2021

Healthy eating, physical activity and sedentary behaviour in family day care

Erin Myee Kerr

Healthy eating, physical activity and sedentary behaviour in family day care

Erin Myee Kerr
Bachelor of Nutrition and Dietetics (Class I Honours)

Supervisors:
Senior Professor Anthony Okely, Associate Professor Bridget Kelly and Dr Megan Hammersley

This thesis is presented as part of the requirement for the conferral of the degree:
Doctorate of Philosophy

This research has been conducted with the support of the Australian Government Research Training Program Scholarship

University of Wollongong
School of Health and Society

December 2021

Dedication

This thesis is dedicated to my loving parents, Jenny and Craig. Thank you for a life full of love and support.

Acknowledgments

I would like to express my heartfelt gratitude to my supervisors, Senior Professor Tony Okely, Associate Professor Bridget Kelly and Dr Megan Hammersley. Thank you for your encouragement, guidance and expertise over these past four years. Each of you has helped me grow and improve my research skills through your insightful and constructive advice and discussions. Thank you for always being approachable, kind and supportive during this challenging journey.

In addition to my supervisors, I would like to extend my sincere thanks to the other members of the FDC advisory team - Sarah Ryan, Dr Jenny Norman, Lara Hernandez, Dr Susan Furber, Julie Parkinson, Lisa Franco, Cecilia Vuong, and Karen Wardle. Thank you for all your valuable contributions to the project – I appreciate your time, feedback and expertise. Big thank you to Sarah; you have been an outstanding project manager and a good friend. Jenny, thank you for your diligence when reviewing my work and always extending an invitation to discuss feedback. I would also like to acknowledge the Prevention Research Support Program who provided funding for this project.

A very special thank you to all the FDC educators, families and services providers who participated in this project and made this research possible. I would also like to gratefully acknowledge and thank Emma, Sarah, Kaitlyn and Andrew for your help with recruitment and data collection. My particular thanks to Emma, who was involved from the beginning. I would also like to thank Associate Professor Marijka Batterham for your statistical expertise and Mohamed Basheer for your assistance with preparing the accelerometry data. Thank you Anne-Maree and Megan for your support during our writing sessions throughout lockdown – your encouragement and words of wisdom motivated me to progress my writing and finish my thesis.

When I embarked on this journey I could not have imagined all the incredible friendships and experiences I would make. I would like to thank all my wonderful Early Start friends and colleagues for their support and encouragement – Ruth, Sarah, Amy, Linda, Kar Hau, Sumantla, Byron, Karen, Soo Jin, Kalina, Katharina, Lyndel, Yvonne, Michele, Penny, Karel, Laura, Anne-Maree, Dylan, Rachel, Jenny, Megan, Bridget and Tony. I have made many wonderful memories - mountain walks led by Jenny, pizza parties at Karen's, dumpling nights at Ruth's, office handball organised by Byron, and coffee walks with Kar Hau and Ruth. A special mention to my dear friend Ruth – for all the laughs, love and support. I will treasure our friendship forever.

Finally, thank you to the most important people in my life, my wonderfully supportive family and friends - Scott, Meg, Aunty Marg and Sal, Steph, Michelle, and all my other aunties, uncles and cousins. Special mention to my gorgeous nieces and nephews for lighting up my life. Thank you Ryan for your continual encouragement through the highs and lows. After four years, you have remained genuinely interested in my research and believed in me when I doubted myself.

Finally, I would not be here without my wonderful mum and dad. Words cannot express how grateful I am for your unconditional love and support. Thank you for everything you do for me and for always encouraging me to do my best.

Abstract

Background

In Australia, family day care (FDC) services operate under a unique two-tier structure whereby the service provider gives overarching organisational and policy support, and educators provide education and care to children in their homes. FDC services can influence children's healthy eating, physical activity and sedentary behaviours. However, research on Australian FDC services is limited. *Munch & Move* is a state-wide obesity prevention program offered to FDC service providers in NSW; however, the program has only been evaluated in centre-based Early Childhood Education and Care services. The overall aim of this thesis was to investigate how FDC services promote healthy eating and physical activity for children aged 0-5 years at the service provider and educator levels of the FDC sector. In addition, this thesis aimed to examine the associations with the food provided to children, educators' feeding practices, and children's physical activity and sedentary behaviours.

Methods

First, a systematic literature review investigated the factors associated with children's dietary intake, physical activity and sedentary behaviour in FDC. Following this, FDC service providers from two large geographic areas in New South Wales, Australia, were invited to participate in a survey and policy review to examine the effect of *Munch & Move* training on existing policies, resources and professional development used by service providers. Finally, an observation study was conducted with FDC educators using the Environment Policy Assessment and Observation tool. The food provided was also assessed using weighed food records, and children's time spent in sedentary, light and moderate- to vigorous-intensity physical activity was measured using Actigraph GT3X+ accelerometers.

Results

The systematic review included 16 studies; six assessed associations with children's dietary intake, and 10 assessed physical activity and sedentary behaviours. Most studies were conducted in the US (n=3), and few studies assessed the same correlates. Findings from the survey and policy audit revealed service providers trained in *Munch & Move* were more likely to offer professional development to educators on healthy eating (90% vs. 25%, p = 0.00) and physical activity (90% vs 13%, p = 0.00), and to have more comprehensive nutrition policies (average policy score out of 17: 11.8 vs. 9.0, p = 0.03).

Full-day observations were conducted with 33 educators and 105 children aged 11 months to 5 years. Less than one-quarter of children were provided with 50% of their recommended food group servings for vegetables (17%), lean meat and meat alternatives (19%), and dairy (25%); 71% of children were provided with excess discretionary foods. Educators were observed using positive and negative feeding practices during mealtimes but did not consistently use positive feeding practices. Just over half of the children (56%) in FDC met the Institute of Medicine recommendations of 15 minutes of total physical activity per hour in FDC. Healthy food provision scores were significantly associated with the children's age (younger) (p= 0·01), lower socio-economic status (p= 0·03) and the type of main meal provided (mixed dish vs. sandwich) (p= 0·01). No associations were found with educators' feeding practices or children's physical activity levels. However, time provided for physical activity was positively associated with children's physical activity with a medium effect size.

Discussion

This thesis is the first known Australian study to objectively assess the nutrition and physical activity environments in FDC services and contributes to the literature on

healthy eating, physical activity and sedentary behaviour in FDC services. The findings highlighted modifiable practices to target at the service provider and educator level to improve children's healthy eating and physical activity behaviours. This research can inform the enhancement of the *Munch & Move* program by developing additional policies, resources and professional development tailored to FDC services.

Certification

I, Erin Kerr, declare that this thesis submitted in fulfilment of the requirements for the conferral of the degree Doctorate of Philosophy, from the University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. This document has not been submitted for qualifications at any other academic institution.

_____

Erin Myee Kerr
November 2021

List of names or abbreviations

ACECQA	Australian Children's Education & Care Quality Authority
CACFP	Child and Adult Care Food Program
ECEC	Early childhood education and care
EPAO	Environment and Policy Assessment and Observation
FDC	Family day care
IOM	Institute of Medicine
MVPA	Moderate- to vigorous-intensity physical activity
NAP SACC	Nutrition and Physical Activity Self-assessment for Child Care
NSW	New South Wales
NQF	National Quality Framework
NQS	National Quality Standards
PRSP	Prevention research support program

Statement of thesis style

This thesis has been prepared following a journal article compilation style, in agreement with my PhD supervisors (Senior Professor Anthony Okely, Associate Professor Bridget Kelly and Dr Megan Hammersley). A journal article compilation style was selected to allow quick dissemination of the research findings to academics and practitioners. The research described in this PhD thesis has been reported in five individual manuscripts (Chapters 3, 5, 6, 7 and 8) that have been published or accepted for publication in peer-reviewed journals. These manuscripts include a systematic literature review (Chapter 3) and four quantitative cross-sectional studies (Chapters 5 to 8). Two manuscripts (Chapters 5 and 6) have been published as research briefs, and additional information has been provided in this thesis. In addition, a general introductory chapter, (Chapter 1) a general literature review chapter (Chapter 2), methodology chapter (Chapter 4), linking text between manuscripts and a general discussion chapter (Chapter 9) have been added to this thesis.

Impact summary of thesis-related research

Peer-reviewed publications
Three peer-reviewed publications
Two manuscripts under-review

Professional magazine publication
One magazine publication

Conference presentations
Two international conference presentations
Three national conference presentations

Knowledge Brokering presentations
Two presentations to a National Nutrition Network for Early Childhood Education and Care Services

Three presentations to members of NSW Health

Publications constituting this thesis

Published peer-reviewed publications

Chapter 5

Kerr, E.M., Kelly, B., Norman, J., Furber, S., Hernandez, L., Hammersley, M.L., Ryan, S., Franco, L., Vuong, C., Okely, A.D., 2021. 'Nutrition, physical activity and screen time policies and practices in Family Day Care in Australia'. *Public Healh Research and Practice*. 1–5. DOI: 10.17061/31342114

(Appendix A)

Chapter 6

Kerr, E.M., Kelly, B., Hammersley, M.L., Hernandez, L., Norman, J., Furber, S., Vuong, C., Ryan, S., Wardle, K., Okely, A.D., 2020. 'Foods provided to children in family day care: An observational study'. *Public Health Nutrition*. 24 (11), 3196-3204. doi.org/10.1017/S1368980021001506

(Appendix B)

Chapter 7

Kerr, E.M., Kelly, B., Norman, J., Furber, S., Hernandez, L., Hammersley, M.L., Ryan, S., Franco, L., Vuong, C., Okely, A.D. 'Assessment of feeding practices and mealtime environments in Australian family day care services: an observational study'. *Journal of Nutrition Education and Behavior*. In Press, accepted October 2021.

(Appendix C)

Submitted for publication

Chapter 3

Kerr, E.M., Hewitt, L, Ryan, S., Norman, J., Kelly, B., Hammersley, M.L, Okely, A.D., 'Correlates of children's dietary intake, physical activity and sedentary behavior in home-based childcare: A systematic review'. *Preventive Medicine* (under review).

Chapter 8

Kerr, E., Hammersley, M.L., Norman, J., Furber, S., Hernandez, L., Ryan, S., Franco, L., Vuong, C., Okely, A.D., 2021. 'Environmental influences on physical activity and sedentary behaviour of children in family day care'. *Child: Care, Health and Development* (under review).

Other publications (2020-2021)

Yoong, S.L., Lum, M., Jones, J., **Kerr, E.**, Falkiner, M., Delaney, T., McCrabb, S., Chai, L.K., Seward, K., Grady, A., 2020. 'A systematic review of interventions to improve the dietary intake, physical activity and weight status of children attending family day care services'. *Public Health Nutrition*. 23, 2211–2220. https://doi.org/10.1017/S1368980019005275

Hewitt, L., **Kerr, E**., Stanley, R.M., Okely, A.D., 2020. 'Tummy time and infant health outcomes: A systematic review'. *Pediatrics.* 145. https://doi.org/10.1542/peds.2019-2168

Yoong, S.L., Jones, J., Pearson, N., Swindle, T., Barnes, C., Delaney, T., Lum, M., Golley, R., Matwiejczyk, L., Kelly, B., **Kerr, E.**, Love, P., Esdaile, E., Ward, D., Grady, A., 2021. An overview of research opportunities to increase the impact of nutrition intervention research in early childhood and education care settings according to the re-aim framework. International Journal of Environmental Research and Public Health 18, 1–19. https://doi.org/10.3390/ijerph18052745

Professional magazine article

Kerr E., Okely A., Hammersley M., Hernandez L. 2021, 'Screen time use in the family day care environment,' Every Child magazine, Volume 26, No. 1. Early Childhood Australia.

(Appendix D)

Oral Presentations

Kerr E, Kelly B., Norman J., Furber S., Hernandez L., Hammersley M., Ryan S., Franco L., Vuong C., Okely A., (2019) 'Opportunities for Family Day Care Service Providers to promote healthy eating and physical activity', presented at the International Society of Behavioral Nutrition and Physical Activity.

(Appendix E)

Kerr E., Okely A., Hammersley M., Kelly B., Norman J., Furber S., Franco L., Hernandez L., Ryan S., Vuong C., Wardle K. (2020), 'Educators' positive and negative feeding practices and mealtime environments in the family day care setting', presented at the Australasian Journal of Early Childhood Research Symposium, Sydney, Australia 13-14 February 2020.

(Appendix F)

Kerr E, Kelly B, Hernandez L, Hammersley M, Norman J, Furber S, Franco L, Vuong C , Wardle K, Nacher Espuig M , Okely A. (2020), 'What's in the lunchbox? Food provision in family day care', presented online at the World Public Health Nutrition Congress.

(Appendix G)

Kerr E., Okely A., Hammersley M., Kelly B., Norman J., Furber S., Franco L., Hernandez L., Ryan S., Vuong C., Wardle K. (2021), 'Screen time use in the family day care environment', Early Childhood Australia conference, 6-9 September 2021.

