVERED TODAY	31	

November 2020

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
WEEK 4 MENU STARTS 2 Send your order form for **week 1** to T&M for Friday's delivery.	3	4	5	6 *Reminder: Phone check in!* **WEEK 1** MENU BOX DELIVERED TODAY	7	8
WEEK 1 MENU STARTS 9 Send your order form for **week 2** to T&M for Friday's delivery.	10	11	12	13 *Reminder: Phone check in!* **WEEK 2** MENU BOX DELIVERED TODAY	14	15
WEEK 2 MENU STARTS 16 Send your order form for **week 3** to T&M for Friday's delivery.	17	18	19	20 *Reminder: Phone check in!* **WEEK 3** MENU BOX DELIVERED TODAY	21	22
WEEK 3 MENU STARTS 23 Send your order form for **week 4** to T&M for Friday's delivery.	24	25	26	27 *Reminder: Phone check in!* **WEEK 4** MENU BOX DELIVERED TODAY	28	29
WEEK 4 MENU STARTS 30 **No order forms sent this week.**	DECEMBER 1	2	3	**NO DELIVERY** 4 *Reminder: Last phone check in!* **MENU BOX END**	5	6

APPENDIX 4 PROTOCOL PAPER

Open access Protocol

BMJ Open

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

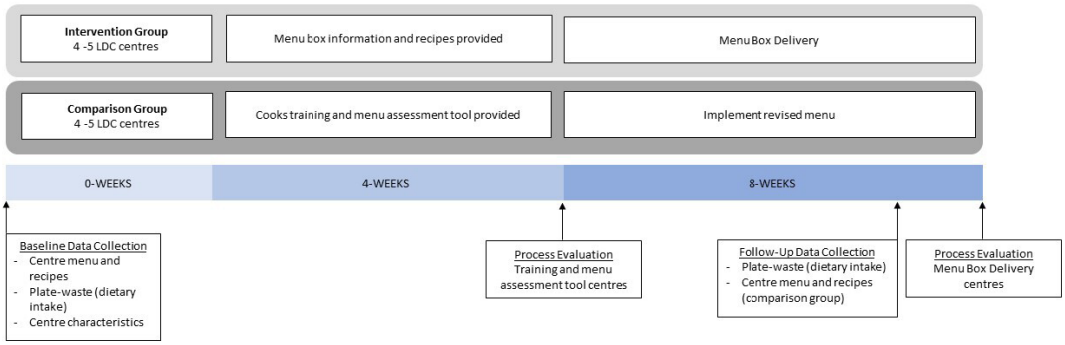

Figure 1 Intervention flow and data collection points. LDC, long day care.

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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APPENDIX 5 CONSORT GUIDELINES EXTENSION FOR CLUSTER RANDOMISED CONTROLLED TRIALS CHECKLIST

Developed from the Consort 2010 statement: extension to cluster randomised trials published by Campbell et al. (2010)[190]

Section/Topic	Item No	Standard Checklist item	Extension for cluster designs	Page No *
Title and abstract				
	1a	Identification as a randomised trial in the title	Identification as a cluster randomised trial in the title	NA
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)[1,2]	See table 2	NA
Introduction				
Background and objectives	2a	Scientific background and explanation of rationale	Rationale for using a cluster design	Chapter 1
	2b	Specific objectives or hypotheses	Whether objectives pertain to the the cluster level, the individual participant level or both	Pages 51 – 52
Methods				
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	Definition of cluster and description of how the design features apply to the clusters	Pages 59 – 60
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons		Pages 69 – 73
Participants	4a	Eligibility criteria for participants	Eligibility criteria for clusters	Pages 60 – 61
	4b	Settings and locations where the data were collected		Pages 60 – 61
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	Whether interventions pertain to the cluster level, the individual participant level or both	Pages 62 – 65
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	Whether outcome measures pertain to the cluster level, the individual participant level or both	Pages 66 – 76
	6b	Any changes to trial outcomes after the trial commenced, with reasons		NA

Sample size	7a	How sample size was determined	Method of calculation, number of clusters(s) (and whether equal or unequal cluster sizes are assumed), cluster size, a coefficient of intracluster correlation (ICC or *k*), and an indication of its uncertainty	Page 76
	7b	When applicable, explanation of any interim analyses and stopping guidelines		NA
Randomisation:				
Sequence generation	8a	Method used to generate the random allocation sequence		Page 62
	8b	Type of randomisation; details of any restriction (such as blocking and block size)	Details of stratification or matching if used	Pages 61 – 62
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	Specification that allocation was based on clusters rather than individuals and whether allocation concealment (if any) was at the cluster level, the individual participant level or both	Pages 61 – 62
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	Replace by 10a, 10b and 10c	Pages 61 – 62 (see 10a, 10b, 10c)
	10a		Who generated the random allocation sequence, who enrolled clusters, and who assigned clusters to interventions	Page 62
	10b		Mechanism by which individual participants were included in clusters for the purposes of the trial (such as complete enumeration, random sampling)	Page 61 – 62
	10c		From whom consent was sought (representatives of the cluster, or individual cluster members, or both), and whether consent was sought before or after randomisation	Pages 61 – 62
Blinding	11a	If done, who was blinded after assignment to		Page 62

		interventions (for example, participants, care providers, those assessing outcomes) and how		
	11b	If relevant, description of the similarity of interventions		NA
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	How clustering was taken into account	Page 76 & 78
	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses		Pages 76 – 78
Results				
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	For each group, the numbers of clusters that were randomly assigned, received intended treatment, and were analysed for the primary outcome	Page 84 – 85
	13b	For each group, losses and exclusions after randomisation, together with reasons	For each group, losses and exclusions for both clusters and individual cluster members	Page 84
Recruitment	14a	Dates defining the periods of recruitment and follow-up		Page 65
	14b	Why the trial ended or was stopped		NA
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	Baseline characteristics for the individual and cluster levels as applicable for each group	Pages 86 & 115 & 116
Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	For each group, number of clusters included in each analysis	Page 84 – 85 Pages 86 & 115 & 116
Outcomes and estimation	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	Results at the individual or cluster level as applicable and a coefficient of intracluster correlation (ICC or k) for each primary outcome	Chapter 4 (Pages 119 - 129)
	17b	For binary outcomes, presentation of both		Page 212

		absolute and relative effect sizes is recommended		
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory		Chapter 4 (Pages 119 - 129)
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms[3])		NA
Discussion				
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses		Page 159
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	Generalisability to clusters and/or individual participants (as relevant)	Pages 158 – 159
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence		Chapter 6 (Pages 148 – 163)
Other information				
Registration	23	Registration number and name of trial registry		Page 60
Protocol	24	Where the full trial protocol can be accessed, if available		Page 59
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders		Page XVIII

** Note: page numbers optional depending on journal requirements*

APPENDIX 6 CHEERS REPORTING CHECKLIST

Developed from the Consolidated Health Economic Evaluation Reporting Standards published by Husereau et al. (2022)[212]

CHEERS 2022 Checklist

Topic	No.	Item	Location where item is reported
Title			
	1	Identify the study as an economic evaluation and specify the interventions being compared.	NA
Abstract			
	2	Provide a structured summary that highlights context, key methods, results, and alternative analyses.	NA
Introduction			
Background and objectives	3	Give the context for the study, the study question, and its practical relevance for decision making in policy or practice.	Chapter 1, Page 51 & Pages 79 - 80
Methods			
Health economic analysis plan	4	Indicate whether a health economic analysis plan was developed and where available.	Pages 79 - 83
Study population	5	Describe characteristics of the study population (such as age range, demographics, socioeconomic, or clinical characteristics).	Pages 60 - 62
Setting and location	6	Provide relevant contextual information that may influence findings.	Page 60
Comparators	7	Describe the interventions or strategies being compared and why chosen.	Page 59, Pages 62 - 65
Perspective	8	State the perspective(s) adopted by the study and why chosen.	Page 79 & Page 82
Time horizon	9	State the time horizon for the study and why appropriate.	Page 79 &Page 82
Discount rate	10	Report the discount rate(s) and reason chosen.	Page 80
Selection of outcomes	11	Describe what outcomes were used as the measure(s) of benefit(s) and harm(s).	Page 82
Measurement of outcomes	12	Describe how outcomes used to capture benefit(s) and harm(s) were measured.	Pages 67 - 74

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Topic	No.	Item	Location where item is reported
Valuation of outcomes	13	Describe the population and methods used to measure and value outcomes.	Pages 67 - 74
Measurement and valuation of resources and costs	14	Describe how costs were valued.	Pages 80 - 81
Currency, price date, and conversion	15	Report the dates of the estimated resource quantities and unit costs, plus the currency and year of conversion.	Page 82
Rationale and description of model	16	If modelling is used, describe in detail and why used. Report if the model is publicly available and where it can be accessed.	NA
Analytics and assumptions	17	Describe any methods for analysing or statistically transforming data, any extrapolation methods, and approaches for validating any model used.	Page 82
Characterising heterogeneity	18	Describe any methods used for estimating how the results of the study vary for subgroups.	NA
Characterising distributional effects	19	Describe how impacts are distributed across different individuals or adjustments made to reflect priority populations.	NA
Characterising uncertainty	20	Describe methods to characterise any sources of uncertainty in the analysis.	Page 83
Approach to engagement with patients and others affected by the study	21	Describe any approaches to engage patients or service recipients, the general public, communities, or stakeholders (such as clinicians or payers) in the design of the study.	NA
Results			
Study parameters	22	Report all analytic inputs (such as values, ranges, references) including uncertainty or distributional assumptions.	Pages 133 - 138
Summary of main results	23	Report the mean values for the main categories of costs and outcomes of interest and summarise them in the most appropriate overall measure.	Pages 133 - 138
Effect of uncertainty	24	Describe how uncertainty about analytic judgments, inputs, or projections affect findings. Report the effect of choice of discount rate and time horizon, if applicable.	Page 141, Page 142 & Page 144

Topic	No.	Item	Location where item is reported
Effect of engagement with patients and others affected by the study	25	Report on any difference patient/service recipient, general public, community, or stakeholder involvement made to the approach or findings of the study	NA
Discussion			
Study findings, limitations, generalisability, and current knowledge	26	Report key findings, limitations, ethical or equity considerations not captured, and how these could affect patients, policy, or practice.	Pages 145 - 147, & Pages 151 - 164
Other relevant information			
Source of funding	27	Describe how the study was funded and any role of the funder in the identification, design, conduct, and reporting of the analysis	Acknowledgements
Conflicts of interest	28	Report authors conflicts of interest according to journal or International Committee of Medical Journal Editors requirements.	NA

From: Husereau D, Drummond M, Augustovski F, et al. Consolidated Health Economic Evaluation Reporting Standards 2022 (CHEERS 2022) Explanation and Elaboration: A Report of the ISPOR CHEERS II Good Practices Task Force. Value Health 2022;25. doi:10.1016/j.jval.2021.10.008

APPENDIX 7 ETHICS APPROVAL

From: Human Research Ethics
To: Shabnam Kashef; Dorota Zarnowiecki; Rebecca Golley
Subject: 8566 ETHICS approval notice (10 March 2020)
Date: Tuesday, 10 March 2020 1:56:26 PM
Attachments: image001.png
8566 conditional approval response (28 February 2020).msg
image002.png
Importance: High

Dear Shabnam,

Your conditional approval response for project 8566 was reviewed by the Chairperson of the Social and Behavioural Research Ethics Committee (SBREC) and was **approved.** The ethics approval notice can be found below.