(Appendix H)

Kerr E., Okely A., Hammersley M., Kelly B., Norman J., Furber S., Franco L., Hernandez L., Ryan S., Vuong C., Wardle K. (2020), 'Physical activity and screen time in family day care' abstract accepted at the Early Start Conference 2020, conference postponed due to COVID-19.

(Appendix I)

Statement of contribution of others

Article 1 (Chapter 3)

Erin Kerr was involved in developing the research question, PROSPERO protocol, and search strategy, extracting the literature from academic databases, screening articles, extracting data, conducting the risk of bias assessment, synthesising results and drafting the manuscript. Anthony Okely and Bridget Kelly contributed to developing the research question, developing the PROSPERO protocol, reviewing the search strategy, and providing advice on the synthesis of results and risk of bias assessment. Megan Hammersley provided advice on the synthesis of results and risk of bias assessment, was involved in reviewing literature and conducting the risk of bias assessment. Lyndel Hewitt, Sarah Ryan, Jennifer Norman and Melanie Lum were involved in screening articles. Lyndel Hewitt, Sarah Ryan and Jennifer Norman were involved in extracting the data and conducting the risk of bias assessment. All authors reviewed and approved the final manuscript.

Article 2 (Chapter 5)

All authors contributed to the conception and design of the research, interpretation of data and critically revised the manuscript. Erin Kerr was responsible for gaining ethical approvals, developing the research question, acquisition of the data, policy review and drafting the article. Megan Hammersley and Sarah Ryan contributed to the policy review.

Article 3 (Chapter 6)

All authors contributed to the conception and design of the research, interpretation of data and critically revised the manuscript. Erin Kerr was responsible for gaining ethical

approvals, developing the research question, acquisition of the data, analysing the data and drafting the article.

Article 4 (Chapter 7)

All authors contributed to the conception and design of the research, interpretation of data and critically revised the manuscript. Erin Kerr was responsible for gaining ethical approvals, developing the research question, acquisition of the data, analysing the data and drafting the article.

Article 5 (Chapter 8)

All authors contributed to the conception and design of the research, interpretation of data and critically revised the manuscript. Erin Kerr was responsible for gaining ethical approvals, developing the research question, acquisition of the data, analysing the data and drafting the article.

The candidate and all co-authors hereby agree with the author contributions statement

Prof Tony Okely

Dr Megan Hammersley

Assoc Prof Bridget Kelly

Sarah Ryan

Dr Jennifer Norman

Dr Susan Furber

Lara Hernandez

Lyndel Hewitt

Lisa Franco

Melanie Lum

Karen Wardle

Cecilia Vuong

Table of contents

List of tables

List of figures

Chapter 1: Introduction

1.1 Background

Early childhood (birth to 5 years old) is a critical period for growth and development (Woo Baidal et al., 2016). Good nutrition supports children's optimal cognitive, emotional and physical development (Dalwood et al., 2020; Wu et al., 2019) and can reduce the risk of developing chronic diseases, such as cardiovascular disease, Type 2 Diabetes and some cancers (Afshin et al., 2019). The feeding practices used by families and carers can also have a long-term impact on children's diet quality and weight status (Mou et al., 2021). Physical activity in young children is positively associated with motor and cognitive development and psychosocial, bone, and cardiometabolic health (Carson et al. 2017; Timmons, LeBanc and Carson 2012). Conversely, excessive sedentary screen time is associated with adverse health effects for children, including obesity, motor development problems, sleep issues, concentration and socialisation (Li, Cheng, Sha, Cheng, & Yan, 2020).

The majority of Australian children under the age of 5 do not meet national guidelines for healthy eating, physical activity and sedentary behaviour. According to the Australia National Health Survey (2017–18), only 19% of children aged 2-3 years and 4% of children aged 4-8 years meet the recommended intake of vegetables (Australian Bureau of Statistics, 2018). Children were more likely to meet the recommended intake for fruit, with 97% and 78% of children aged 2-3 years and 4-8 years, respectively, meeting the guidelines (Australian Bureau of Statistics, 2018). The Australian National Health Survey (2011–12) reported that less than 50% of children aged 2-8 years were meeting guidelines for dairy, lean meat and meat alternatives and grains (Australian Bureau of Statistics, 2016). One exception was 65% of children aged 2-3 years consumed the recommended serves of dairy (Australian Bureau of Statistics, 2016). Sugar-sweetened drinks are consumed at least once per week by 18% of children aged 2-3 years and 31% of children aged 4-8 years (Australian Bureau of Statistics,

2018). The Australian National Health Survey (2017–18) has not released findings from the other three food groups. The National Nutrition and Physical Activity Survey reported that less than two-thirds (61%) of Australian children aged 2-5 years meet the physical activity guidelines, and only one-quarter (25%) meet screen time guidelines (Australian Institute of Health and Welfare, 2018).

Early Childhood Education and Care (ECEC) services are a key setting to promote healthy eating and physical activity behaviours in young children (World Health Organization, 2015). ECEC services reach a large proportion of young children, with 36% of infants and toddlers (birth to 2 years of age) and 87% pre-schoolers (3-5 years of age) in high-income countries attending for an average of 30 hours each week (OECD, 2021). ECEC services also provide a platform to influence children's healthy eating and physical activity and communicate health messages to families, making them an ideal health promotion setting (Wolfenden et al., 2020; Yoong et al., 2021).

The National Quality Framework (NQF) is the Australian regulatory system (introduced in 2012) for ECEC services (Australian Children's Education and Care Quality Authority, 2020). The NQF is comprised of the National Quality Standard (NQS), Early Years Learning Framework and national laws and regulations (Australian Children's Education and Care Quality Authority, 2020). Healthy eating and physical activity are integral components of the NQF, and element 2.1.3 in the NQS specifies that healthy eating and physical activity should be promoted as appropriate for each child (Australian Children's Education and Care Quality Authority, 2020). In addition, the NQF advises ECEC services to follow the Australian Government's Dietary Guidelines and Get Up & Grow Guidelines: Healthy Eating and Physical Activity for Early Childhood (Australian Children's Education and Care Quality Authority, 2020).

Family day care (FDC) is an approved ECEC service in which educators provide education and care for up to four children below school age and an additional three school-aged children, in a home environment. Family day care is also known as family child care homes in the United States, home-based childcare in Canada and child-minding in the United Kingdom. In 2020, FDC services comprised approximately 17% of the ECEC sector (excluding Out of School Hours childcare), with 107,670 Australian children registered in FDC compared to 795,340 in centre-based ECEC services (Australian Government, 2020). Australian FDC services operate within the same policy and regulatory framework as other ECEC services; however, educators are supported and monitored by a FDC service provider (also called a scheme or coordination unit). The service provider is responsible for ensuring the educators adhere to the service provider's policies, national regulations and the National Quality Framework (Australian Children's Education and Care Quality Authority, 2020). Educators are supported by a coordinator who monitors and supports the FDC educators who are part of the service.

In New South Wales (NSW), Australia, the *Munch & Move* program was developed in collaboration with NSW (Ministry of) Health and the ECEC sector to support the healthy development of children from birth to 5 years by promoting physical activity, healthy eating and reduced screen time (Green et al., 2020). *Munch & Move* is a large-scale capacity-building program that offers ECEC services professional development and resources that align with the NQS and the Early Years Learning Framework (Green et al., 2020). Services are also provided with additional resources and support by a Local Health District health promotion officer to implement organisation-wide health-promoting practices (NSW Government, 2020). The capacity-building model originally involved one representative from an ECEC service participating in face-to-face (2008-2015) or online webinar (2016-2019) professional development, who was then encouraged to train the educators from the service

using a staff development kit, and resources and handouts for educators and parents (Green et al., 2020). All FDC service providers in NSW were officially invited to participate in the *Munch & Move* webinar training in July 2016 (Kantar Public Division, 2019). The training model aimed to facilitate organisational change; trained FDC service providers were encouraged to support their FDC educators to implement the program and minor modifications were made to the training for FDC after consultation with the FDC sector. However, uptake of training in FDC services has been relatively low compared to centre-based ECEC services and preschools. In March 2019, 87% of centre-based ECEC services had participated in the *Munch & Move* program training compared to 49% of FDC service providers across NSW (NSW Ministry of Health, 2019). The formative work to develop *Munch & Move* was conducted with centre-based services, and the program's impact has only been evaluated in preschools and long day care settings (Green et al., 2020; Hardy et al., 2010). Further, the extent to which the *Munch & Move* training and resources are appropriate and relevant to FDC is not known.

Compared to centre-based ECEC services and preschools, little research has been conducted in the FDC setting (Francis et al., 2018; Yoong et al., 2020). FDC services experience unique challenges, with one educator providing education and care for multiple children of different ages and abilities (Stitou et al., 2018). Barriers to promoting healthy eating and physical activity include limited time, budget, space, resources, availability and challenges participating in professional development (Earnesty et al., 2021; Fees et al., 2009). Most research related to healthy eating and physical activity practices and policies in FDC services is from the USA (Francis et al., 2018). However, the conditions in which FDC services operate vary in other countries, such as educational qualifications, regulations and child-to-educator ratios (Stitou et al., 2018). Therefore, it is unknown whether the US-based research is transferrable to the Australian context. Limited Australian studies have investigated healthy

eating or physical activity policies and practices in FDC, and no studies have used objective measurements to capture healthy eating and physical activity outcomes (Bravo et al., 2008; Daniels et al., 2003; De Silva-Sanigorski et al., 2011; Lum et al., 2020; McGuire et al., 2020; Riethmuller et al., 2009; Temple and O'Connor, 2003; Wallace and Mills, 2019). Recognising the lack of research on healthy eating and physical activity in Australian FDC services, the NSW Health Prevention Research Support Program provided funding to undertake research with FDC services in two Local Health Districts in NSW: South Western Sydney Local Health District and Illawarra Shoalhaven Local Health District.

1.2 Aims and research questions

The overall aim of this doctorate was to assess the healthy eating, physical activity and screen time practices and policies in the FDC sector, with assessments undertaken at both the FDC service provider level (through a survey and policy audit) and the educator level (through direct observation in an educator's home). This research collected evidence to compare service providers' and educators' current practices against national guidelines and ECEC standards and to assess whether service providers' practices and policies were related to educators' practices and environment and to children's nutrition and physical activity behaviours. Children's physical activity levels and food provided during FDC were also assessed using accelerometers and food audits.

Aim 1: to assess the factors associated with children's dietary intake, physical activity and sedentary behaviour in FDC

Research Question 1:

What are the correlates of children's dietary intake, physical activity and sedentary behaviours in FDC settings?

Aim 2: to examine the effect of Munch & Move training on the policies held and the resources and professional development delivered by FDC service providers that were designed to promote healthy eating and physical activity and reduce screen time for children aged 0-5 years

Research Question 2:

i. Is *Munch & Move* training associated with FDC service providers' nutrition, physical activity and screen time policies, resources and professional development?

ii. To what extent do the service provider's policies adhere to national guidelines and relevant guidelines?

Aim 3: to (i) assess the quality and quantity of food and beverages provided to children aged 0-5 years in FDC services in two large geographic areas in New South Wales, Australia, and (ii) identify structural and sociodemographic factors associated with the nutritional quality of foods provided to children

Research Question 3:

i. What is the nutritional quality of food provided to children during FDC?

ii. Are the policies, practices and environments at a service provider and educator level associated with the type of food provided to children by parents or educators during FDC?

Aim 4: to (i) assess educators' feeding practices and the mealtime environments in FDC services through direct observation and (ii) examine factors associated with FDC educators' feeding practices and mealtime environments

Research Question 4:

i. What are educators' feeding practices and the mealtime environment during FDC?

ii. What factors are associated with educators' feeding practices and the mealtime environment in FDC settings?

Aim 5: to objectively measure the physical activity and sedentary levels of children attending FDC and assess what aspects of the FDC environment were associated with children's physical activity in FDC

Research Question 5:

i. How much time do children spend in physical activity and sedentary behaviour during FDC?

ii. Are the policies, practices and environments at a service provider and educator level associated with children's physical activity and sedentary behaviour?

1.3 Overview of thesis

This thesis by compilation consists of five manuscripts that have been submitted or published in peer-reviewed journals. It is structured according to the first and third phases of the Behavioural Epidemiology Framework, focusing on identifying the prevalence of health behaviours in FDC and the factors that influence health behaviours (Table 1.1) (Sallis et al., 2000). Each manuscript is presented as a distinct chapter in this thesis.