APPROVAL NOTICE

Project No.:	**8566**
Project Title:	Piloting a meal delivery service direct to long day care
Principal Researcher:	Miss Shabnam Kashef
Email:	shabnam.kashef@flinders.edu.au
Approval Date:	10 March 2020
Ethics Approval Expiry Date:	**31 December 2021**

The above proposed project has been **approved** on the basis of the information contained in the application, its attachments and the information subsequently provided with the addition of the following comments.

Additional comments:

1. Permissions (Conditional approval response #8 and item D8)
   A reminder to please submit written permissions from the Heads of all Long Day Care Centre's to be involved with the research on receipt.

RESPONSIBILITIES OF RESEARCHERS AND SUPERVISORS

1. **Participant Documentation**
   Please note that it is the responsibility of researchers and supervisors, in the case of student projects, to ensure that:
   - all participant documents are checked for spelling, grammatical, numbering and formatting errors. The Committee does not accept any responsibility for the above mentioned errors.
   - the Flinders University logo is included on all participant documentation (e.g., letters of

APPENDIX 8 CENTRE STAFF STUDY INFORMATION

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CRICOS Provider No. 00114A

INFORMATION SHEET
Long Day Care Centres

Supporting Healthy Meals in Childcare

Researcher(s)
Shabnam Kashef
College of Nursing and Health Sciences
Flinders University
Tel: 7221 8273

Supervisor(s)
Dr Dorota Zarnowiecki
College of Nursing and Health Sciences
Flinders University
Tel: 8201 5519

Supervisor(s)
Prof Rebecca Golley
College of Nursing and Health Sciences
Flinders University
Tel: 8201 5596

Your centre has been invited to take part in a study to support childcare cooks to provide menus aligned with menu planning guidelines for long day care. Before you decide whether your centre can be involved, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with your staff and centre cook. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you want your centre to take part. This decision is entirely up to you.

Description of the study

In Australia, less than 4% of children aged four to five years consume the recommended amount of vegetables. About half of Australian children aged 2-5 years attend formal early care and education. These settings, such as Long Day Care, can provide 40-60% of children's daily food intake. In centres where food is provided onsite, the responsibility for menu planning and food preparation falls with the cooks. **This**

project aims to evaluate a menu box delivery service in the long day care setting compared to an online cook's training module and menu planning tool tailored for long day care cooks.

Your centre is invited to participate in this randomised controlled trial in which the cook at the centre will receive support to plan healthy menus that align with menu planning guidelines for long day care. Your Centre will be randomly allocated receive either a tailored **menu box delivery service** for 8 weeks or complete **online cooks training and use a menu planning tool** to plan and implement your Centre menu. Participation is entirely voluntary.

What is the menu box delivery service?

If your centre is allocated to the menu box delivery group, you will receive a menu box delivery service that provides pre-portioned ingredients and recipes to produce meals at your centre – think of an at home meal kit delivery on a much larger scale with enough ingredients to feed all children at the centre. These meals and recipes have been carefully selected by dietitians from Nutrition Australia (Victoria), experienced in the childcare sector to provide a nutritionally balanced meal that meets childcare guidelines that children enjoy. The goal of the menu box service is to simplify menu planning, ordering ingredients and preparing meals by combining it all into one service. You will be asked to implement the menu boxes into your daily centre mealtime routine for eight weeks, which will be provided free of charge.

What is the Cook's online training and menu planning tool?

If your centre is allocated to the online training and menu planning tool group, your centre cook will complete a tailored online training module, specific to long day care settings. This training is delivered online via Nutrition Australia (Victoria) and takes approximately 45 – 55 minutes to complete. The training provides material on topics such as the importance and benefits of healthy eating, how to utilize the menu planning tool, case study examples and activities and strategies to overcome common challenges along with supplementary resources and recipes. Your cook will also be asked to use the menu planning tool, which is an innovative automated menu planning tool, that assesses menus, food items and recipes against dietary guidelines specific to the long day care setting to plan your next menu cycle. The aim of the tool is to save your cook time and takes the guess work out of menu planning, it allows users to create and save recipes, assess, or modify current menus as well as creating new menus.

What will my centre be asked to do?

You, your centre's cook, teachers and educators, and selected children attending your centre will be involved in this study.

Directors

Your role as the director will involve providing consent to participate in the study. From here we will ask you for details about your Centre for our baseline data including food budget, number of cook staff, number of enrolments and average attendance. You will also be asked to report participating children's date of birth, gender and any medical conditions that affect a child's food intake. If your centre is allocated to the online

training and planning tool group, will also need to allow time for your staff to complete training and access the menu planning tool to plan the next menu. Your centre will be asked to participate in two days of data collection at the start and end of the study as described in more detail below.

Cooks

Centres allocated to menu box delivery: Cooks in the menu box delivery group will need to receive the menu boxes upon the delivery, prepare the meals and recipes provided by the menu boxes delivered each week for eight weeks. You will be provided with a menu pack that provides information about the menu, how to order menu boxes and all recipes needed for the menu. At the end of each week, cooks will complete a quick check list over the phone with a researcher (<10minutes) to summarise their experiences with the menu box that week, with questions such as: did the menu box arrive on time or were there enough ingredients provided? During the eight-week period of the study, cooks will be asked to collect any receipts related to menu costs. At the end of the 8-weeks we will ask the cook to participate in a 30-minute interviewer administered questionnaire to provide feedback on the process.

Centres allocated to online training & menu planning: In the online training and planning tool group, cooks will complete the online training module prior to planning the winter seasonal menu and use the online menu planning tool to develop the new menu. At the end of each week (during the 8-week study period), cooks will check in with a researcher over the phone to report how much time they spent on menu planning that week (<3minutes). During the eight-week period of the study, cooks will be asked to collect any receipts related to menu costs. We will also ask the cook to participate in a 30-minute interviewer administered questionnaire to provide feedback on the process.

Interviewer administered questionnaires will be audio recorded, with consent, to ensure all data collected is accurate.

Teachers/Co-Educators

We will ask your classroom staff to complete a child food record for eligible children attending on days of food intake measurements at both the start and end of the study. The child food record asks staff to report on usual dietary intake for the child in focus via observation. Educators will receive training on how to complete the questionnaire and use support material to report dietary intake as accurately as possible. One questionnaire will take around 14 minutes to complete for one child.

Children

On two separate days, at both the start and end of the study, the research staff will observe a full day of meals, including morning tea, lunch, and afternoon tea to measure food intake using the plate waste method. On these days two trained dietitians will attend your centre for approx. 7 hours to complete data collection.

For plate waste measurements children will be asked to:

- wear a study ID sticker for the day

- allow the study researchers to photograph their plate before they start eating a meal/snack (no children will be photographed)
- give their plate to the study researcher when they have finished eating their meal/snack (with staff assistance)

Parents

Parents will be provided with information about the study using your centres main parent communication channel. Parents will be asked to indicate if they DO NOT consent for their child's dietary intake to be measured. This will be indicated by a tick box form signed by the parent notifying research staff that they wish their child to be excluded from dietary intake measurements. This will be returned to the centre or directly to the researchers. If parents do not want their child's dietary intake to be measured, research staff will not collect data from this child.

How will plate waste be measured in my centre?

To conduct plate waste measurements:

- Prior to each food service (i.e. morning tea, lunch, and afternoon tea), research staff will weigh plates and food items to be served to study children.
- As study children are served, a photograph and weight of their plate will be taken by the study researcher.
- The study researcher will record any additional servings provided to the study children and then collect their plate to weigh food/beverage leftovers.

On two separate days research staff will observe a full day of meals, including morning tea, lunch and afternoon tea.

What benefit will I gain from being involved in this study?

By participating in this study, you will be contributing to the body of research that aims to improve the dietary behaviours and health of Australian children. Your centre will provide valuable insights and contribution to the development of recommendations for the childcare sector about supporting a healthy food environment. Your centre will receive free support for menu planning for the duration of the study.

Will I be identifiable by being involved in this study?

All the information that we collect about your centre during the course of the research will be kept strictly confidential. Children will only be identified using a study identification number and any information collected that would identify the child will be removed. Any identifying information will be removed, and your comments will not be linked directly to your centre or your staff. All information and results obtained in this study will be stored in a secure way, with access restricted to relevant researchers. The parent company and names/ locations of the study centres will not be revealed in any publication arising from this research.

Are there any risks or discomforts if I am involved?

By participating in this study your centre will have to change its menu planning processes and like change of any kind this may cause some discomfort for your staff while you adjust. Our research team will be available to support your centre and answer any questions you may have. As part of our research we will be asking your staff for feedback via an interviewer administered questionnaire. The interviewer administered questionnaire is designed to be short (<30mins each) but will take time. You will also be asked to collect receipts and check in with a researcher.

Menu boxes will be Halal and nut free, and provide vegetarian options, however, will not cater to specific allergies as these will be unique to each centre. For allergy management and texture modification for infants and toddlers, we encourage your centre to follow to standard practice.

Any unexpected discomforts, disadvantages, and risks, which arise during the research, should be brought immediately to our attention, please contact **Shabnam Kashef** on **(08) 7221 8273**. If you have any concerns regarding anticipated or actual risks or discomforts, please raise them with us. All study researchers will have current Working with Children clearance and attend centres only on agreed dates. Copies of these will be provided prior to data collection days.

How do I agree to participate?

Participation is voluntary and you are free to withdraw from the study at any time without effect or consequences. A consent form accompanies this information sheet. If you agree to participate please read and sign the form and send it back to me at **shabnam.kashef@flinders.edu.au.**

We ask that you talk with your centre staff before deciding whether or not your Centre should be involved in this study. Staff can opt out of participating in feedback and/or questionnaires should they wish not to.

How will I receive feedback?

On project completion a summary of project results will be provided to you via email.

How is this study funded?

This study is part of VegKIT, which is a five-year national project designed to address the significant issue of underconsumption of vegetables in children and will deliver free resources for educators, health professionals and research agencies.

VegKIT brings together science and industry with CSIRO, Flinders University and Nutrition Australia to deliver evidence-informed nutrition promotion with real world impact. VegKIT is funded by Hort Innovation, using the vegetable research and development levy and contributions from the Australian Government.

For more information visit https://www.vegkit.com.au/

Thank you for taking the time to read this information sheet, and we hope that you will accept our invitation to be involved.