- *Chapter 2 Correlates of children's nutrition, physical activity and sedentary behavior in home-based childcare: A systematic review*
- *Chapter 3 Nutrition, physical activity and screen time policies and practices in family day care in NSW, Australia*
- *Chapter 4 Foods provided to children in family day care: an observational study*
- *Chapter 5 Assessment of feeding practices and mealtime environments in Australian Family Day Care services: an observational study*
- *Chapter 6 Environmental influences on physical activity and sedentary behaviour of children in family day care*

Table 1. 1 Behavioural Epidemiology Framework and how they relate to the thesis chapters

Phases of Behavioural Epidemiological Framework	Associated chapters
1. Establish links between behaviours and health (a) Association with health (b) Prevalence of health behaviours	Chapter 1 provides evidence for the associations between healthy eating and physical activity and health outcomes. Chapter 2 examines the prevalence of healthy eating and physical activity in ECEC centres and FDC services. Chapter 6 examines the food provided, and Chapter 8 assesses children's physical activity
3. Identify factors that influence behaviour	Chapter 3 identifies correlates of children's dietary intake, physical activity and sedentary behaviour. Chapters 5-8 examined the factors that influence FDC services in NSW.

1.4 Significance of the study

This is the first known study in Australia to objectively assess the nutrition and physical activity environments in FDC services. The doctoral research project collected data at multiple organisational levels to gain a comprehensive representation of the sector's current policies and practices based on the socio-ecological model. The research will inform the modification and development of resources and professional development in collaboration with the FDC sector. As part of the PRSP project, the findings will also be used by NSW Health to enhance the capacity-building model of the *Munch & Move* program and inform policy and resource allocation. Ultimately, the research aims to improve the healthy eating and physical activity practices in the FDC sector across NSW.

1.1 References

Afshin, A. *et al.* (2019) 'Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017', *The Lancet*, 393(10184), pp. 1958–1972. doi: 10.1016/S0140-6736(19)30041-8.

Australian Bureau of Statistics (2018) *National Health Survey: First Results, 2017-18, 4364.0.55.001*. Available at: https://www.abs.gov.au/statistics/health/health-conditions-and-risks/childrens-risk-factors/latest-release.

Australian Children's Education and Care Quality Authority (2020) 'Guide to the National Quality Framework', (January), pp. 1–634. Available at: https://www.acecqa.gov.au/sites/default/files/2020-09/Guide-to-the-NQF-September-2020.pdf.

Australian Government (2020) Child Care in Australia report March quarter 2020, *Australian Government Department of Education Skills and Employment*. Available at: https://www.dese.gov.au/key-official-documents-about-early-childhood/early-childhood-and-child-care-reports/child-care-australia/child-care-australia-report-march-quarter-2020.

Australian Institute of Health and Welfare (2018) *Physical activity across the life stages*. Cat. no. P. Canberra: AIHW. Available at: https://www.aihw.gov.au/reports/physical-activity/physical-activity-across-the-life-stages/contents/table-of-contents.

Bravo, A., Cass, Y. and Tranter, D. (2008) 'Good food in family day care: Improving nutrition and food safety in family day care', *Nutrition and Dietetics*, 65(1), pp. 47–55. doi: 10.1111/j.1747-0080.2007.00136.x.

Dalwood, P. *et al.* (2020) *Diet quality indices and their associations with health-related outcomes in children and adolescents: an updated systematic review*, *Nutrition Journal*. Nutrition Journal. doi: 10.1186/s12937-020-00632-x.

Daniels, L. A., Franco, B. and McWhinnie, J. A. (2003) 'An assessment of the potential of Family Day Care as a nutrition promotion setting in South Australia', *Nutrition & Dietetics*, 60(1), pp. 30–37.

Earnesty, D. *et al.* (2021) 'A Qualitative Study: Perceived Barriers and Facilitators to Nutrition Standard Adherence by In-home Childcare Providers', *Journal of the Academy of Nutrition and Dietetics*. doi: 10.1016/j.jand.2021.08.104.

Fees, B. *et al.* (2009) 'Physical Activity Programming in Family Child Care Homes: Providers' Perceptions of Practices and Barriers', *Journal of Nutrition Education and Behavior*, 41(4), pp. 268–273. doi: 10.1016/j.jneb.2008.01.013.

Francis, L. *et al.* (2018) 'Examining the Obesogenic Attributes of the Family Child Care Home Environment: A Literature Review', *Journal of Obesity*, 2018, pp. 1–20. doi: 10.1155/2018/3490651.

Green, A. M. *et al.* (2020) 'Implementation of an Early Childhood Healthy Eating and Physical Activity Program in New South Wales, Australia: Munch & Move', *Frontiers in Public Health*, 8(February). doi: 10.3389/fpubh.2020.00034.

Hardy, L. L. *et al.* (2010) 'Munch and Move: Evaluation of a preschool healthy eating and movement skill program', *International Journal of Behavioral Nutrition and Physical Activity*, 7(1), p. 80. doi: 10.1186/1479-5868-7-80.

Kantar Public Division (2019) *Munch & Move Family Day Care Evaluation*. Available at: https://healthykids.nsw.gov.au/downloads/file/campaignsprograms/FDC Final Report.pdf.

Lum, M. *et al.* (2020) 'Assessing the implementation of healthy eating and physical activity policies and practices in the family day care setting: A cross sectional study', *Health Promotion Journal of Australia*, (September), pp. 1–10. doi: 10.1002/hpja.420.

McGuire, J. *et al.* (2020) 'Creating supportive environments for responsive infant feeding in australian early childhood education and care', *Breastfeeding Review*, 28(3), pp. 47–64.

Mou, Y. *et al.* (2021) 'Associations of family feeding and mealtime practices with children's overall diet quality: Results from a prospective population-based cohort', *Appetite*, 160(October 2020), p. 105083. doi: 10.1016/j.appet.2020.105083.

NSW Government (2020) *Munch & Move Support*. Available at: https://healthykids.nsw.gov.au/munch-move-support/ (Accessed: 27 August 2020).

NSW Ministry of Health (2019) *Population Health Information Management System [PHIMS], Healthy Children Initiative, Data extraction: 1st April 2019.*

OECD (2021) *PF3 . 2 : Enrolment in childcare and pre-school, OECD Family Database*. Available at: https://data.oecd.org/students/enrolment-rate-in-early-childhood-education.htm.

Riethmuller, A. *et al.* (2009) 'Developing and active play resource for a range of Australian early childhood settings: Formative findings and recommendations', *Australasian Journal of Early Childhood*, 34(1), pp. 43–52.

Sallis, J. F., Owen, N. and Fotheringham, M. J. (2000) 'Behavioral epidemiology: A systematic framework to classify phases of research on health promotion and disease prevention', *Annals of Behavioral Medicine*, 22(4), pp. 294–298. doi: doi:10.1007/bf02895665.

De Silva-Sanigorski, A. *et al.* (2011) 'Obesity prevention in the family day care setting: Impact of the Romp & Chomp intervention on opportunities for children's physical activity and healthy eating', *Child: Care, Health and Development*, 37(3), pp. 385–393. doi: 10.1111/j.1365-2214.2010.01205.x.

Stitou, M., Bourgeault, I.-L. and Kohen, D. (2018) 'The job content, context, and requirements of regulated home-based childcare workers', *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*, 27(4), pp. 607–628. doi: 10.1177/1048291117739417.

Temple, V. A. and O'Connor, J. P. (2003) 'Family day care environments and physical activity.', *ACHPER Australia Healthy Lifestyles Journal*, 51(4), pp. 12–17.

Wallace, R. and Mills, B. (2019) 'A study of the food environment at Australian family day care', *Nutrients*, 11(10), p. 2395. doi: 10.3390/nu11102395.

Wolfenden, L. *et al.* (2020) 'Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within childcare services (Review)'. doi: 10.1002/14651858.CD011779.pub3.www.cochranelibrary.com.

Woo Baidal, J. A. *et al.* (2016) 'Risk Factors for Childhood Obesity in the First 1,000 Days: A Systematic Review', *American Journal of Preventive Medicine*, 50(6), pp. 761–779. doi: 10.1016/j.amepre.2015.11.012.

World Health Organization (2015) 'Population-based approaches to Childhood obesity PREVENTION', *JAMA - Journal of the American Medical Association*, 314(8), p. 850. doi: 10.1001/jama.2015.6674.

Wu, X. Y. *et al.* (2019) 'The influence of diet quality and dietary behavior on health-related quality of life in the general population of children and adolescents: a systematic review and meta-analysis', *Quality of Life Research*, 28(8), pp. 1989–2015. doi: 10.1007/s11136-019-02162-4.

Yoong, S. L. *et al.* (2020) 'A systematic review of interventions to improve the dietary intake, physical activity and weight status of children attending family day care services', *Public Health Nutrition*, 23(12), pp. 2211–2220. doi: 10.1017/S1368980019005275.

Yoong, S. L. *et al.* (2021) 'An overview of research opportunities to increase the impact of nutrition intervention research in early childhood and education care settings according to the re-aim framework', *International Journal of Environmental Research and Public Health*, 18(5), pp. 1–19. doi: 10.3390/ijerph18052745.

Chapter 2: Thesis literature review

The previous chapter established the background of this thesis and provided a broad overview of the thesis, including the aims and research questions. This chapter summarises the evidence on healthy eating, physical activity and sedentary behaviours and environments in ECEC center-based services and FDC settings. The next chapter provides an overview of the socio-ecological model and then summarises the correlates of children's and educators' healthy eating, physical activity and sedentary behaviours, practices and environments accordingly.

1.1 Healthy eating in ECEC settings

In Australian ECEC center-based services, about two-thirds (62%) provide food to children, and children bring food from home in the remaining services (Green et al., 2020). Several Australian studies have assessed the foods provided and consumed by children between the ages of 2-5 years in ECEC center-based services by direct observation (Jones et al., 2017), weighed food records (Kelly et al., 2010; Pearson et al., 2020; Sambell et al., 2014), and menu assessments (Yoong et al., 2014). Currently, no national guidelines exist that provide recommendations for the quantity of food children should be provided while attending ECEC services. However, the NSW Health *Caring for Children* guidelines recommend that children in care for 8 hours or more receive 50% of their dietary requirements in line with the Australian Dietary Guidelines (NSW Ministry of Health, 2014).

Studies from Australian ECEC center-based services where families provide food have shown that the food frequently does not meet recommended dietary guidelines and contains excess discretionary foods (Jones et al., 2017; Kelly et al., 2010; Pearson et al., 2020). A lunchbox audit assessing the food provided to children in NSW preschools found that few parents provided children with vegetables (5%) and dairy (22%), but over two-thirds

provided children with discretionary foods (69%) (Kelly et al., 2010). Another study assessed children's dietary intake in NSW using the Dietary Observation for Child Care protocol and found that children only consumed 5% of their recommended daily intake of vegetables and dairy whilst in childcare (Jones et al., 2017). This study also found that children consumed an average of 0.7 serves of discretionary foods per day while attending the ECEC center-based services (Jones et al., 2017). A recent study assessed the foods provided and consumed by 355 children in the Hunter New England region of NSW (Pearson et al., 2020). Most lunchboxes contained grains/cereals (95%), fruit (93%), and dairy and alternatives (90%), but much fewer contained vegetables (44%) and meat and alternatives (18%) (Pearson et al., 2020). Over half of the lunchboxes provided to children achieved the NSW *Caring for Children* guideline recommendations for grains/cereals (65% achieved recommendations) and fruit (64%). However, less than one-third of the lunchboxes met recommendations for dairy and alternatives (33%), vegetables (2%) and meat and alternatives (4%) (Pearson et al., 2020). Foods consumed by children were even less likely to meet the recommendations. For example, only 42% of children consumed the recommended amounts of grains/cereals (Pearson et al., 2020). Most lunchboxes contained discretionary foods (82%), and on average, children were provided with and consumed 1.3 and 0.9 serves of discretionary foods, respectively (Pearson et al., 2020).

ECEC center-based services that provide food to children also do not comply with recommended amounts for the provision of vegetables (Sambell et al., 2014; Yoong et al., 2014), lean meat and meat alternatives (Sambell et al., 2014; Yoong et al., 2014) and dairy (Sambell et al., 2014). For example, one study conducted menu reviews for 46 ECEC center-based services in NSW and reported that no services met recommendations for vegetables, while 59% of services met recommendations for meat and alternatives (Yoong et al., 2014). Conversely, most services met recommendations for fruit (96%), dairy (89%) and grains

(87%) (Yoong et al., 2014). Another study in Western Australia weighed the ingredients of meals and snacks provided to 126 children across eight ECEC center-based services to determine the number of serves of food provided to children and their alignment with 50% of the food group servings recommended by the Australian Dietary Guidelines (Sambell et al., 2014). The food groups that were least likely to meet the recommended number of serves were the meat and meat alternatives food group (average 0.3 serves out of 0.5 recommended serves), vegetables (average 1.1 serves out of 2 recommended serves) and dairy (average 0.8 serves out of 1 recommended serves) (Sambell et al., 2014). Notably, these studies did not assess discretionary foods. However, ECEC interventions in South Australia and NSW reported mixed findings on the provision and consumption of discretionary foods. One study reported that services provided children with minimal discretionary foods (median 0 serves) at baseline and follow-up using weighed food records and the plate wastage methods (Bell et al., 2015). However, another study reported that less than one-third of services (n=44) met discretionary food guidelines before and after a nutrition intervention (Finch et al., 2019).

Studies in the USA have reported similar findings using direct observation methods in ECEC center-based services, where centres (Erinosho et al., 2013) and families provided food (Romo-Palafox et al., 2015). Both studies found that children were not meeting US dietary guidelines for vegetables, protein foods (particularly seafood and plant proteins) and foods high in saturated fat, sodium, and discretionary foods (assessed as empty calories) (Erinosho et al., 2013; Romo-Palafox et al., 2015). Additionally, both studies found that foods provided to children did not meet guidelines for wholegrains (Erinosho et al., 2013; Romo-Palafox et al., 2015). However, one key difference between studies was that children met the guidelines for dairy in the study where centres provided food (Erinosho et al., 2013) but not in the study where families provided food (Romo-Palafox et al., 2015).

Systematic reviews have found that children's dietary intake in ECEC services is positively associated with the availability of healthy food (Stacey et al., 2017) and educators' feeding practices (Ward et al., 2015). Positive feeding practices, such as role modelling eating healthy foods, repeated exposure to healthy foods and autonomy-supportive practices (for example allowing children to decide how much food they eat at set snack and meal times) are associated with improved vegetable and dairy intake (Patrick et al., 2005). Conversely, negative feeding practices, such as pressuring children to eat, force-feeding, and bribing or rewarding with food, are associated with reduced appetite self-regulation, increased intake of energy-dense foods, increased body mass index and dislike of certain foods (Benjamin Neelon and Briley, 2011; Shloim et al., 2015). The mealtime environment can also influence children's eating behaviours, such as the mealtime atmosphere, who is present and eating with the child, and distractions in the room, such as using electronic devices while eating. Mealtimes in ECEC services also provide a valuable opportunity for children to learn healthy eating behaviours and develop social, language and fine motor skills through multiple learning opportunities and socialisation (Harte et al., 2019).

2.2 Physical activity and sedentary behaviour in ECEC settings

Currently, no Australian guidelines are available for physical activity in ECEC services. However, the USA Institute of Medicine (IOM) recommends that children be active for at least 15 minutes per hour in an ECEC service (Birch et al., 2011).

A systematic review identified 55 studies that objectively assessed children's physical activity and sedentary behaviours in ECEC center-based services in 11 countries published between 2004–2017 (O'Brien et al., 2018). The review highlighted the variability in children's activity levels. For example, total physical activity levels ranged from 4.23 to 47.17 minutes/hour (n=42 studies), and moderate- to vigorous-intensity physical activity (MVPA) ranged from

1.29 to 22.66 minutes/hour (n=46 studies) (O'Brien et al., 2018). Time spent sedentary also varied considerably, ranging from 12.38 to 55.77 minutes/hour (n=47 studies) (O'Brien et al., 2018). A recent study conducted in ECEC center-based services in the Illawarra and Sydney, NSW, reported that on average, children spent 17 minutes/hour in total physical activity, 10 minutes/hour in MVPA and 29 minutes/hour in sedentary behaviour (Tonge et al., 2021). On average, only 50% of children met the IOM physical activity guidelines (Tonge et al., 2020). Another study conducted in the Illawarra region of NSW, Australia reported that only 16% of children met the IOM recommendations for physical activity (Ellis et al., 2017). This study also reported that children spent over half their day sitting (Ellis et al., 2017).

A longitudinal study in NSW found that after one year, children spent significantly more time sitting (increasing from 40% to 51% of the time) and less time standing (reducing from 38% to 31% of the time) and stepping (reducing from 22% to 18% of the time) (Zhang et al., 2019). In addition, the study identified educators' interactions and program structure as determinants of children's physical activity. A recent cross-sectional study identified that free routines were associated with increased physical activity (Tonge et al., 2020), and educators' sedentary behaviour was associated with children's sedentary behaviour (Tonge et al., 2021). A systematic review of 27 studies conducted in seven countries synthesised the correlates of children's objectively measured physical activity and sedentary behaviour in ECEC center-based services (Tonge et al., 2016). The strongest associations for children's physical activity levels (i.e. reported in four or more studies) were for motor coordination, sex (boys more active), outdoor environments (including size and time spent outside) and the provision of active opportunities (Tonge, 2019). Sedentary behaviour was associated with children's age, outdoor environments (including size and time spent outside), the provision of active opportunities, service quality and preschool type (Tonge, 2019).

2.3 Healthy eating in FDC

2.3.1. Food and beverage provision

Most studies assessing healthy eating in FDC have been conducted in the USA. However, the food environment likely differs compared with other countries. For example, food may be provided by the family or the FDC educator in Australia (Wallace and Mills, 2019), while the educator typically provides food in the USA.

In Australia, two studies have assessed the food provided to children in FDC using diet histories (Bravo et al., 2008; Daniels et al., 2003). Daniels et al., (2003) conducted a cross-sectional survey with 225 FDC educators from South Australia, where educators supplied most food. The study found that less than one-third of children were provided with vegetables, but over 85% were provided with fruit and grain/cereal foods (Daniels et al., 2003). More than three-quarters of children received discretionary foods (Daniels et al., 2003). Another study evaluated the Good Food in Family Day Care program (1998–2000) using a single-group pre-post design with 104 FDC educators and 123 children in south eastern Sydney (Bravo et al., 2008). Parents supplied most of the food, and over 90% of children aged 1-5 years were provided with fruit and grain/cereal foods before and after the program (Bravo et al., 2008). After the Good Food program, 30% of children were still receiving sugary drinks, and less than half of children were provided with vegetables (36%) and adequate iron sources (32%) (Bravo et al., 2008). These studies showed that children were not provided with healthy food in Australian FDC; however, they used self-report dietary assessment methods, which are subject to self-reporting bias. Further, two studies were conducted before 2003, and the findings may not apply to current FDC practices due to the introduction of the National Quality Framework in 2012, updated Australian Dietary Guidelines and changes to the food environment (for example, marketing and availability of discretionary foods).

Research in the USA has also identified that FDC services are not providing children with food in line with best practice guidelines and dietary guidelines. Studies have assessed the food provided to children using direct observation (Gans et al., 2019; Tovar et al., 2018a) and surveys (Cotwright et al., 2019; Lee et al., 2018; Nanney et al., 2017; Trost et al., 2009). Two studies used direct observation methods to assess the quality and quantity of food provided to children. One study assessed the foods provided by 166 FDC educators using the Dietary Observation in Child Care (DOCC) protocol (Tovar et al., 2018a). The food provided to children was close to meeting the Healthy Eating Index guidelines for whole fruit (4.8 out of 5), dairy (9.6 out of 10) and discretionary foods (16.9 out of 20) (assessed as empty calories) (Tovar et al., 2018a). Conversely, Healthy Eating Index scores for provision of vegetables (particularly greens and beans (1.4 out of 5)), protein foods (particularly seafood or plant proteins (1.8 out of 5), and wholegrains (3.9 out of 10) were low (Tovar et al., 2018a). Another study assessed the proportion of FDC educators (n=119) meeting best practice nutrition guidelines using the Environment and Policy Assessment and Observation (EPAO) tool (Gans et al., 2019). Less than half the FDC educators met best practice guidelines for limiting provision of high fat meats to children (48%), and drinking water at all times (17%), with rates particularly low for provision of wholegrain foods (5%) and vegetables (2%), and limiting provision of high sugar, salt and high fat foods (2%) (Gans et al., 2019).

State-wide cross-sectional surveys involving between 297 and 1000 educators in four USA states revealed mixed findings (Cotwright et al., 2019; Lee et al., 2018; Nanney et al., 2017; Trost et al., 2009). In one study, most educators reported serving vegetables (85%) and fruit (82%) at least once per day (Trost et al., 2009). In another study, only 57% of educators reported serving at least one vegetable or fruit at every meal and snack (Nanney et al., 2017). Most FDC educators (90%) reported providing at least one serve of wholegrains per day to children (Lee et al., 2018), but less than half of FDC educators reported providing at least two

servings of wholegrains per day (Lee et al., 2018) or only providing wholegrain breads and cereals (Nanney et al., 2017). Only 56% of educators met the best practice for only providing lean meats, nuts and legumes to children (Lee et al., 2018), and less than half (42%) reported serving lean meats more than four times per week (Trost et al., 2009). In one study, most educators reported serving snacks high in sugar, fat or salt less than twice per week (96%) (Trost et al., 2009). In another study, the minority of educators reported serving high-fat foods (30%) and high sugar foods (33%) less than once per week (Nanney et al., 2017), with most serving these foods more often.

Cross-sectional studies have reported mixed findings on the healthy beverages provided for infants and children aged 1-5 years. Overall, less than three-quarters of educators (40-70%) reported making water readily available for children indoors and outdoors (Cotwright et al., 2019; Lee et al., 2018; Nanney et al., 2017; Trost et al., 2009). Conversely, a recent Australian study found that 173 out of 174 educators reported ensuring children had access to water all day (Lum et al., 2020). In two studies, less than half of the FDC educators reported providing children with low-fat milk to children older than 2 years of age (14- 49%) (Nanney et al., 2018; Trost et al., 2009), but in two other studies more than half (63-76%) of the FDC educators reported providing children with low-fat milk (Cotwright et al., 2019; Lee et al., 2018). Less than two-thirds of educators (49-66%) reported serving full fat milk for children aged 1-2 years old (as recommended for this age group) (Cotwright et al., 2019; Lee et al., 2018).

Three studies also assessed juice and sugar-sweetened beverages provided to infants and children (Cotwright et al., 2019; Lee et al., 2018; Nanney et al., 2017). Over three-quarters of educators met standards for limiting juice provided to infants (70-71%) and children aged 1-5 years (67-88%) (Cotwright et al., 2019; Lee et al., 2018; Nanney et al., 2017). In two studies,

most educators did not provide sugar-sweetened beverages to infants (94-96%) (Cotwright et al., 2019; Lee et al., 2018) or children aged 1-5 years (94%) (Cotwright et al., 2019). However, only 57% of educators met this standard in another study (Nanney et al., 2017).

Collectively, studies assessing the foods and beverages provided to children in FDC's services have highlighted that children are not provided with enough vegetables, wholegrains or lean meats and alternatives, and are offered excessive servings of discretionary foods. This was apparent in the two studies that assessed the quantities of food provided (Gans et al., 2019; Tovar et al., 2018a). Comparison between the studies that used surveys was difficult due to different nutrition best practice standards across states, such as serving wholegrains at least once per day compared to serving wholegrains at least two times per day. Further, these studies only assessed the frequency of foods and beverages provided, not the quantity and are subject to self-reporting bias.

2.3.2. Children's dietary intake in FDC

Two studies have assessed children's dietary intake in FDC services using the DOCC protocol (Ramirez et al., 2020; Tovar et al., 2018a). Baseline data from the Keys to Healthy Family Child Care Homes (Keys) intervention assessed the foods consumed by 495 children in North Carolina (Tovar et al., 2018a). Baseline data from the Healthy Start/Comienzos Sanos study assessed the foods consumed by 374 children aged 2-5 years in Rhode Island (Cuadrado-Soto et al., 2019; Tovar et al., 2020). Both studies reported similar findings for children's dietary intake, analysed using the Healthy Eating Index (Tovar et al., 2020, 2018a). Children's fruit and dairy consumption were close to meeting Healthy Eating Index guidelines, whereas consumption of protein foods (particularly seafood or plant proteins (1.7 out of 5)), wholegrains (3.6 out of 10), and vegetables (1.9 out of 5) was low (Tovar et al., 2020, 2018a). In the Keys intervention, children consumed between 61-81% of the food

groups served and were least likely to consume vegetables (Tovar et al., 2018a). The Healthy Start study also found that over 70% of children had micronutrient densities below recommendations for vitamin D, E and K (Cuadrado-Soto et al., 2019).

2.3.4. FDC feeding practices and mealtime environment

Educators' feeding practices have been observed in the baseline data collection of the Healthy Start intervention (Gans et al., 2019) and the Keys intervention (Benjamin-Neelon et al., 2018; Tovar et al., 2018b, 2016). The EPAO was used to assess feeding practices in both studies (Benjamin-Neelon et al., 2018; Gans et al., 2019). In the Healthy Start Intervention, the EPAO was used in conjunction with the Nutrition and Physical Activity Self-Assessment for Child Care survey (NAP SACC) to determine the proportion of educators (n=119) who met best-practice nutrition guidelines (Gans et al., 2019). Educators were most likely to meet guidelines for never pressuring children to eat more food than they want (89%), followed by always praising children for trying new or less preferred foods (65%) (Gans et al., 2019). However, less than half of educators met the best practice guidelines for not using food as a reward (38%), role modelling healthy eating (8%) and always sitting with children during mealtimes (7%) (Gans et al., 2019).