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee in South Australia (Project number 8566). For queries regarding the ethics approval of this project please contact the Executive Officer of the Committee via telephone on +61 8 8201 3116 or email human.researchethics@flinders.edu.au

APPENDIX 9 PARENT/CHILD STUDY INFORMATION AND CONSENT (OPT-OUT FORM)

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INFORMATION SHEET
Parents

Supporting Healthy Meals in Childcare

Researcher(s)
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College of Nursing and Health Sciences
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Supervisor(s)
Dr Dorota Zarnowiecki
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Tel: 8201 5519

Supervisor(s)
Prof Rebecca Golley
College of Nursing and Health Sciences
Flinders University
Tel: 8201 5596

Description of the study
Your child's childcare centre is taking part in a research project to trial two approaches for supporting childcare cooks to provide healthy meals. **To evaluate this research project, we will be measuring that food that children eat at the Centre on two days, at the start and end of the study. We are seeking your permission to record your child's food intake at the centre on these data collection days**. Before you decide whether your child can be involved, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others, including your child, if you wish. Ask us if there is anything that is not clear or if you would like more information to decide whether or not you want your child to take part. This decision is entirely up to you. If you do not give for your child to be involved, please indicate this on the attached consent form and return this to us.

Purpose of the study
In Australia, less than 4% of children aged four to five years old consume the recommended amount of vegetables. About half of Australian children aged 2-5 years attend formal early care and education. These settings, such as Long Day Care, can provide 40-60% of children's daily food intake. In centres where food is provided onsite, the responsibility for menu planning and food preparation falls with the cooks. This project will investigate the use of a menu box delivery service in the long day care setting compared to an online training module and menu planning tool tailored for long day care cooks.

What will my child be asked to do?
While nor you or your child will be actively participating in the study, your child may be involved in food intake data collection. On two separate days research staff will observe a full day of meals, including morning tea, lunch and afternoon tea to measure food intake using the plate wastage method. On these days, a trained dietitian will attend your centre for ~6 hours to complete data collection.

For plate waste measurements children will be asked to:

- Wear a study ID sticker for the day
- Allow the study researchers to photograph their plate before they start eating a meal/snack (no children will be photographed)
- Give their plate to the study researcher when they have finished eating their meal/snack (with staff assistance). At the end of the meal the plate will be photographed and weighed by researchers.

All study researchers will have current Working with Children Check and attend centres only on agreed dates.

Usual Food intake: To measure usual food intake, centre staff (teachers and co-educators) will be asked to complete the Child Food Record. The Child Food Record is a questionnaire tool designed to be used in the childcare setting to capture the individual child food intake reflecting the last month. This is completed in a questionnaire format and asks staff to report on usual food intake for the child in focus through observation.

We will also ask to centre to tell us the gender, date of birth (age) and Indigenous Status of children who are participating in the data collection.

What benefit will my child gain from being involved in this study?
While there are no immediate benefits for your child, the expected benefit of this study is to gather evidence to contribute the body of research that aims to improve the dietary behaviours and health of Australian children. The data from this study will provide valuable insights and contribution to the development of recommendations for the childcare sector about supporting a healthy food environment.

Will my child be identifiable by being involved in this study?
All the information that we collect about your child during the course of the research will be kept strictly confidential, with access restricted to relevant researchers. Your child's information will not be disclosed to any third party without your permission and your child will not be able to be identified in any reports or publications arising from this study. The parent company and names/ locations of the study centres will not be revealed in any publication arising from this research. Please note that no photographs will be taken of your child.

Are there any risks or discomforts if my child is involved?
There are no foreseeable discomforts, disadvantages, or risks for taking part in this study beyond those they encounter in their normal childcare day. Any unexpected discomforts, disadvantages, and risks, which arise during the research, should be brought immediately to our attention, Shabnam Kashef (7221 8273).

Does my child have to take part?
It is up to you to decide whether or not your child can be involved. If you are happy for your child to take part simply keep this information for your records. We will keep you informed of the study progress and your child's involvement via the centre newsletter and the centre director. If you decide you do not wish for your child to participate, please complete the slip attached and return to the centre or study staff. Once the study commences, your child can still withdraw from being involved in the study at any time without it affecting them in any way. You or your child does not have to give a reason.

How is this study funded?
This study is part of VegKIT, which is a five-year national project designed to address the significant issue of underconsumption of vegetables in children and will deliver free resources for educators, health professionals and research agencies.

VegKIT is brings together science and industry with CSIRO, Flinders University and Nutrition Australia to deliver evidence-informed nutrition promotion with real world impact. VegKIT is funded by Hort Innovation, using the vegetable research and development levy and contributions from the Australian Government.

For more information visit https://www.vegkit.com.au/

Thank you for taking the time to read this information sheet.

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee in South Australia (#8566). For queries regarding the ethics approval of this project please contact the Executive Officer of the Committee via telephone on +61 8 8201 3116 or email human.researchethics@flinders.edu.au

STUDY OPT OUT SLIP

If you are happy for your child to be involved in the study, you do not need to do anything. In summary, this means you have understood your child's participation in the study, Supporting Healthy Meals in Childcare. This means that:

- You have read the Parent Information Sheet
- The nature and purpose of the research project has been explained to you
- You understand the purpose of the research project and your child's involvement in it and you agree for your child to take part
- You understand that your child may withdraw from the research project at any stage and that this will not affect them in any way
- You understand that while information gained during the study may be published, your child will not be identified, and their personal results will remain confidential.

If you are happy for your child to be involved in the study, ignore this slip, you do not need to do anything. To indicate that you do not want your child to be involved in the Supporting Healthy Meals in Childcare remove this section and return to the centre reception or centre director.

Alternatively you can mail the slip to: Shabnam Kashef Flinders University, College of Nursing and Health Science, Sturt North (N315) GPO Box 2100, Adelaide 5001, South Australia, or scan and email to shabnam.kashef@flinders.edu.au

☐ (tick if applicable) I/We request that (write child's full name) _____
from (enter name of centre child attends) _____ not participate in the Supporting Healthy Meals in Childcare study

APPENDIX 10 CENTRE STAFF CONSENT FORM

CONSENT FORM FOR PARTICIPATION IN RESEARCH
Centre Staff Participation

Supporting Healthy Meals in Childcare

I ....., being over the age of 18 years, hereby consent to participate in the Supporting Healthy Meals in Childcare study.

1. I have read the information provided.
2. Details of procedures and any risks have been explained to my satisfaction.
3. I agree to audio recording of my interviewer administered questionnaire responses (applies to cook staff only)
4. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.
5. I understand that:
    - Participation in this study is entirely voluntary and I am free to withdraw from the at any time; and am free to decline to answer particular questions.
    - Whether I participate or not, or withdraw after participating, will have no effect on my current employment
    - I may ask that the audio recording (cook staff questionnaire interview) be stopped at any time, and that I may withdraw at any time from the session or the research without disadvantage.
    - While the information gained in this study will be published as explained, my participation and the centre's participation will be anonymous, and any individual information will remain confidential.
    - All records containing information about the centre and its staff and children will remain confidential and no information which could lead to the identification of any individual or centre will be released, unless required by law
6. Only the researchers on this project will have access to my research data and raw results; unless I explicitly provide consent for it to be shared with other parties. If the need to seek consent to share your research data with other parties does arise, I will be contacted by the researchers via phone or email
7. I have had the opportunity to discuss taking part in this research with a family member or friend.

Staff member signature……**Date**……..

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

Researcher's name…….....

Researcher's signature……..**Date**……

NB:	*Two signed copies should be obtained (one for researcher; one for participant). The copy retained by the researcher may then be used for participant review and approval of interview transcripts (point 8) where relevant.*

APPENDIX 11 STAFF FOLLOW UP QUESTIONNAIRES

COOK QUESTIONNAIRE
INTERVENTION: MENU BOX

To be administered by researcher as interviewer administered questionnaire

Length: 30 minutes **Interviewee:** Centre cook

Aim: To understand the **barriers and facilitator** around the application of a menu box delivery service straight to long day care.

Introduction

Thank you for agreeing to participate in this interview. I am interviewing you to understand your experience of using the menu box delivery service. The aim of the questionnaire is to understand your experiences with the menu boxes and recipes, so please feel free to add any additional details that I may not have specifically asked about, we want to know your feedback as the expert so any information you can provide will be very helpful.

There are no right or wrong answers to any of the questions, we are interested in your own honest feedback as you are the expert. With your permission, I would like to audio record the interview, so I don't miss any of your comments. The interview should take approximately half an hour.

I should also note that all responses will be kept confidential. This means that your de-identified interview responses will only be shared with research team and we will ensure that any information we include in any report from this study does not identify you as the respondent.

You may decline to answer any question or stop the interview at any time and for any reason. Participation in this study is voluntary and your decision to participate, or not participate, will not affect your position at [CENTRE NAME].

Are there any questions about what I have just explained?

May I start recording?

When recording commences, ask for name and verbal consent to recording interview.

PART 1 – THE MENU PACK USER GUIDE

The following questions will ask about how your feedback on the Menu Pack User Guide you received, such as whether you found it useful and if they were visually appealing.

Q1. I am going read out several statements about the Menu Pack User Guide. For each statement, please let me know whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree.

Interviewer: *repeat response options as you read each question*

	Strongly Disagree	**Disagree**	**Neutral**	**Strongly Agree**	**Agree**
a. The level of detail in the Menu Pack User Guide was appropriate ***Prompt:*** *was there enough detail to help you understand everything you need to know?*					
b. The Menu Pack User Guide and materials (e.g. recipes) useful					
c. The Menu Pack User Guide easy to use ***Prompt:*** *was it easy to use when you needed to find recipes, or find out how the boxes work?*					
d. The Menu Pack User Guide is visually appealing ***Prompt:*** *this refers to format of the pages, the colours, images and lay out of the pack.*					
e. The Menu Pack User Guide helped with the practical implementation of the menu boxes including **ordering and receiving menu boxes** ***Prompt:*** *Did you find the packs helpful in familiarising with the order and delivery of the menu boxes*					
f. The Menu Pack User Guide helped with the practical implementation of the menu box including **planning and preparing recipes**. ***Prompt:*** *Did you find the packs helpful in planning for and preparing the recipes*					

Q2. Overall, how satisfied were you with the Menu Pack User Guide?
Prompt: *taking into account the visual appeal, the information in the packs, how satisfied were you with the packs?*

a. Very satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Very dissatisfied

Q3. Can you tell me more about why you selected [*State Question 2 Response*]?

Q4. Do you have any other comments about the Menu Pack User Guide?

PART 2 – THE ORDER PROCESS

The following questions will ask about how your feedback on the **Order Process** including receiving the menu boxes and the form used to order substitutions for dietary requirements and items for breakfast and late snack.