Baseline findings from the Keys intervention also identified that educators' feeding practices and feeding environment were well below meeting best practices. The average EPAO subscores out of 3 for the feeding environment (1.4 (SD=0.2)) and feeding practices (1.4 (SD=0.3)) were low (Benjamin-Neelon et al., 2018). As part of the Keys intervention, the EPAO was further modified in two studies to capture additional feeding practices (Tovar et al., 2018b) and educators' reactions to children's eating behaviours (Tovar et al., 2016). One study assessed the frequency of feeding practices observed during at least one meal in 133 FDC services (Tovar et al., 2018b). In contrast with the study described in the paragraph

above, most educators in this study were observed to sit with children (81%), encourage pleasant conversation (91%) and talk with children about the foods they were eating (96%) during at least one meal (Tovar et al., 2018b). However, this difference in findings is likely due to the differences in reporting (i.e. at least one meal vs. always). Only 36% of the educators were observed to enthusiastically role model eating and drinking healthy foods and to use an authoritative feeding style (31%) during at least one meal in an observation study (Tovar et al., 2018b). Educators were also observed to use negative feeding practices, such as insisting that a child eat a particular food (73%), spoon-feeding a child to get them to eat (64%), pressuring a child to eat (38%) and using food as a reward or a bribe (32%) (Tovar et al., 2018b). In the second study, educators' feeding practices were influenced by children's behaviours (Tovar et al., 2016). Specifically, educators were more likely to use coercive feeding practices in response to children requesting more food (Tovar et al., 2016). However, educators were more likely to use autonomy-supportive practices if children accepted the foods they were offered (Tovar et al., 2016).

A combination of positive and negative feeding practices have been reported in surveys from Australia (Daniels et al., 2003) and the USA (Erinosho et al., 2018; Trost et al., 2009) in FDC services. The most common positive reported feeding practice involved educators often or always sitting with children during meals (68-86%) (Daniels et al., 2003; Erinosho et al., 2018; Trost et al., 2009). Three studies found that over half of the educators (53-77%) reported allowing children to decide how much they should eat (Daniels et al., 2003; Gans et al., 2019; Nanney et al., 2017). However, less than three-quarters of educators (34-72%) reported often or always eating the same food as children. Studies also found that FDC educators used negative feeding practices. For example, over one-third of educators always or often reported (34%) encouraging children to eat even if they said they were not hungry (Gans et al., 2019). Similarly, another study found that 19% of educators reported requiring

children to finish all the food on their plate before leaving the table most or all the time (Trost et al., 2009). Between 61-99% of educators reported never rewarding, encouraging or punishing children for eating a particular food or using food as a reward (Daniels et al., 2003; Gans et al., 2019; Nanney et al., 2017; Trost et al., 2009). Overall, these studies suggest that educators' feeding practices are not ideal. However, these studies also highlighted the substantial variation in educators' reported and observed feeding practices.

2.4.5. FDC nutrition policies and professional development

In Australia, policies are held at the FDC service provider level (Australian Children's Education and Care Quality Authority, 2020), not by individual educators like in the USA (Vaughn et al., 2017). A recent Australian study reviewed service providers' policies and found that no service providers had a comprehensive breastfeeding policy, but 69% had a comprehensive policy related to other aspects of nutrition (Lum et al., 2020). Another Australian study qualitatively assessed FDC services' infant feeding policies and found many policies lacked detail, focused predominately on food safety information, and did not include correct information from the Australian Infant Feeding Guidelines (McGuire et al., 2018). In a recent survey with 16 service providers in Hunter New England region of NSW, only three service providers reported that at least 80% of educators were trained in *Munch & Move* (Lum et al., 2020).

Baseline findings from the Keys intervention also identified that nutrition policy (0.9 out of 3) and nutrition education and professional development (0.6 out of 3) scores were well below meeting best practices (Benjamin-Neelon et al., 2018). Other studies have reported that between 24-66% of educators had nutrition policies (Temitope Erinosho et al., 2018; Nanney et al., 2017; Trost et al., 2009) and less than half of educators (44-46%) reported participating in nutrition professional development at least once per year (Nanney et al., 2017; Trost et al.,

2009).

2.5 Physical activity and sedentary behaviour in FDC

2.5.1 Children's physical activity and sedentary behaviour in FDC

Ten studies have measured children's physical activity or sedentary behaviour using accelerometers in FDC services in the USA and Canada. Most studies reported that children met the IOM guidelines (≥15 minutes of physical activity per hour in ECEC), with children spending between 19-34 minutes per hour in physical activity in FDC (Chai et al., 2020; Delaney et al., 2014; Gunter et al., 2012; Kang et al., 2021; Neshteruk et al., 2018; Temple et al., 2009; Vanderloo et al., 2015). One study reported that children only spent 10 minutes/hour of physical activity in FDC (Rice and Trost, 2014). This is likely explained by the higher cut-points used to define total physical activity (Van Cauwenberghe et al., 2011) in this study compared to the cut-points used in the other studies (Evenson et al., 2008; Pate et al., 2006; Pfeiffer et al., 2006). Studies also reported that children spent between 2-10 minutes/hour in MVPA. Most studies found that children spent over half their time sedentary (between 31-41 minutes/hour) in FDC (Chai et al., 2020; Delaney et al., 2014; Kang et al., 2021; Neshteruk et al., 2018; Rice and Trost, 2014; Tucker et al., 2015), with one study reporting that children spent less than 30 minutes/hour of their time sedentary in FDC (Gunter et al., 2012).

2.5.2 Physical activity and sedentary environments in FDC

Few studies have directly observed the physical activity and sedentary environments in FDC. Baseline findings from the Keys intervention using the modified EPAO for FCCH reported on the physical activity and sedentary environments in two studies (Mazzucca et al., 2018; Neshteruk et al., 2018). The most supportive physical activity environments (highest EPAO

scores out of 3) were for screen time (2.1) and screen time practices (2.5). Conversely, the least supportive areas were physical activity education and professional development (0.3) and physical activity policy (0.8). The physical activity and sedentary environments in Canadian FDC services were assessed as part of the Learning Environments' Activity Potential for Preschoolers using the original version of EPAO for centre-based ECEC services (best practices reported out of 20) (Tucker et al., 2015; Vanderloo et al., 2015). Similar to Mazucca (2018), the policies (0) and physical activity training and education (0.5) were assessed as the lowest EPAO subscale (Vanderloo et al., 2015). Conversely, Vanderloo et al., (2015) reported higher subscales for staff behaviours (15.60) and portable play environment (16.00), followed by sedentary opportunities (12.83), fixed play environment (10.81), active opportunities (8.83), and sedentary environment (7.00).

Two Australian studies have assessed FDC services' physical activity and screen time opportunities using questionnaires (Lum et al., 2020; Temple and O'Connor, 2003). The first study involved 11 FDC services from a rural area (Temple and O'Connor, 2003). On average, educators reported spending 19% of their day in outdoor play (11% of the time in free play and 8% of the time in structured play) and 3% of their time walking (Temple and O'Connor, 2003). Educators reported spending 16% of their time using screen devices (television, video or computer games) (Temple and O'Connor, 2003). Lum (et al., 2020) identified poor screen time practices in a recent Australian survey with 174 FDC educators from Hunter New England, NSW. Just over one-third (36%) of FDC educators reported only using small-screen devices with children for educational or physical activity purposes and not providing screen time for children under two years (Lum et al., 2020). Over two-thirds of educators reported ensuring access to suitable physical activity equipment (98.85%), providing daily opportunities for fundamental movement skills for children 3-5 years of age (75.76%) and providing supervised floor-based play for babies 0-12 months of age every day (68.0%) (Lum

et al., 2020). Both studies identified that screen time was an issue; however, both studies used self-report data. Further, the research conducted by Temple and O'Connor (2003) was conducted 20 years ago, and the sample size was small (n=11).

Multiple state-wide surveys assessed the physical activity practices of 297 to 1000 FDC educators caring for children between 0-5 years of age in Canada (McConnell-Nzunga et al., 2020) and the USA (Leng and Lessard, 2013; Nanney et al., 2017; Tandon et al., 2017; Trost et al., 2009). Over two-thirds of educators (67-83%) reported providing children with more than 60 minutes of physical activity per day (Leng and Lessard, 2013; Nanney et al., 2017; Tandon et al., 2017). In another study over 82% of educators reported providing children with more than 120 minutes of active play per day (McConnell-Nzunga et al., 2020); however, only 12% reported providing more than 120 minutes of physical activity (Tandon et al., 2017). Over three-quarters reported providing daily outdoor play for more than 60 minutes (McConnell-Nzunga et al., 2020; Tandon et al., 2017; Trost et al., 2009). When assessing educators' engagement in physical activity, less than two-thirds of educators reported joining in gross motor activities (52%) (Nanney et al., 2017) or playing with children during active play (53-62%) (Leng and Lessard, 2013; Trost et al., 2009).

The standards and reporting of screen time varied in each study. For example, one study determined that 55% of educators reported allowing children to watch TV, videos or play video games at least once a day (Trost et al., 2009). Other studies have used measures of 30 minutes or less on screens (reported by 54% of educators) (McConnell-Nzunga et al., 2020), less than 60 minutes per day watching television, video, and computer time (reported by 62% of educators) (Nanney et al., 2017) and rarely or never watching TV (reported by only 29% of educators) (Tandon et al., 2017). Despite the variations in reporting, these findings, combined with the Australian study by Lum et al., (2020), highlight that many FDC

educators allow children to use screens at least once per day and some children may be exceeding the daily limit for screen time just in their time at FDC.

2.5.3 FDC physical activity policies and professional development

As described above, one Australian study assessed the policies and practices of sixteen FDC service providers in the Hunter New England region of NSW (Lum et al., 2020). Less than one-third of the FDC service providers possessed a comprehensive physical activity (31%) or screen time policy (19%) (Lum et al., 2020). Further, only three service providers reported that at least 80% of educators are trained in *Munch & Move* (Lum et al., 2020).

In the Keys intervention, the least supportive physical activity environment categories were physical activity education and professional development (0.3 out of 3) and physical activity policy (0.8 out of 3) (Mazzucca et al., 2018). Other studies in the USA have also reported that less than one-third of FDC educators (22-25%) had written physical activity policies (Nanney et al., 2017; Trost et al., 2009). Varied findings have been reported on physical activity training. In one study, 86% of educators reported participating in physical activity training at least once per year (Leng and Lessard, 2013), whereas between 11-46% of educators reported in participating other studies (Nanney et al., 2017; Trost et al., 2009).

2.6 Conclusion

Most research on healthy eating and physical activity practices and policies in FDC services has been conducted in the USA. However, the regulations and conditions in which FDC services operate in other countries vary, for example in areas such as qualifications, training and child-to-educator ratios. It is not clear if USA-based research is comparable to the Australian context. Furthermore, there is a knowledge gap in how the Australian Dietary Guidelines, Australian 24-hour Movement Guidelines and the state-wide *Munch & Move*

program are implemented at the FDC educator level. This is the first known study in Australia to objectively assess FDC services' nutrition and physical activity environments using validated food audits, accelerometry, and direct observations. This research will provide valuable research on the sectors' current practices and identify where resources and professional development can be strengthened to improve support to the FDC sector.

2.7 References

Australian Children's Education and Care Quality Authority (2020) 'Guide to the National Quality Framework', (January), pp. 1–634. Available at: https://www.acecqa.gov.au/sites/default/files/2020-09/Guide-to-the-NQF-September-2020.pdf.

Bell, L. K. *et al.* (2015) 'Impact of a nutrition award scheme on the food and nutrient intakes of 2- to 4-year-olds attending long day care', *Public Health Nutrition*, 18(14), pp. 2634–2642. doi: 10.1017/S1368980014003127.

Benjamin-Neelon, S. E. *et al.* (2018) 'The family child care home environment and children's diet quality', *Appetite*, 126, pp. 108–113. doi: 10.1016/j.appet.2018.03.024.

Benjamin Neelon, S. E. and Briley, M. E. (2011) 'Position of the American Dietetic Association: Benchmarks for Nutrition in Child Care', *Journal of the American Dietetic Association*, 111(4), pp. 607–615. doi: 10.1016/j.jada.2011.02.016.

Birch, L. L., Parker, L. and Burns, A. (2011) *Early Childhood Obesity Prevention Policies Committee on Obesity Prevention Policies for Young Children*. Available at: http://www.nap.edu. (Accessed: 13 August 2019).

Bravo, A., Cass, Y. and Tranter, D. (2008) 'Good food in family day care: Improving nutrition and food safety in family day care', *Nutrition and Dietetics*, 65(1), pp. 47–55. doi: 10.1111/j.1747-0080.2007.00136.x.