Q5. Thinking about the process for ordering the overall, menu boxes, which involved providing attendance numbers for standard and vegetarians menu for Monday through to Thursday, overall, how satisfied were you with the process?

a. Very satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Very dissatisfied

Q6. Can you tell me more about why you selected [*State Question 5 Response*]?

The following questions are about the order forms you sent to the supplier each week to order additional items for dietary requirements, breakfast and late snack.

Q7. Overall, how satisfied were you with the process of using the order form?

Prompt: *considering the visual appeal and usability of the form, the level of detail, how satisfied were you with the order form process?*

a. Very satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Very dissatisfied

Q8. Can you tell me more about why you selected [*State Question 7 Response*]?

Q9. Did you have any difficulties using the Order Form?
Prompt: *such as not being able to find the foods you need, the process of filling out and sending the forms*

a. Yes
b. No

Q10. If yes, what difficulties did you experience? (Skip question if no)

PART 3 – THE MENU BOX DELIVERY OVERALL

Now I am going to ask some questions about the menu box delivery service overall.

Q11. Thinking about the time it took to prepare the **recipes** provided, how did you find the time it took?
Interviewer: *For example, you think the time was appropriate, too long or really fast?*

Q12. For the following statement, please tell me whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree. *"The Menu Box Delivery Service saved me time in **planning** my centre menu"*
Prompt: *compared to your usual practice, did the menu box delivery service save you time in planning the menu?*

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

Q13. For the following statement, please tell me whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree. *"The Menu Box Delivery Service saved me time in **ordering and implementing** my centre menu"*
Prompt: *compared to your usual practice, did the menu box delivery service save you time when it came to ordering foods and implementing the menu in your centre?*

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

Q14. Would you say the Menu Box Delivery Service made preparing the menu in your centre? (*Read out options*)
a. Easier than usual practice
b. Not very different to usual practice
c. More complicated than usual practice

Q15. I am going to read out a few more statements. These refer to the Menu Box Delivery Service, including the recipes. Similar to before, for each statement, please tell me whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree.
Interviewer: *repeat response options as you read each question*

	Strongly Disagree	Disagree	Neutral	Strongly Agree	Agree
a. If able to, my centre would continue to use the Menu Box Delivery Service					
b. I noticed an improvement in vegetable intake of children who attended the service when using the Menu Box Delivery Service					
c. I believe the children at the centre, benefitted from the Menu Box Delivery Service					
d. I would recommend the Menu Box Delivery Service to other centres					

Q16. Overall, how satisfied were you, overall, with the Menu Box Delivery Service?
Prompt: *taking into account the visual appeal, the information in the packs, how satisfied were you with the packs?*

a. Very satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Very dissatisfied

Q17. Can you tell me more about why you selected [*State Question 16 Response*]?

Q18. What did you find useful about the Menu Box Delivery Service?

Q19. Was there anything did you **NOT** find useful about the Menu Box Delivery Service?

Q20. Are there any improvements you would make to Menu Box Delivery Service?

Q21. Would you like to provide any further comments?

PART 4 – Menu Planning Guidelines

Thank you for your feedback so far. We are up to the final part of the questionnaire. The following questions are about the Victorian Menu Planning Guidelines for Long Day Care. As you may know, the menu and recipes used in the Menu Box Delivery were designed to meet these guidelines.

Your menu pack provided some information about the menu planning guidelines, you may or may not know the guidelines in detail, so there are no right or wrong answers.

Q22. I am going to read some more statements. These refer to the Menu Planning Guidelines. Similar to before, for each statement, please tell me whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree.

Interviewer: *repeat response options as you read each question*

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. I am aware of the content of the (Victorian) Menu Planning Guidelines for Long Day Care					
b. I know how to plan a menu according to the Menu Planning Guidelines					
c. I have the skills needed to plan a menu according to the Menu Planning Guidelines					
d. I have been able to practice planning a menu according to the Menu Planning Guidelines					
e. In the centre where I work, all necessary resources (e.g. computer) are available to plan a menu according to the Menu Planning Guidelines					
f. I have support from the management of my centre to plan and implement a menu according to the Menu Planning Guidelines					
g. I have support from other staff at my centre to plan and implement a menu according to the Menu Planning Guidelines					
h. The centre where I work for provides **sufficient time** for me to plan a menu according to the Menu Planning Guidelines					
i. The centre where I work provides sufficient **budget** for me to plan a menu according to the Menu Planning Guidelines					
j. Families of children attending the centre where I work are supportive of me planning a menu according to the Menu Planning Guidelines					
k. I believe planning a menu according to the Menu Planning Guidelines will lead to benefits for the children who attend the service					

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
l. In my view, planning a menu according to the Menu Planning Guidelines, is useful					
m. It is my responsibility to plan a menu according to the Menu Planning Guidelines					
n. Planning a menu according to the Menu Planning Guidelines, is part of my role					
o. I am confident that I can plan a menu according to the Menu Planning Guidelines					

Thank you for your time.

DIRECTOR QUESTIONNAIRE
INTERVENTION: MENU BOX

To be administered by researcher at follow up data collection with centre director. If director has changed since study commencement, please note date of change below. Advise director to answer to best of ability.

Introduction

Thank you for participating in the Supporting Healthy Meals in Childcare. This questionnaire will be used to understand your experience using the menu box delivery service your centre. There are no right or wrong answers to any of the questions, we are interested in your own honest feedback.

I should also note that all responses will be kept confidential. This means that your de-identified interview responses will only be shared with research team and we will ensure that any information we include in any report from this study does not identify you or your centre as the respondent. You are free to decline answering any question for any reason.

Q1. Overall, how satisfied were you, overall, with the Menu Box Delivery Service? (Circle response)

a. Very satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Very dissatisfied

Q2. I will be reading out a several statements that refer to the menu box delivery service, including the recipes. For each statement, please tell me whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. If able to, my centre would continue to use the **menu box delivery service.**					
b. I noticed an improvement in vegetable intake of children who attended the service when using the **menu box delivery service**					
c. I believe the children at the centre, benefitted from the **menu box delivery service**					
d. I would recommend the **menu box delivery service** to other centres					

Q3. Thinking about the menu box delivery service and the potential menu planning time saved, how much are you willing to spend on the menu boxes?

Q4. Would you like to provide any further comments?

COOK QUESTIONNAIRE
MENU PLANNING

To be administered by researcher as interviewer administered questionnaire

Length: 30 minutes **Interviewee:** Centre cook

Aim: To understand the barriers and facilitators around the application of a menu planning tool to plan long day care service menus.

Introduction

Thank you for agreeing to participate in this interview. We are interviewing you to understand your experience of completing the menu planning tool and online training module recently and how we can improve these resources.

There are no right or wrong answers to any of the questions, we are interested in your own honest feedback as you are the expert. With your permission, I would like to audio record the interview, so I don't miss any of your comments. The interview should take approximately half an hour.

I should also note that all responses will be kept confidential. This means that your de-identified interview responses will only be shared with research team and we will ensure that any information we include in any report from this study does not identify you as the respondent.

You may decline to answer any question or stop the interview at any time and for any reason. Participation in this study is voluntary and your decision to participate, or not participate, will not affect your position at [CENTRE NAME].

Are there any questions about what I have just explained?

May I start recording?

When recording commences, ask for name and verbal consent to recording interview

PART 1 – Cook Training

The following questions will ask about your experience of completing the Online Cook Training for Long Day Care.

Q1. Did you complete the Online Cook Training?

***Prompt if needed**: did you complete all of the module; did you start the module*

a. Yes, I completed the training module
b. No, but I completed most of the module
c. No, I started, but never completed
d. No, I never started

Q2. If you did not complete the training, could you explain a little more about why? (Skip if answered yes)
***Prompt**: what prevented you from completing it?*

Q3. Did you have enough time to complete the Online Cook Training?

a. Yes
b. No

Q4. If no, can you tell me more about what prevented you from having enough time? (Skip if answered yes)

***Prompt:** why didn't you have enough time*

Q5. Thinking about the time you had to complete the training module, in what part of your day did you make time to the Online Cook Training? For example, did you have time at work allocated to doing the training, or did you have to do it in your own time? (Open ended response, interviewer to select all that apply)

Prompt if needed: *read out options below*

a. During work hours – I was allocated time by my manager to complete
b. During work hours – but I was not allocated time by my manager to complete (***prompt:*** *did you need to fit it around your day at work)*
c. Outside of my usual work hours (i.e. I stayed at work longer)
d. Outside of my usual work hours at home (i.e. completed in own time at home)

Q6. How much time do you think it took, overall, for you to complete the Online Cook Training?

Q7. I am going to read some more statements about the Online Cook Training. Similar to before, for each statement, please tell me whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree.

Interviewer: *repeat response options as you read each question*

	Strongly Disagree	Disagree	Neutral	Strongly Agree	Agree
a. I would recommend the Online Cook Training to other centres					
b. My centre would continue to use the Online Cook Training to plan menus.					
c. Using the Online Cook Training is an acceptable training tool for cooks at this centre					
d. I believe the children at the centre, benefitted from the use of the Online Cook Training					

Q8. Overall, how satisfied were you, overall, with the Online Cook Training?

a. Very satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Very dissatisfied

Q9. Can you tell me more about why you selected [*State Question 8 Response*]?

_____

_____

_____

_____

PART 2 –Menu Assessment Tool

Thank you for your feedback! This next part of the interview will ask about how you found the Menu Assessment Tool.

Q10. Did you use the Menu Assessment Tool tool to assess your menu?

Interviewer: *Select response below that fits best.*

Prompt if needed: *Read out responses*

a. Yes, used The Menu Assessment Tool and assessed menu
b. No, started, but never completed
c. No, never started

Q11. How many weeks of your menu did you asses using The Menu Assessment Tool?
Interviewer: *Open ended question, full menu, or started X weeks and did not complete. Note if it was the full menu e.g. 4 weeks of 4 week menu.*

Q12. If you did not use The Menu Assessment Tool, or continue using it, could you tell me a little more about why? (Short Answer)
Interviewer: *skip if answered Yes (a) to Question 10*

Q13. Did you modify your menu after using The Menu Assessment Tool to assess your menu?

a. Yes, I modified my menu
b. No, I did not modify my menu
c. NA – did not use The Menu Assessment Tool

Q14. If you selected (b), i.e. did not modify the menu, could you explain a little more about why not?

Q15. Did you have enough time to assess your centre menu using The Menu Assessment Tool?

a. Yes
b. No

Q16. If no, can you tell me more about what prevented you from having enough time?
Prompt: *why didn't you have enough time*

Q17. Thinking about the time you had to use The Menu Assessment Tool, in what part of your day did you make time assess your menu using The Menu Assessment Tool? For example, did you have time at work allocated to doing the training, or did you have to do it in your own time? (Open ended response, interviewer to select all that apply)

Prompt if needed: *read out options below*

a. During work hours – I was allocated time by my manager to complete
b. During work hours – but I was not allocated time by my manager to complete (***prompt:*** *did you need to fit it around your day at work)*
c. Outside of my usual work hours (i.e. I stayed at work longer)
d. Outside of my usual work hours at home (i.e. completed in own time at home)
e. Not applicable, did not assess menu.