Van Cauwenberghe, E. *et al.* (2011) 'Calibration and comparison of accelerometer cut points in preschool children', *International Journal of Pediatric Obesity*, 6(2–2), pp. 582–590. doi: 10.3109/17477166.2010.526223.

Chai, L. K., Rice-McNeil, K. and Trost, S. G. (2020) 'Patterns and Correlates of Sedentary Behavior in Children Attending Family Child Care', *International journal of environmental research and public health*, 17(2), pp. 1–10. doi: 10.3390/ijerph17020549.

Cotwright, C. J. *et al.* (2019) 'Beverage policy implementation by child and adult care food program participation and program type: A statewide examination in Georgia', *Childhood Obesity*, 15(3), pp. 185–193. doi: 10.1089/chi.2018.0101.

Cuadrado-Soto, E. *et al.* (2019) 'Micronutrient adequacy in preschool children attending family child care homes', *Nutrients*, 11(9), pp. 1–15. doi: 10.3390/nu11092134.

Daniels, L. A., Franco, B. and McWhinnie, J. A. (2003) 'An assessment of the potential of Family Day Care as a nutrition promotion setting in South Australia', *Nutrition &*

Dietetics, 60(1), pp. 30–37.

Delaney, S. L., Monsivais, P. and Johnson, D. B. (2014) 'Physical activity levels in family child care homes', *Journal of Physical Activity and Health*, 11(7), pp. 1362–1366. doi: 10.1123/jpah.2012-0297.

Ellis, Y. G. *et al.* (2017) 'Sedentary time, physical activity and compliance with IOM recommendations in young children at childcare', *Preventive Medicine Reports*, 7, pp. 221–226. doi: 10.1016/j.pmedr.2016.12.009.

Erinosho, T. *et al.* (2018) 'Participation in the Child and Adult Care Food Program Is Associated with Healthier Nutrition Environments at Family Child Care Homes in Mississippi', *Journal of Nutrition Education and Behavior*, 50(5), pp. 441–450. doi: 10.1016/j.jneb.2017.11.004.

Erinosho, Temitope *et al.* (2018) 'The quality of nutrition and physical activity environments of child-care centers across three states in the southern U.S', *Preventive Medicine*, 113(April), pp. 95–101. doi: 10.1016/j.ypmed.2018.04.029.

Erinosho, T. O. *et al.* (2013) 'Assessing foods offered to children at child-care centers using the healthy eating index-2005', *Journal of the Academy of Nutrition and Dietetics*, 113(8), pp. 1084–1089. doi: 10.1016/j.jand.2013.04.026.

Evenson, K. R. *et al.* (2008) 'Calibration of two objective measures of physical activity for children', *Journal of Sports Sciences*, 26(14), pp. 1557–1565. doi: 10.1080/02640410802334196.

Finch, M. *et al.* (2019) 'Challenges of Increasing Childcare Center Compliance With Nutrition Guidelines: A Randomized Controlled Trial of an Intervention Providing Training, Written Menu Feedback, and Printed Resources', *American Journal of Health Promotion*, 33(3), pp. 399–411. doi: 10.1177/0890117118786859.

Gans, K. M. *et al.* (2019) 'Nutrition-related practices of family child care providers and differences by ethnicity', *Childhood Obesity*, 15(3), pp. 167–184. doi: 10.1089/chi.2018.0083.

Green, A. M. *et al.* (2020) 'Implementation of an Early Childhood Healthy Eating and Physical Activity Program in New South Wales, Australia: Munch & Move', *Frontiers in Public Health*, 8(February). doi: 10.3389/fpubh.2020.00034.

Gunter, K. B. *et al.* (2012) 'Factors associated with physical activity in children attending family child care homes', *Preventive Medicine*, 54(2), pp. 131–133. doi: 10.1016/j.ypmed.2011.12.002.

Gunter, K. B., Rice, K. R. and Trost, S. (2012) 'Nutrition and physical activity policies and

practices in child care homes in Oregon: Baseline findings from the health home child care project', *Extension Journal*, 50(3), p. 3FEA3. Available at: http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed9&NEWS=N&AN=2009605265.

Harte, S., Theobald, M. and Trost, S. G. (2019) 'Culture and community: Observation of mealtime enactment in early childhood education and care settings', *International Journal of Behavioral Nutrition and Physical Activity*, 16(1), pp. 1–11. doi: 10.1186/s12966-019-0838-x.

Jones, J. *et al.* (2017) 'Dietary intake and physical activity levels of children attending Australian childcare services', *Nutrition and Dietetics*, 74(5), pp. 446–453. doi: 10.1111/1747-0080.12375.

Kang, A. W. *et al.* (2021) 'Physical Activity Levels among Preschool-Aged Children in Family Child Care Homes: A Comparison between Hispanic and Non-Hispanic Children Using Accelerometry', *Children*, 8(5), p. 349. doi: 10.3390/children8050349.

Kelly, B. *et al.* (2010) 'Opening up Australian preschoolers' lunchboxes', *Australian and New Zealand Journal of Public Health*, 2334(3), pp. 288–292. doi: 10.1111/j.1753-6405.2010.00528.x.

Lee, D. L. *et al.* (2018) 'Compliance with the New 2017 Child and Adult Care Food Program Standards for Infants and Children before Implementation', *Childhood Obesity*, 14(6), pp. 393–402. doi: 10.1089/chi.2018.0092.

Leng, S. W. and Lessard, L. (2013) 'Family child care provider's compliance with state physical activity regulations, delaware child care provider survey, 2011', *Preventing Chronic Disease*, 10(7), pp. 1–10. doi: 10.5888/pcd10.120295.

Lum, M. *et al.* (2020) 'Assessing the implementation of healthy eating and physical activity policies and practices in the family day care setting: A cross sectional study', *Health Promotion Journal of Australia*, (September), pp. 1–10. doi: 10.1002/hpja.420.

Mazzucca, S. *et al.* (2018) 'Physical activity and sedentary behaviors of children in family child care homes: Are there opportunities for improvement?', *Pediatric Exercise Science*, 30(4), pp. 529–536. doi: 10.1123/pes.2018-0040.

McConnell-Nzunga, J. *et al.* (2020) 'Child care setting and its association with policies and practices that promote physical activity and physical literacy in the early years in British Columbia', *Journal of Physical Activity and Health*, 17(4), pp. 429–434. doi: 10.1123/jpah.2019-0215.

McGuire, J., Gallegos, D. and Irvine, S. (2018) 'Infant feeding nutrition policies in Australian

early childhood education and care services: a content and qualitative analysis', *International Journal of Child Care and Education Policy*, 12(1), p. 14. doi: 10.1186/s40723-018-0053-2.

Nanney, M. S. *et al.* (2017) 'Obesity Prevention in Early Child Care Settings: A Bistate (Minnesota and Wisconsin) Assessment of Best Practices, Implementation Difficulty, and Barriers', *Health Education and Behavior*, 44(1), pp. 23–31. doi: 10.1177/1090198116643912.

Nanney, M. S. *et al.* (2018) 'Change in the implementation of healthy nutrition and physical activity best practices in Minnesota early care settings: A longitudinal cohort study (2010–2016)', *Preventive Medicine Reports*, 10(October 2017), pp. 234–241. doi: 10.1016/j.pmedr.2018.03.012.

Neshteruk, C. D. *et al.* (2018) 'The physical environment in family childcare homes and children's physical activity', *Child: Care, Health and Development*, 44(5), pp. 746–752. doi: 10.1111/cch.12578.

NSW Ministry of Health (2014) *Caring for children birth to 5years. North*. North Sydney. doi: 10.1377/hlthaff.2014.1291.

O'Brien, K. T. *et al.* (2018) 'Physical activity and sedentary time among preschoolers in centre-based childcare: a systematic review', *International Journal of Behavioral Nutrition and Physical Activity*, 15(1), pp. 1–16. doi: 10.1186/s12966-018-0745-6.

Pate, R. R. *et al.* (2006) 'Validation and Calibration of an Accelerometer in Preschool Children', *Obesity*, 14(11), pp. 152–157. doi: 10.1249/01.mss.0000183219.44127.e7.

Patrick, H. *et al.* (2005) 'The benefits of authoritative feeding style: Caregiver feeding styles and children's food consumption patterns', *Appetite*, 44(2), pp. 243–249. doi: 10.1016/j.appet.2002.07.001.

Pearson, N. *et al.* (2020) 'A cross-sectional study of packed lunchbox foods and their consumption by children in early childhood education and care services', *Nutrition and Dietetics*, (June), pp. 1–9. doi: 10.1111/1747-0080.12632.

Pfeiffer, K. A. *et al.* (2006) 'Validation and calibration of the actical accelerometer in preschool children', *Medicine and Science in Sports and Exercise*, 38(1), pp. 152–157. doi: 10.1249/01.mss.0000183219.44127.e7.

Ramirez, A. *et al.* (2020) 'Dietary Contributors to Food Group Intake in Preschool Children Attending Family Childcare Homes: Differences between Latino and Non-Latino Providers', *Nutrients*, 12, pp. 1–15.

Rice, K. R. and Trost, S. G. (2014) 'Physical Activity Levels Among Children Attending

Family Day Care', *Journal of Nutrition Education and Behavior*, 46(3), pp. 197–202. doi: 10.1016/j.jneb.2013.09.001.

Romo-Palafox, M. J. *et al.* (2015) 'Dietary Quality of Preschoolers' Sack Lunches as Measured by the Healthy Eating Index', *Journal of the Academy of Nutrition and Dietetics*, 115(11), pp. 1779–1788. doi: 10.1016/j.jand.2015.05.017.

Sambell, R., Devine, A. and Lo, J. (2014) 'Does the food group provision in early years' education and care settings in metropolitan Perth, Western Australia, meet national dietary requirements; and how can Home Economics support this?', *Journal of the Home Economics Institute of Australia*, 21(2), p. 20.

Shloim, N. *et al.* (2015) 'Parenting styles, feeding styles, feeding practices, and weight status in 4-12 year-old children: A systematic review of the literature', *Frontiers in Psychology*, 6(DEC). doi: 10.3389/fpsyg.2015.01849.

Stacey, F. G. *et al.* (2017) 'Evidence of the Potential Effectiveness of Centre-Based Childcare Policies and Practices on Child Diet and Physical Activity: Consolidating Evidence from Systematic Reviews of Intervention Trials and Observational Studies', *Current Nutrition Reports*, 6(3), pp. 228–246. doi: 10.1007/s13668-017-0212-z.

Tandon, P. S. *et al.* (2017) 'Physical Activity Practices, Policies and Environments in Washington State Child Care Settings: Results of a Statewide Survey', *Maternal and Child Health Journal*, 21(3), pp. 571–582. doi: 10.1007/s10995-016-2141-7.

Temple, V. A. *et al.* (2009) 'Physical activity of children in family child care', *Applied Physiology, Nutrition, and Metabolism*, 34(4), pp. 794–798. doi: 10.1139/H09-061.

Temple, V. A. and O'Connor, J. P. (2003) 'Family day care environments and physical activity.', *ACHPER Australia Healthy Lifestyles Journal*, 51(4), pp. 12–17.

Tonge, K., Jones, R. A. and Okely, A. D. (2020) 'Environmental influences on children's physical activity in early childhood education and care', *Journal of Physical Activity and Health*, 17(4), pp. 423–428. doi: 10.1123/jpah.2019-0119.

Tonge, K. L. (2019) *The Relationship between Educator Engagement & Interaction and Children ' s Physical Activity in Early Childhood Education and Care Services The Relationship between Educator Engagement & Interaction and Children ' s Physical Activity in Early Childhood E*.

Tonge, K. L., Jones, R. A. and Okely, A. D. (2016) 'Correlates of children's objectively measured physical activity and sedentary behavior in early childhood education and care services: A systematic review', *Preventive Medicine*, 89, pp. 129–139. doi: 10.1016/j.ypmed.2016.05.019.

Tonge, K. L., Jones, R. A. and Okely, A. D. (2021) 'The relationship between educators' and children's physical activity and sedentary behaviour in early childhood education and care', *Journal of Science and Medicine in Sport*, 24(6), pp. 580–584. doi: 10.1016/j.jsams.2021.02.003.

Tovar, A. *et al.* (2016) 'Providers' response to child eating behaviors: A direct observation study', *Appetite*, 105, pp. 534–541. doi: 10.1016/j.appet.2016.06.020.

Tovar, A., Vaughn, A. E., *et al.* (2018) 'Modifying the Environment and Policy Assessment and Observation (EPAO) to better capture feeding practices of family childcare home providers', *Public Health Nutrition*, 22(2), pp. 223–234. doi: 10.1017/s1368980018002665.

Tovar, A., Benjamin-Neelon, S. E., *et al.* (2018) 'Nutritional Quality of Meals and Snacks Served and Consumed in Family Child Care', *Journal of the Academy of Nutrition and Dietetics*, 118(12), pp. 2280–2286. doi: 10.1016/j.jand.2018.08.154.

Tovar, A. *et al.* (2020) 'Exploring the Provider-Level Socio-Demographic Determinants of Diet Quality of Preschool-Aged Children Attending Family Childcare Homes', *Nutrients*, 12(5), p. 1368. doi: 10.3390/nu12051368.

Trost, S. G. *et al.* (2009) 'Nutrition and Physical Activity Policies and Practices in Family Child Care Homes', *American Journal of Preventive Medicine*, 37(6), pp. 537–540. doi: 10.1016/j.amepre.2009.09.020.

Tucker, P. *et al.* (2015) 'Prevalence and influences of preschoolers' sedentary behaviors in early learning centers: A cross-sectional study', *BMC Pediatrics*, 15(1). doi: 10.1186/s12887-015-0441-5.

Vanderloo, L. M. *et al.* (2015) 'Environmental influences on preschoolers' physical activity levels in various early-learning facilities', *Research Quarterly for Exercise and Sport*, 86(4), pp. 360–370. doi: 10.1080/02701367.2015.1053105.

Vaughn, A. E. *et al.* (2017) 'Assessment of nutrition and physical activity environments in family child care homes: Modification and psychometric testing of the Environment and Policy Assessment and Observation', *BMC Public Health*, 17(1), p. 680. doi: 10.1186/s12889-017-4686-9.

Wallace, R. and Mills, B. (2019) 'A study of the food environment at Australian family day care', *Nutrients*, 11(10), p. 2395. doi: 10.3390/nu11102395.

Ward, S. *et al.* (2015) 'Systematic review of the relationship between childcare educators' practices and preschoolers' physical activity and eating behaviours', *Obesity Reviews*, 16(12), pp. 1055–1070. doi: 10.1111/obr.12315.

Yoong, S. L. *et al.* (2014) 'Do childcare services provide foods in line with the 2013 Australian Dietary guidelines? A cross-sectional study', *Australian and New Zealand Journal of Public Health*, 38(6), pp. 595–596. doi: 10.1111/1753-6405.12312.

Zhang, Z. *et al.* (2019) 'The associations between environmental characteristics of early childhood education and care centers and 1-year change in toddlers' physical activity and sedentary behavior', *Journal of Physical Activity and Health*, 16(11), pp. 1000–1006. doi: 10.1123/jpah.2019-0066.

Chapter 3: Correlates of children's dietary intake, physical activity and sedentary behaviour in FDC: a systematic review

The previous chapter provided an overview of the existing literature related to this dissertation. This included a summary of the healthy eating, physical activity and sedentary behaviours and environments in ECEC center-based services and FDC settings. This chapter contains a systematic literature review, which reviewed the correlates of children and educators' healthy eating, physical activity and sedentary behaviours. This chapter also includes a section on the correlates of educators' nutrition and physical activity practices and environments, which was prepared separately to the published review. This chapter starts with an overview of the socio-ecological model, which has been used to frame the synthesis of the evidence on FDC educators' healthy eating and physical activity practices and environment and children's dietary intake, physical activity and sedentary behaviour. Further information on the socio-ecological model is provided in the Methods chapter (Chapter 4), including how this model informed the development and interpretation of this thesis more broadly.

This chapter addresses Research Question 1:

What are the correlates of children's dietary intake, physical activity and sedentary behaviours in FDC settings?

3.1 Socio-ecological model

The socio-ecological model recognises that health is multifaceted and influenced by individual, social, physical and policy factors (Mcleroy et al., 1988). The socio-ecological model was used as a framework in this thesis to explore the influences of children's healthy eating and physical activity levels in FDC services. Children are placed at the centre of the system, and whilst they have individual characteristics (intrapersonal level), their behaviours are shaped by their connections and associations with the different levels of the system, at the interpersonal, organisational, community and policy levels (Mcleroy et al., 1988). This literature review used the socio-ecological model to categorise the correlates of educators' healthy eating and physical activity practices and environment and children's dietary intake, physical activity and sedentary behaviour into the associated social-ecological framework domains.

Interpersonal relationships include the educator's direct involvement with children, such as engaging or playing with children during physical activity and sitting and talking with children during mealtimes. This level also encompasses educators' values, beliefs and confidence. The organisational level includes the physical environment at FDC (such as outdoor space, equipment and mealtime environment), program structure (such as time provided for physical activity), education provided to children and professional development of educators. It also encompasses the provider of food for children during ECEC attendance, for example, educators or families. The organisational level also acknowledges the important role of service providers in supporting educator's practices, such as their policies and practices and one-to-one support from coordinators.

The community level includes the geographic location (such as urban or rural areas) and access to health-promoting environments and programs (such availability of healthy, affordable and

accessible food, recreational facilities and parks). The community level also includes the availability of professional development programs, such as the *Munch & Move* program. Finally, the policy level includes the government regulations and policies at a local, state and national level that influence the healthy eating and physical activity environments and practices in ECEC services. For example, the national quality framework, Get Up and Grow Guidelines, and Australian Dietary Guidelines.

3.2 Correlates of children's dietary intake, physical activity and sedentary behavior in FDC: A systematic review

The following systematic review has been submitted to a peer-reviewed journal and is currently under review:

Citation: **Kerr, E.M.**, Hewitt, L, Ryan, S., Norman, J., Kelly, B., Hammersley, M.L, Okely, A.D., 'Correlates of children's dietary intake, physical activity and sedentary behavior in home-based childcare: A systematic review'. *Preventive Medicine* (under review).

3.2.1 Introduction

Healthy eating and physical activity in early childhood are essential for optimal development and the prevention of lifestyle diseases, such as cardiovascular disease and type 2 diabetes (Dalwood 2020, Morze 2020, Carson 2017). The World Health Organisation recognises early childhood education and care (ECEC) as a key setting to develop healthy nutrition and physical activity behaviours (WHO, 2017). Educator practices and environments in ECEC services can impact health-related behaviours of many children. In high-income countries where approximately 87% of children aged 3-5 years attend an ECEC setting for an average of 30 hours each week (OECD, 2021). While ECEC settings can improve children's diet quality and physical activity, they can also contribute to unhealthy behaviours and obesity (Swyden et al., 2017; Zhang et al., 2018).

Family day care (FDC) is a formal type of childcare where educators provide education and care to children in the educators' home. FDC is an important type of ECEC for many families, especially those from lower socioeconomic and ethnically diverse backgrounds, often offering lower fees and more flexible hours (Layzer and Burstein, 2007; Tonyan et al., 2017; Williamson et al., 2011). Over three million children attend FDC in the United States (National Center on Early Childhood Quality Assurance, 2016), 228,975 in Canada (Statistics Canada, 2020) and 107,670 children in Australia (Australian Government, 2020). The conditions in which FDC services operate, such as the regulations, qualification requirements, and child-to-educator ratios, vary across countries. The primary food provider also differs between countries. For example, educators typically provide food in the USA (Francis et al., 2018), whereas both educators and families may provide food to children in Australia (Wallace and Mills, 2019).

Research in the ECEC sector has predominately focused on centre-based services (Tonge et al., 2016; Wolfenden et al., 2020), with less research conducted in home-based child care settings (Francis et al., 2018; Yoong et al., 2020). Home-based childcare services have distinct challenges compared to centre-based services, with one educator often providing education and care for multiple children of different ages and abilities (Stitou et al., 2018). Additional structural barriers in FDC, such as equipment availability, challenges participating in professional development, and limited budget, space and resources, also mean findings from research in centre-based services may not be generalisable to FDC services (Fees et al., 2009; O'Connor and Temple, 2005).

Understanding the factors that influence children's healthy eating and physical activity behaviours in FDC is critical to informing educator professional development and FDC-based interventions. Systematic reviews in centre-based ECEC services have identified multiple

correlates of children's physical activity and sedentary behaviour, including provision of active opportunities, features of outdoor environments, total area, provision of portable play equipment every day and educator's involvement in, and promotion of, physical activity (Tonge et al., 2016; Ward et al., 2015). In addition, mealtime practices, such as family-style meals, have been positively associated with children's consumption of nutritious foods (Ward et al., 2015). A review assessing the obesogenic characteristics of FDC services in the USA found that the physical, sociocultural, and policy environments were not associated with children's health behaviours (Francis et al., 2018). However, no reviews have synthesised the factors associated with children's healthy eating and physical activity in FDC. In light of this, the aim of this systematic review was to assess the factors associated with children's dietary intake, physical activity and sedentary behaviour in FDC.

3.2.2 Methods

Protocol and registration

This systematic review was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Page et al., 2021) and prospectively registered with PROSPERO, the international prospective register of systematic reviews (registration no. CRD42019103429).

Eligibility criteria

Papers were included if they: (1) were peer-reviewed, written in English and available in full text, (2) included data from a FDC service (birth-5 years) setting, (3) were a quantitative study that reported children's dietary intake, physical activity or sedentary behaviour, and (4) included variables associated with children's dietary intake, physical activity or sedentary behaviour.

FDC was defined as formal home-based child care where children are cared for in a home by an educator (also known as a child care provider). Studies that only involved centre-based childcare services (for example, pre-schools, long day care services and kindergartens) or informal types of childcare provided in the child's own home (for example, care given by grandparents, nannies, au pairs or babysitters) were excluded. Studies involving both FDC and centre-based child care services were included if the correlates of FDC-related practices were reported separately to centre-based services. Studies only comparing FDC combined with other types of ECEC services were not included. The primary outcome variables included measures of children's dietary intake, physical activity or sedentary behaviour. Examples of exposure variables (i.e. correlates) included child characteristics, educator characteristics, physical environment, policies and training.

Data sources and search strategy

A computerised literature search was conducted in March 2020 and updated in July 2021 using MEDLINE, ERIC, Scopus, PsychINFO and Web of Science. The databases were searched from January 2000 to July 2021. The search was conducted using the search terms for family day care AND diet OR physical activity OR sedentary behaviour (Table 3.1). The complete search strategy is outlined in supplementary file 3.1 (Appendix J).

Table 3. 1 Search strategy

S1 All fields	“family day care” OR “family daycare” OR “family child care” OR “family childcare” OR “child minder*” OR “childminder*” OR “child minding*” OR “childminding*” OR “family-based child care" OR “family based child care" OR “family-based childcare” OR “home-based child care” OR “home-based childcare” OR “homebased childcare” OR “home based child care” OR “home-based education” OR “home-based early childhood education” OR “home child care”
S2 All fields	"eat*" OR "nutrition*" OR “nutrient” OR "diet*" OR "feed*" OR “food” OR "meal*" OR “fruit*” OR “vegetable*” OR "physical activit*" OR "physical inactivit*" OR “movement” OR "sedent*" OR “gross motor” OR “exercise*” OR "motor activity" OR "physical education" OR "physical training" OR “sport*”
S3	Combine S1 and S2 with “AND”

The reference lists of eligible articles were also screened to identify additional articles to be included in the review.

Study selection

Duplicates were removed (EK) in Microsoft Excel, and the remaining articles were uploaded into the software Rayyan (Ouzzani et al., 2016). Titles and abstracts were independently reviewed twice by two authors (EK, LH). All potentially relevant full-text articles were independently assessed by two authors (among EK, SR, LH, JN, ML). Any differences were discussed and then resolved between reviewers.

Data extraction

The following information was independently extracted from each eligible article by two authors (among EK, SR, LH, JN): author, date, location, study design, study population, assessment tool and outcome, correlates assessed, and the correlates identified. An association was classified as significant if $p < 0.05$. However, one study was included that didn't have p-values.

Data analysis and synthesis

A meta-analysis was not possible due to the heterogeneity of the correlates reported in the included studies. A narrative summary of the findings was described instead. Only findings from the most advanced, fully adjusted models were extracted if multiple analytic models were used. The correlates were categorised according to Mcleroy's social-ecological framework domains (interpersonal, intrapersonal, organisational and policy) (Mcleroy et al., 1988).

All exposure variables that had a reported association with children's physical activity or sedentary behaviour were entered into a spreadsheet and coded as having either positive (+), negative (–), or indeterminate (?) association or no association (0). An overall summary code

was calculated based on the percent of correlates that reported the same direction of association for children's physical activity and sedentary behaviour (Table 3.2), consistent with the method used in other studies (Hinkley et al., 2010; Tonge et al., 2016). This was not calculated for the nutrition articles due to the reporting of data from the same sample in multiple studies and heterogeneity of the outcome variables. In studies where moderate- to vigorous-intensity physical activity (MVPA), vigorous-intensity physical activity and moderate-intensity physical activity were reported, only MVPA was included to avoid double reporting results.