Q18. How much time do you think it took, overall, for you to assess your menu using The Menu Assessment Tool?

Q19. I am going to read some more statements about The Menu Assessment Tool. Similar to before, for each statement, please tell me whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree.

Interviewer: *repeat response options as you read each question*

	Strongly Disagree	Disagree	Neutral	Strongly Agree	Agree
I would recommend the Menu Assessment Tool to other centres					
My centre would continue to use the Menu Assessment Tool to plan menus.					
Using the Menu Assessment Tool is an acceptable method for assessing our services menu compliance against the dietary guidelines					
I believe the children at the centre, benefitted from the use of Menu Assessment Tool					

Q20. Overall, how satisfied were you, overall, with The Menu Assessment Tool?

a. Very satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Very dissatisfied

Q21. Can you tell me more about why you selected [*State Question 20 Response*]?

PART 3 – GUIDELINES

Thank you for your feedback so far. We are up to the final part of the questionnaire. The following questions are about the Victorian Menu Planning Guidelines for Long Day Care. You may or may not know the guidelines in detail, so there are no right or wrong answers.

Q22. I am going to read some more statements. These refer to the Menu Planning Guidelines. Similar to before, for each statement, please tell me whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree.

Interviewer: *repeat response options as you read each question*

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**StronglyAgree**
a. I am aware of the content of the (Victorian) Menu Planning Guidelines for Long Day Care					
b. I know how to plan a menu according to the Menu Planning Guidelines					
c. I have the skills needed to plan a menu according to the Menu Planning Guidelines					
d. I have been able to practice planning a menu according to the Menu Planning Guidelines					
e. The organisation where I work for provides sufficient time for me to plan a menu according to the Menu Planning Guidelines					
f. In the centre where I work, all necessary resources (e.g. computer) are available to plan a menu according to the Menu Planning Guidelines					
g. I have support from the management of my centre to plan and implement a menu according to the Menu Planning Guidelines					
h. I have support from other staff at my centre to plan and implement a menu according to the Menu Planning Guidelines					
i. The centre where I work for provides **sufficient time** for me to plan a menu according to the Menu Planning Guidelines					

	Strongly Disagree	Disagree	Neutral	Agree	StronglyAgree
j. The centre where I work provides sufficient **budget** for me to plan a menu according to the Menu Planning Guidelines					
k. Families of children attending the centre where I work are supportive of me planning a menu according to the Menu Planning Guidelines					
l. I believe planning a menu according to the Menu Planning Guidelines will lead to benefits for the children who attend the service					
m. In my view, planning a menu according to the Menu Planning Guidelines, is useful					
n. It is my responsibility to plan a menu according to the Menu Planning Guidelines					
o. Planning a menu according to the Menu Planning Guidelines, is part of my role					
p. I am confident that I can plan a menu according to the Menu Planning Guidelines					

PART 4 – OVERALL

Thank you for your responses. We are now at the last part of the questionnaire. These following questions will ask you how you found the Online Cook Training and The Menu Assessment Tool overall.

Q23. What did you find useful about the Cooks Training Module and Menu Assessment Tool?

Q24. Was there anything you did you **NOT** find useful about the Cooks Training Module and Menu Assessment Tool?

Q25. Before we finish, do you have any further comments?

Thank you for your time today.

DIRECTOR FOLLW-UP QUESTIONNAIRE
MENU PLANNING

To be administered by researcher at follow up data collection with centre director. If director has changed since study commencement, please note date of change below. Advise director to answer to best of ability.

Introduction

Thank you for participating in the Supporting Healthy Meals in Childcare. This questionnaire will be used to understand your experience using the menu planning tool and online cooks training tool at your centre.There are no right or wrong answers to any of the questions, we are interested in your own honest feedback.

I should also note that all responses will be kept confidential. This means that your de-identified interview responses will only be shared with research team and we will ensure that any information we include in any report from this study does not identify you or your centre as the respondent. You are free to decline answering any question for any reason.

Q1. I will be reading out a several statements that refer to the **Online Cook Training**. For each statement, please tell me whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree.
Interviewer: *repeat response options as you read each question*

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. I would recommend the Online Cook Training to other centres					
b. My centre would continue to use the Online Cook Training to plan menus.					
c. Using the Online Cook Training is an acceptable training tool for cooks at this centre					
d. I believe the children at the centre, benefitted from the use of the Online Cook Training					

Q2. Overall, how satisfied were you, overall, with the **Online Cook Training**? (Circle response)

a. Very satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Very dissatisfied

Q3. I will now read out several statements that refer to the **Menu Assessment Tool.**. For each statement, please tell me whether you: Strongly agree, Agree, Neutral, Disagree, Strongly Disagree.

Interviewer: *repeat response options as you read each question*

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. I would recommend the Menu Assessment Tool to other centres					
b. My centre would continue to use the Menu Assessment Tool to plan menus.					
c. Using the Menu Assessment Tool is an acceptable method for assessing our services menu compliance against the dietary guidelines					
d. I believe the children at the centre, benefitted from the use of Menu Assessment Tool					

Q4. Overall, how satisfied were you, overall, with **the Menu Assessment Tool**? (Circle response)

a. Very satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Very dissatisfied

Q5. Would you like to provide any further comments?

Thank you for your time.

APPENDIX 12 ECONOMIC EVALUATION SENSITIVITY ANALYSES

Cost-effectiveness Analysis ICERs

Table A1. Summary of CEA, bootstrapped ICER and 95% confidence Intervals for all cost scenarios

	ICER	95% CI
Mean serves of vegetables and legumes provided on menu at follow up		
Cost at study period	$5,983	$4,697, $7,264
Cost with CPI	$6148	$4,764, $7,589
Cost with CPI and supermarket costing**	$3,443	$2,466, $4,428
Cost at study period and supermarket costing**	$3,597	$2,570, $4,575
*Median child vegetable provision at follow up**		
Cost at study period	$57,864	–$69,911, $70,314
Cost with CPI	$68,799	–$73,057, $69,521
Cost with CPI and supermarket costing**	$25,045	–$35,270, $37,689
Cost at study period and supermarket costing**	$32,455	–$44,225, $43,411
*Median child vegetable consumption at follow up**		
Cost at study period	$73,439	–$853,057, $389,478
Cost with CPI	$75,940	–$35,213, $436,152
Cost with CPI and supermarket costing**	$41,900	–$18,838, $214,028
Cost at study period and supermarket costing**	$45,416	–$21,071, $408,855

*Re-ordered 95% confidence intervals reported using the Bang and Chao (2012) method
**Intervention group invoices with chain supermarket costing
Abbreviations: CI, confidence interval; CPI, Consumer Price Index; ICER, incremental cost-effectiveness ratio

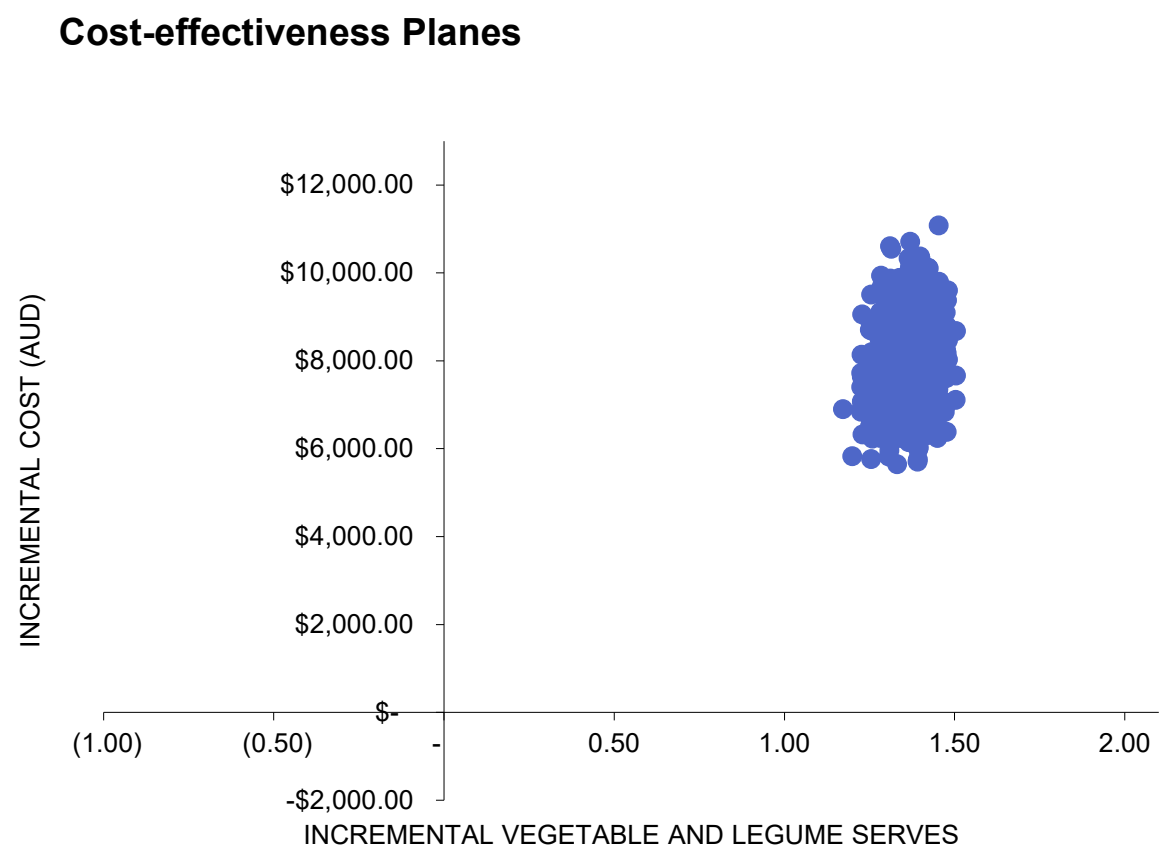

Figure A1. Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for mean serves of vegetable and legume on menu with CPI applied: intervention (costed for large chain supermarket) *v*. comparison (standard practice) centres

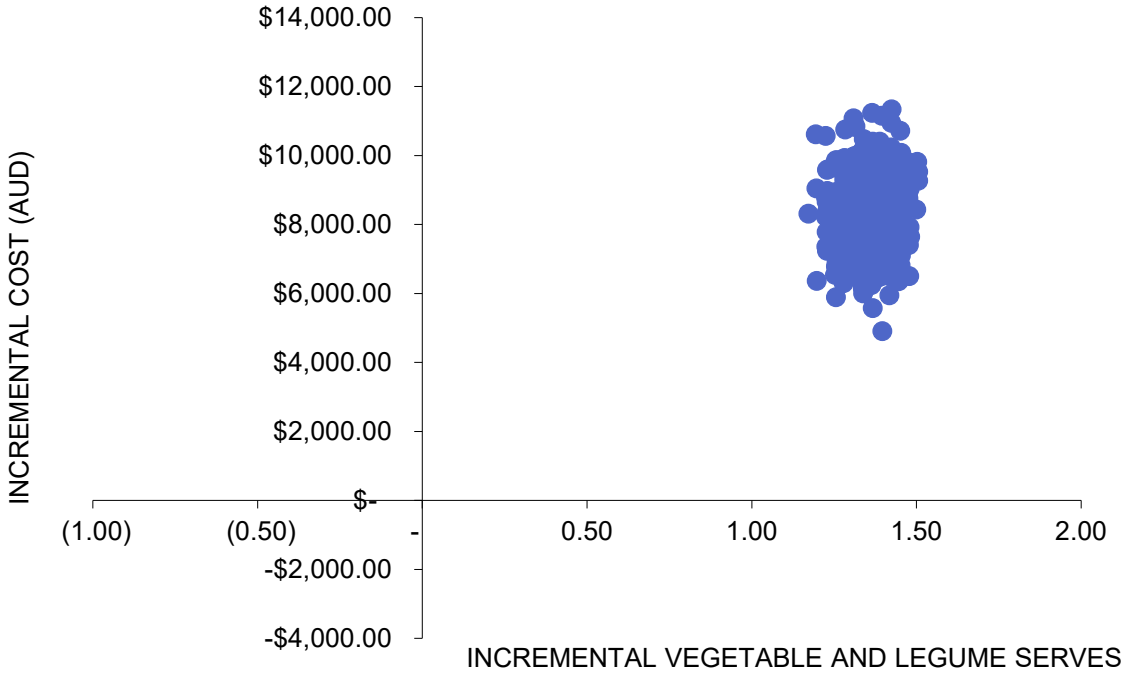

Figure A2. Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for mean serves of vegetable and legume on menu with CPI applied: intervention *v*. comparison (standard practice) centres

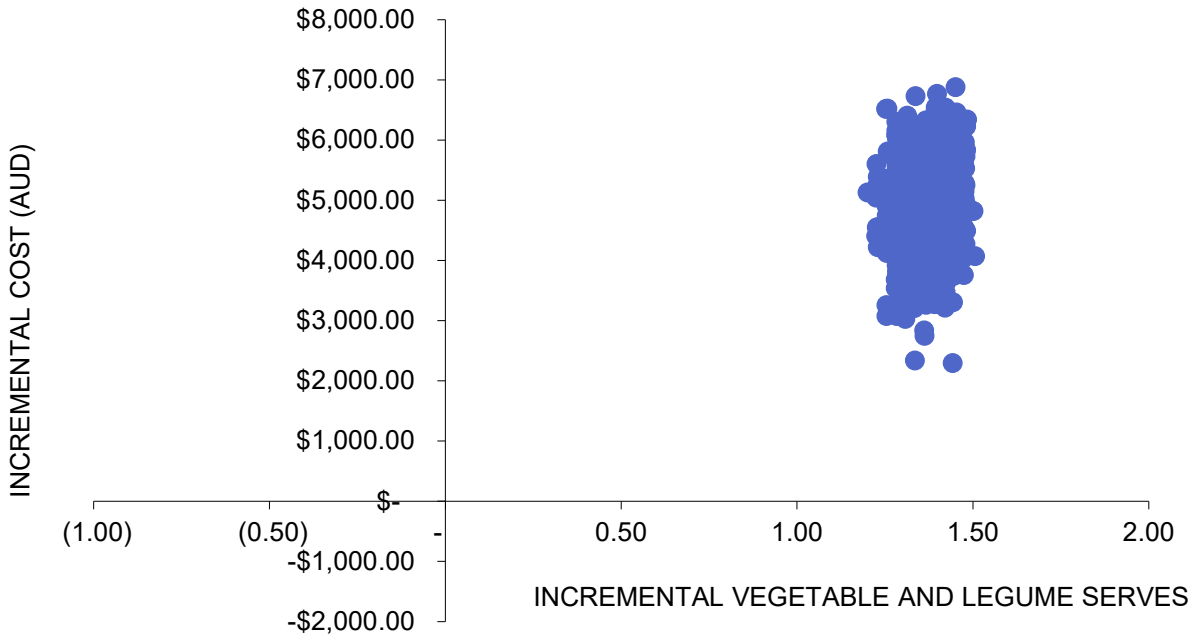

Figure A3. Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for mean serves of vegetable and legume on menu: intervention (costed for large chain supermarket) *v*. comparison (standard practice) centres

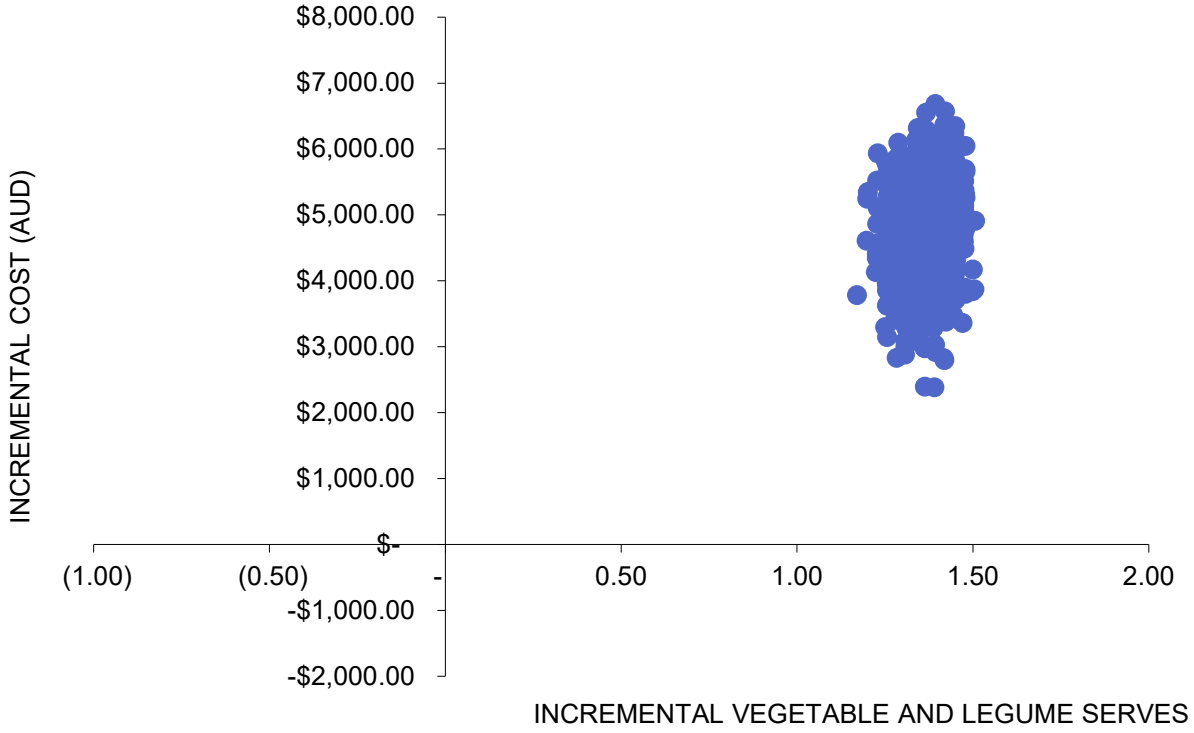

Figure A4. Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for mean serves of vegetable and legume on menu with CPI applied: intervention (costed for large chain supermarket) *v*. comparison (standard practice) centres

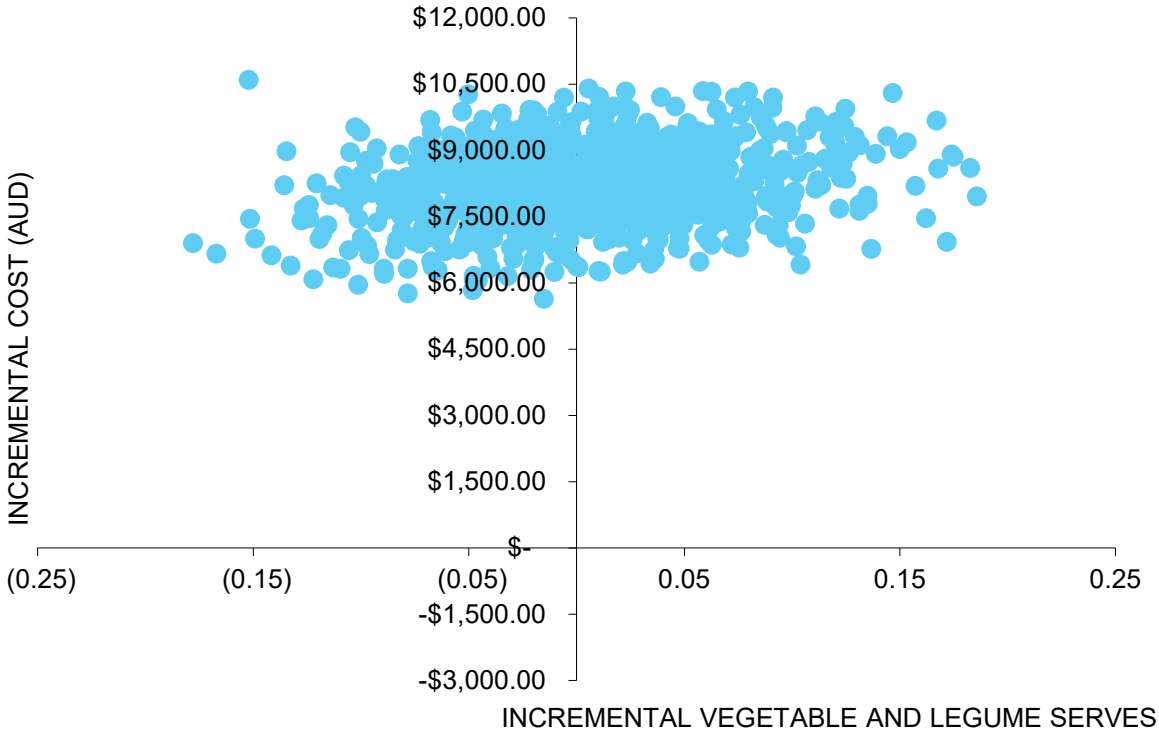

Figure A5 Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for child provision of vegetable and legume serves: intervention *v*. comparison (standard practice) centres

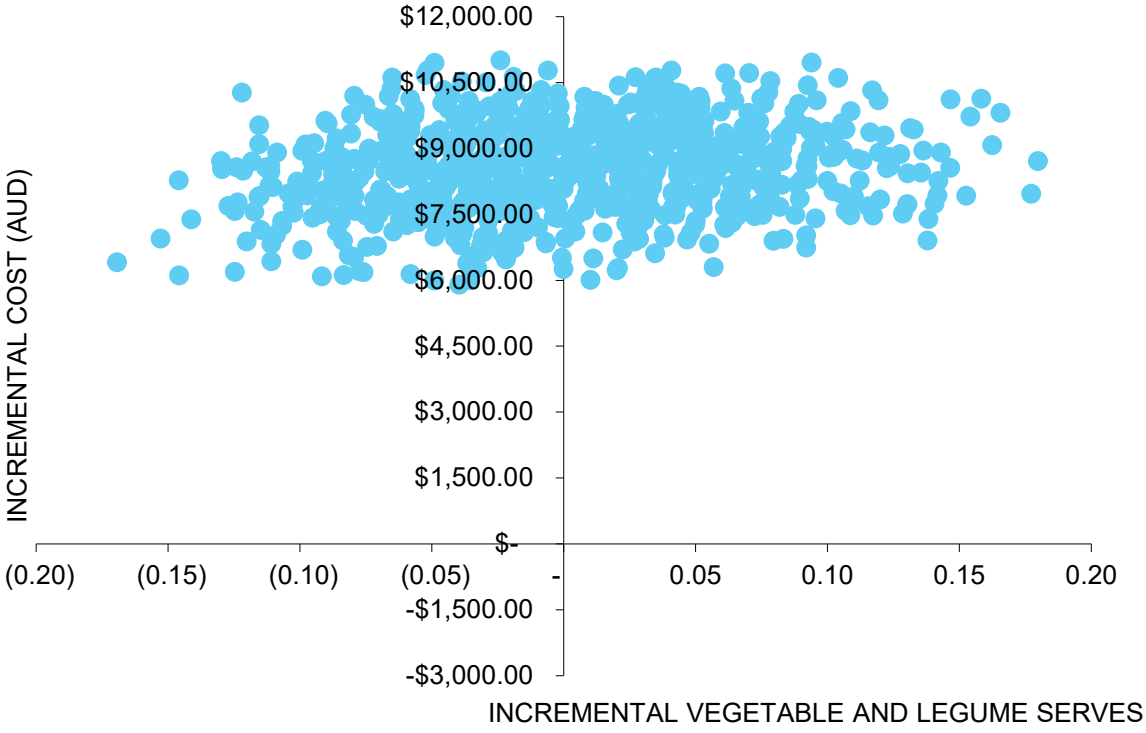

Figure A6 Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for child provision of vegetable and legume serves, with CPI applied: intervention *v*. comparison (standard practice) centres

Figure A7 Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for child provision of vegetable and legume serves: intervention (costed for large supermarket chain) *v*. comparison (standard practice) centres

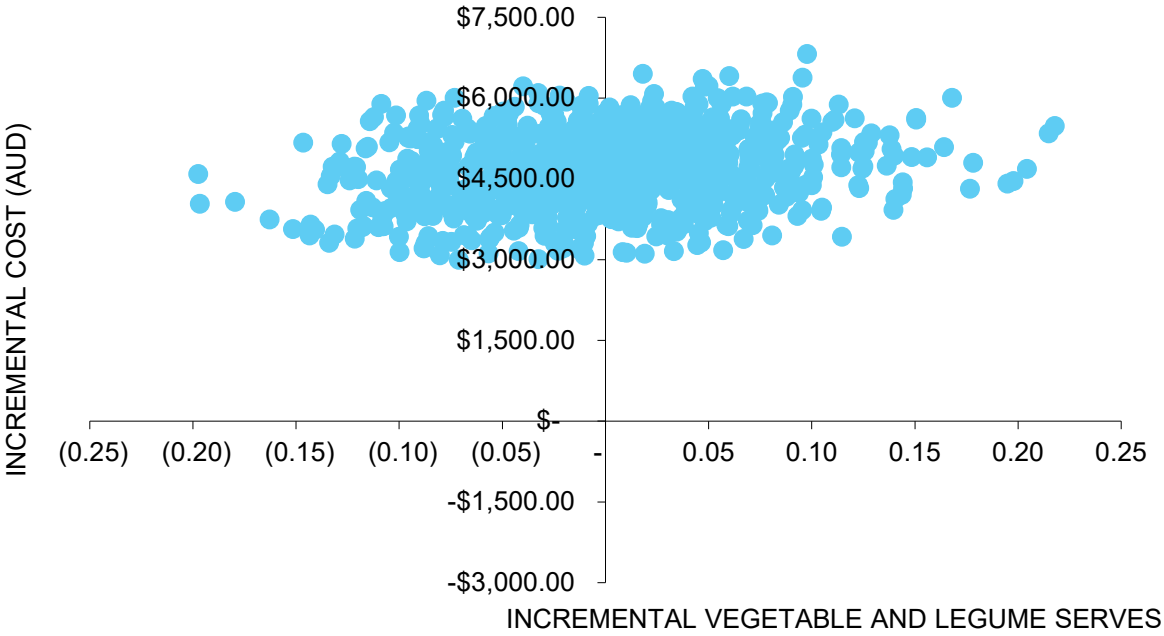

Figure A8 Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for child provision of vegetable and legume serves, with CPI applied: intervention (costed for large supermarket chain) *v*. comparison (standard practice) centres

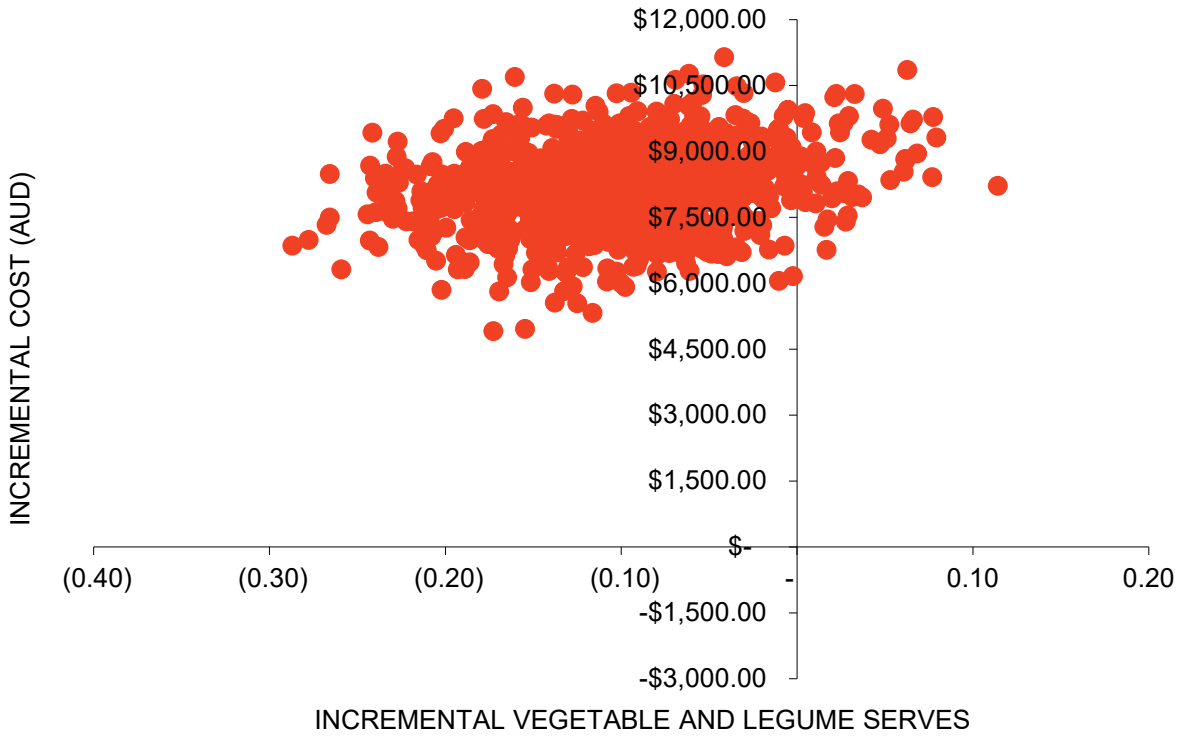

Figure A9 Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for child consumption of vegetable and legume serves: intervention *v*. comparison (standard practice) centres

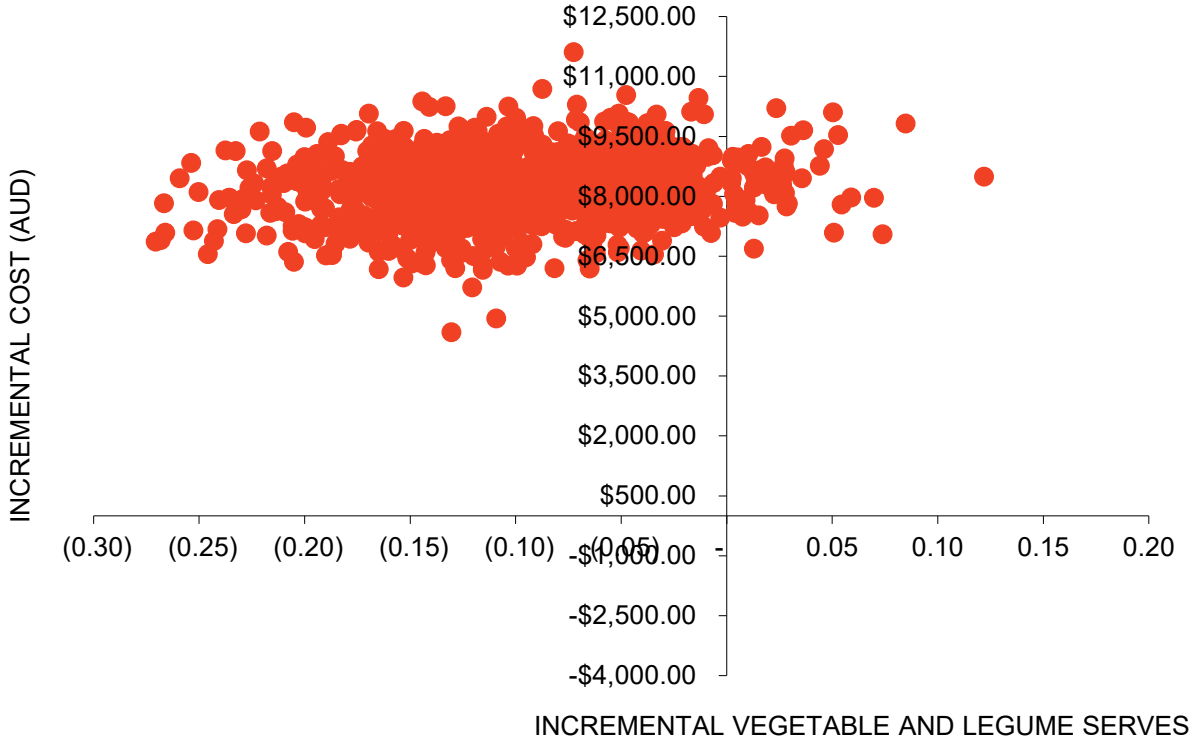

Figure A10 Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for child consumption of vegetable and legume serves, with CPI applied: intervention *v*. comparison (standard practice) centres

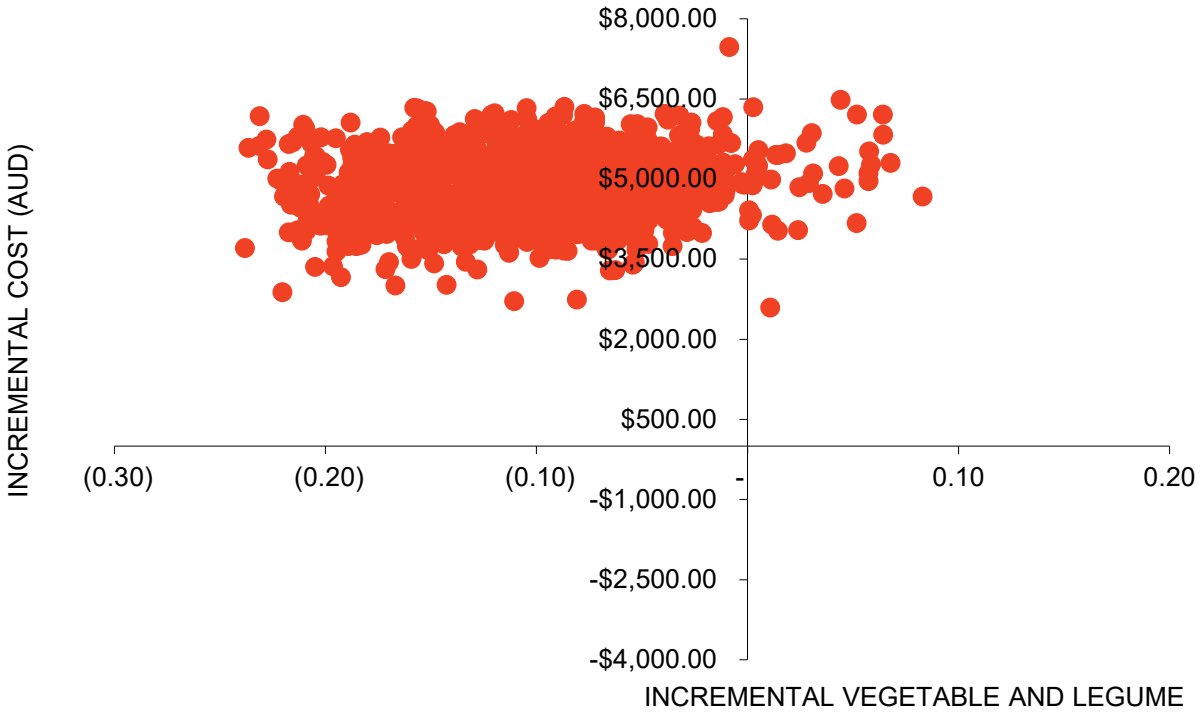

Figure A11 Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for child consumption of vegetable and legume serves: intervention (costed for large supermarket chain) *v*. comparison (standard practice) centres

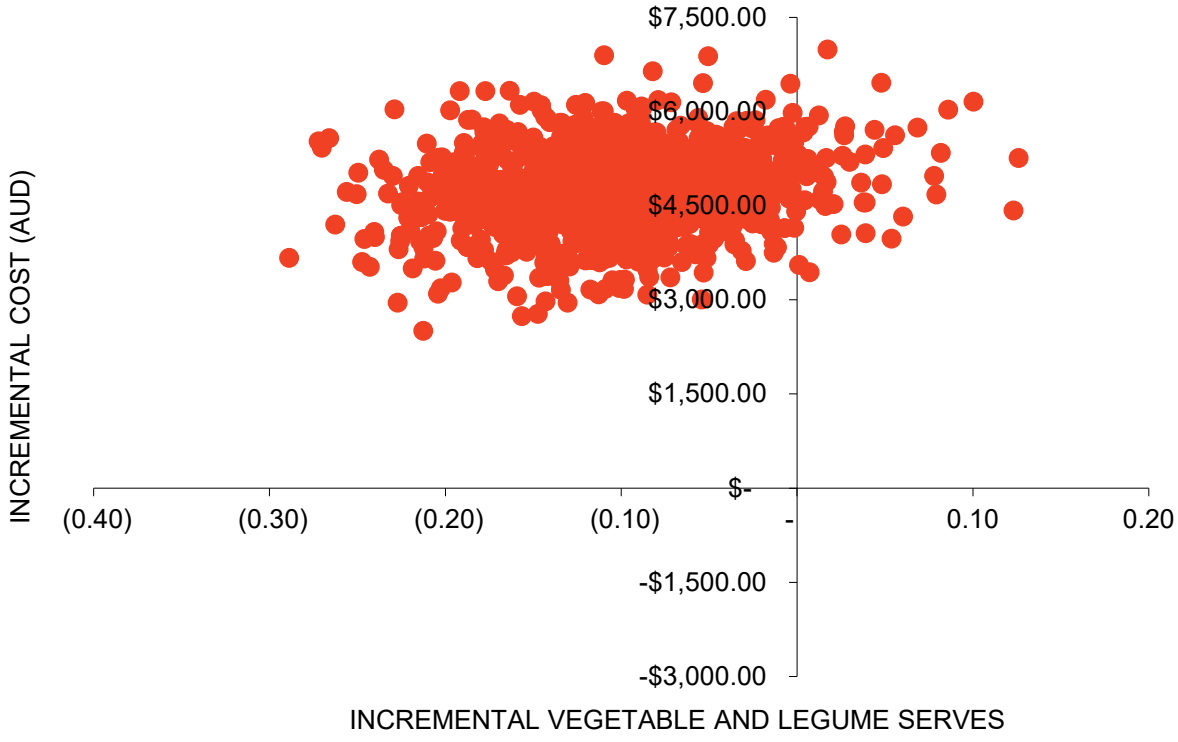

Figure A12 Bootstrapped results, 1,000 iterations, on the cost-effectiveness plane for child consumption of vegetable and legume serves, with CPI applied: intervention (costed for large supermarket chain) *v*. comparison (standard practice) centres

APPENDIX 13 COST-CONSEQUENCE ANALYSIS WITH CPI ADDED

Table A2. CCA of eight-week intervention period, sensitivity analysis with 3.8% CPI applied to cost values[a221]

		Comparison			Intervention			Difference	
	Target serves	Mean	95%CI		Mean	95%CI		Mean	95%CI
Cost									
Intervention cost*	-	$77	($68, $86)		$127	($127, $127)		$50	($41, $60)
Cook labour cost**	-	$377	($360, $395)		$338	($330, $345)		-$39	(-$59, -$21)
Menu ingredient cost	-	$5,330	($5173, $5,475)		$13,825	($13,011, $14,588)		$8,495	($7,692, $9,294)
Total cost	-	$5,808	($5,660, $5,949)		$14,246	($13,491, $15,048)		$8,438	($7,658, $9,250)
Consequence									
Menu compliance, mean serves									
Vegetable and legumes	1–1.5	1.0	(0.9, 1.0)		2.3	(2.3, 2.3)		1.3	(1.3, 1.4)
Fruit	1	1.6	(1.5, 1.7)		1.1	(1.1, 1.1)		-0.5	(-0.6, -0.4)
Cereals and breads	2	2.3	(2.3, 2.4)		2.3	(2.3, 2.3)		0.0	(-0.1, 0.0)
Dairy and alternatives	2	2.0	(2.0, 2.1)		1.9	(1.9, 1.9)		-0.1	(-0.2, -0.0)
Meat and alternatives	1	0.6	(0.6, 0.6)		1.4	(1.4, 1.4)		0.8	(0.8, 0.8)
Food centres provision at follow up, median serves									
Vegetable and legumes	1–1.5	0.9	(0.8, 0.9)		0.8	(0.8,0.9)		0.0	(0.0, 0.1)
Fruit	1	2.2	(1.0, 2.5)		0.6	(0.6, 0.6)		-1.6	(-1.9, -1.3)
Cereals and breads	2	2.0	(1.9, 2.0)		1.2	(1.2, 1.2)		-0.8	(-0.8, -0.7)
Dairy and alternatives	2	1.0	(0.8, 1.1)		1.0	(1.0, 1.1)		0.1	(-0.1, 0.3)
Meat and alternatives	1	0.3	(0.3, 0.4)		0.6	(0.5, 0.6)		0.2	(0.1, 0.3)
Food centres consumption at follow up, median serves									
Vegetable and legumes	1–1.5	0.6	(0.5, 0.6)		0.5	(0.4, 0.5)		-0.1	(-0.2, 0.0)
Fruit	1	1.1	(1.1, 1.2)		0.4	(0.4, 0.4)		-0.8	(-0.8, -0.7)
Cereals and breads	2	1.5	(1.5, 1.5)		0.9	(0.9, 1.0)		-0.6	(-0.6, -0.6)
Dairy and alternatives	2	0.9	(0.7, 1.0)		0.7	(0.6, 0.8)		-0.2	(-0.3, 0.0)
Meat and alternatives	1	0.2	(0.2, 0.3)		0.3	(0.3, 0.3)		0.1	(0.0, 0.1)

[a]Data presented as mean and 95% confidence intervals

* Intervention cost: cost of Online Cook Training and Menu Assessment Tool in comparison centres, cost of menu licence in intervention groups (*n* = 1 centre cooks did not complete cook training, excluded from cost estimations)

**Not including labour to complete Online Cook Training and use Menu Assessment Tool (comparison centres only)

APPENDIX 14 BUDGET IMPACT ANALYSIS

Table A3 BIA of comparison centres *v*. intervention centres for one-year time horizon in AUD

Cost scenario	Comparison		Intervention		Assumptions for scenario
	Centre (*n* = 1)	Whole of Service (*n* = 25)	Centre (*n* = 1)	Whole of Service (*n* = 25)	
Scenario 1*	$43,448	$1,086,200	$89,341	$2,233,528	Intervention menu planning time reduction of 50%, 30% staff turnover and Menu Assessment Tool time reduction of 25%
Scenario 1A*	$45,099	$1,127,476	$92,736	$2,318,402	Intervention menu planning time reduction of 50%, 30% staff turnover and Menu Assessment Tool time reduction of 25% and CPI applied
Scenario 2**	$42,6546	$1,066,363	NA	NA	Intervention menu planning time reduction of 50%, 30% staff turnover and Menu Assessment Tool time reduction of 50%
Scenario 2A**	$44,275	$1,106,885	NA	NA	Intervention menu planning time reduction of 50%, 30% staff turnover and Menu Assessment Tool time reduction of 50% and CPI applied
Scenario 3	NA	NA	$68,075	$1,701,866	Menu costed for large supermarket chain, 30% staff turnover
Scenario 3A	NA	NA	$68,182	$1,704,541	Menu costed for large supermarket chain, 30% staff turnover with CPI applied