Table 3.2. Rules for classifying variables regarding consistency of association with children's physical activity and sedentary behaviour in FDC services

Results supporting association (%)	Summary code	Explanation of code
0-33	0	No association
34-59	?	Indeterminate association
60-100	+	Positive association
60-100	–	Negative association

Note: If an outcome was found four or more times, it was coded as: 00 (no association); ?? (indeterminate); ++ (positive association); or – – (negative association)

Risk of bias assessment

The Office of Health Assessment and Translation (OHAT) Risk of Bias Rating Tool for Human and Animal Studies was used to assess the risk of bias (Office of Health Assessment and Translation, 2019). The OHAT tool was selected because it assesses the study designs of articles that meet the inclusion criteria and provides an assessment rating for each criterion rather than a summary assessment score or quality rating. The risk of bias was assessed by two authors (EK, SR, LH and JN), and any differences were resolved by discussion with other authors (AO, BK and MH). The criteria assessed selection bias, confounding bias, attrition/exclusion bias, detection bias (for correlate and outcome variables), selective reporting bias, conflict of interest and other potential sources of bias. Each criterion was rated: 'definitely low risk of bias', 'probably low risk of bias', 'probably high risk of bias' or 'definitely high risk of bias'.

3.2.3 Results

Summarizing the articles

A total of 2317 articles were screened, and 16 studies met the inclusion criteria (Figure 3.1). All studies were cross-sectional; six assessed associations with children's dietary intake, and 10 assessed physical activity and sedentary behaviours (Table 3.3). Most studies (n=13) were conducted in the USA and the remainder (n=3) in Canada. The age of children ranged from 1.5 years to 5 years.

Figure 3. 1 Study flow diagram of search results and the selection process

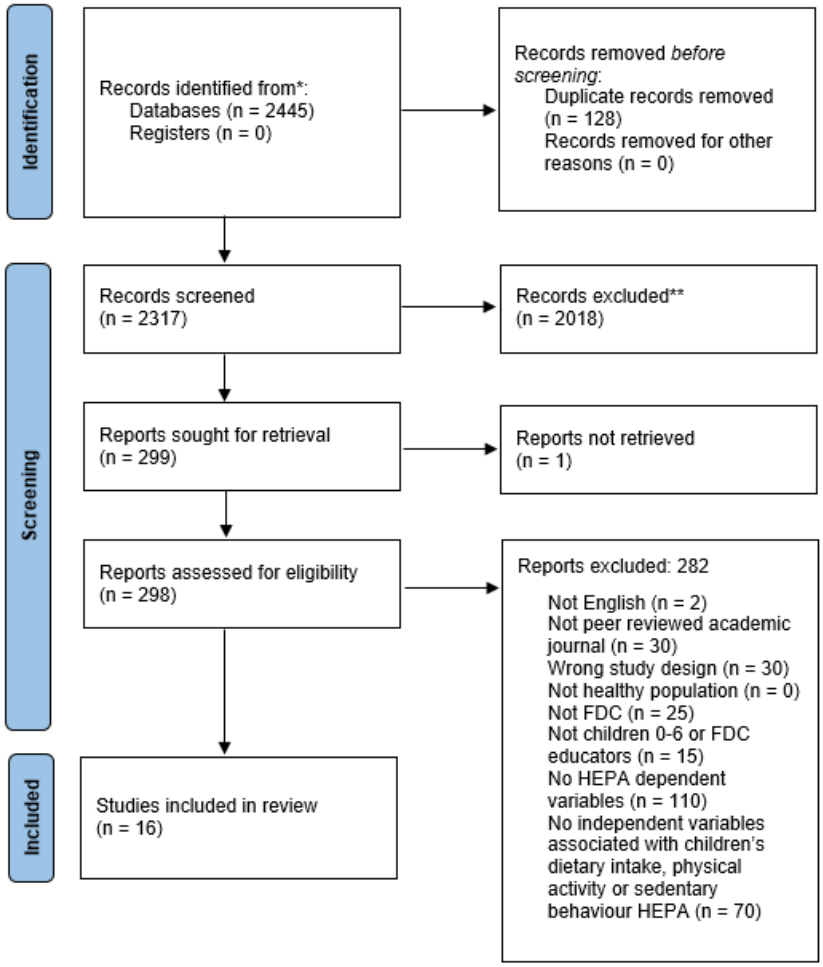


Table 3. 2 Correlates of children's dietary intake, physical activity and sedentary behaviour

Author, date, location	Study population (educators, children)	Outcome assessment method	Correlates assessed	Correlates identified	Socio-ecological Framework Domain Association
Nutrition – Dietary intake					
Cuadrado-Soto et al. 2019 Rhode Island, US	118 FDC educators 366 children age 2-5 years	Food intake assessed using the DOCC over 2 days in FDC Mean critical nutrient density per 1000 kcal calculated for 12 vitamins and 10 minerals	Age 2-3 years vs. 4-5 years	Vitamin B12 higher in younger than older children (3.3 ± 1.6 µg/1000 kcal vs 3.0 ± 1.8 µg/1000 kcal, $p < 0.05$) Potassium higher in younger than older children (1670.2 ± 490.4 mg/1000 kcal vs. 1572.8 ± 443.6 mg/1000 kcal, $p < 0.05$) Zinc densities higher in younger than older children (6.2 ± 2.1 mg/1000 kcal vs. 5.3 ± 1.5 mg/1000 kcal, $p < 0.05$) Sodium:potassium ratio higher in the older children (1.12 ± 0.5 vs. 1.05 ± 0.6, $p < 0.05$)	Intrapersonal
Ramirez et al 2020 Rhode Island, US	120 FDC educators 374 children age 2-5 years	Food intake assessed using the DOCC over 2 days in FDC Food items in major food groups identified, mean food group intake per FDC calculated and proportion of food item to its respective major food group was calculated	Ethnicity Latino vs. non-Latino	Mean servings intake of legumes higher for children cared for by Latino educators compared to non-Latino educators (0.06 (0.07) vs. 0.0 (0.00), $p < 0.00$) Higher total grain foods intake associated with children cared for by non-Latino educators compared to non-Latino educators (0.60 ± 0.27 vs. 0.70±0.32, $p < 0.00$) Mean servings intake of oils higher for children cared for by Latino educators compared to non-Latino educators (0.12 (0.11) vs. 0.05 (0.11); $p < 0.00$)	Interpersonal

				Mean servings intake of vegetable oils higher for children cared for by Latino educators compared to non-Latino educators compared to non-Latino educators (0.16 (0.13) vs. 0.12 (0.19); $p < 0.00$)	
Tovar et al. 2018 North Carolina US	133 FDC educators Final model included 125 FDCs Number of children not specified	Food intake assessed using the DOCC over 2 days in FDC Diet quality calculated using the HEI	Educator feeding practices assessed using a modified version of the EPAO	Higher child HEI scores positively associated with autonomy-support practices (Estimate 9.4; 95% CI 3.9, 15.0, $p = 0.00$)	Interpersonal
Tovar et al. 2020 Rhode Island, US	119 FDC educators 374 children age 2-5 years	Food intake assessed using the DOCC over 2 days in FDC Diet quality calculated using the HEI-2015 (higher scores indicate closer adherence to guidelines)	Educators socio-demographics reported via survey Variables assessed: gender, ethnicity, race, age, income, marital status, income, childcare experience, number of children in care, average hours of FDC, CACFP participation, years in US, country of origin, language spoken at home, language spoken at FDC	Higher child HEI-2015 scores positively associated with: Latinx educators (beta=6.5, SE=2.4, $p = 0.01$) (adjusted for income, ethnicity and CACFP) High total vegetables score associated with: Latinx educators (2.2 (1.4) vs. 1.5 (1.3), $p = 0.02$) Higher greens/beans score associated with: Latinx educators (2.7 (2.0) vs. 0.5 (1.1), p=0.00) Lower income educators (2.5 (2.1) and 2.3 (2.1) vs. 0.6 (1.0), $p = 0.00$) Higher total protein foods score associated with: Latinx educators (3.7 (1.5) vs. 2.8 (1.7), p = 0.01) Lower income educators (3.9 (1.4) and 3.6 (1.5) vs. 2.6 (1.9), $p = 0.02$) Higher seafood and plant protein foods score associated with: Latinx educators (2.8 (2.0) vs. 1.1 (1.7), p < 0.00) Lower income educators (3.1 (2.2) and 2.4 (2.1) vs. 0.9, $p = 0.004$) Higher refined grain foods associated score with:	Interpersonal

				Latinx educators (5.4 (3.3) vs. 3.8 (3.0), $p = 0.01$)	
Benjamin-Neelon et al. 2018 North Carolina, US	166 FDC educators 496 children aged 1.5-4 years	Food intake assessed using the DOCC over 2 days in FDC Diet quality calculated using the HEI	Nutrition best practices assessed via the EPAO	Higher child HEI score associated with: Higher EPAO total nutrition score (1.16; 95% CI: 0.34, 1.98; $p = 0.006$), Foods provided (8.98; 95% CI: 3.94, 14.01; p=0.0006), Nutrition education (5.37; 95% CI: 0.80, 9.94; $p = 0.02$), Nutrition policy (2.36; 95% CI: 0.23, 4.49; $p = 0.03$)	Organizational
Tovar et al. 2018 North Carolina US	166 FDC educators 495 children aged 1.5- 4 years Mean 7.2 (3.6) children	Food intake assessed using the DOCC over 2 days in FDC Diet quality calculated using the HEI-2010	Food served and consumed assessed using the DOCC over 2 days in FDC Diet quality calculated using the HEI	Higher child HEI-2010 score of foods consumed associated with: Higher HEI-2010 score of foods served (Estimate 0.96, 95% CI 0.91, 1.02; $p < 0.00$)	Organizational
Physical activity and sedentary behaviors					
Chai, Rice-McNeil and Trost 2020 Oregan, US	41 FDC educators 127 children aged 2-5 years	ActiGraph GT1M accelerometer worn over a week in FDC 15 s epochs Pate cut-points Sedentary bout ≥4 consecutive 15 s epochs with less than 25 counts each epoch. Short bouts: 1.0–4.9 min	Gender NAP SACC Practices categorized as promoting physical activity (PPA) or not promoting physical activity (non-PPA)	Total number of sedentary bouts and short sedentary bouts higher with girls (41.6 vs. 36.6; $p = 0.002$); (36.0 vs. 30.8; $p = 0.00$) Short bouts less than 5 minutes higher with girls (36.0 vs. 30.8; $p < 0.00$) No significant differences in medium, long or extended bouts Fewer sedentary bouts associated with PPA FDC's compared to non-PPA for the following categories: Daily outdoor active play (38.3 ± 1.2 vs. 43.9 ± 1.7; $p = 0.00$)	Intrapersonal Organizational

	Medium bouts: 0–9.9 min Long bouts: 10.0–14.9 min (long) Extended bouts ≥15 min	Children not seated for more than 30 min at a time (38.6 ± 1.4 vs. 43.2 ± 1.8; $p = 0.01$) Computer use limited to only a few times a week (37.5 ± 0.9 vs. 44.0 ± 1.7, $p = 0.00$) Fixed play equipment available (39.0 ± 1.4 vs. 43.3 ± 2.0, $p = 0.02$) Active play using portable play equipment provided daily (38.2 ± 1.3 vs. 42.4 ± 1.7; $p = 0.01$) Educator routinely played with children during active free play time (37.4 ± 1.3 vs. 42.7 ± 1.5 ; $p = 0.00$) Educator read books or played games with physical activity (39.6 ± 1.5 vs. 44.0 ± 2.3; $p = 0.02$) Education about PA was offered to parents (35.5 ± 1.6 vs. 40.4 ± 1.1; $p = 0.01$) 4≥ significant PPA characteristics (37.5 ± 0.8 vs. 49.6 ± 2.1; p <0.00) Less sedentary time in short bouts associated with PPA FDC compared to non-PPA for the following categories: Daily outdoor active play (60.0 ± 1.6 vs. 68.7 ± 3.1; $p = 0.02$) Children not seated for more than 30 min at a time (59.9 ± 2.1 vs. 67.2 ± 2.4; $p = 0.02$) Computer use limited to only a few times a week (59.2 ± 1.6 vs. 71.6 ± 3.0; $p < 0.00$) Active play using portable play equipment provided daily (59.4 ± 1.8 vs. 66.2 ± 2.4; $p = 0.02$) Educators routinely played with children during active free play time (57.8 ± 1.8 vs. 67.7 ± 2.2; $p = 0.00$) Educators read books or played games with physical activity (62.0 ± 2.6 vs. 71.4 ± 4.0; $p = 0.01$)

				Education about PA was offered to parents (56.4 ± 2.8 vs. 63.7 ± 1.7; $p = 0.03$) 4≥ significant PPA characteristics (59.3 ± 1.4 vs. 80.3 ± 3.9; $p < 0.00$) Less sedentary time in medium bouts associated with FDC classified as promoting physical activity for the following categories compared to non-PPA: Children not seated for more than 30 min at a time (24.2 ± 2.1 vs. 31.2 ± 2.7; $p = 0.00$) Active play using portable play equipment provided daily (24.3 ± 2.1 vs. 28.7 ± 2.6; $p = 0.04$) Indoor play space available for all activities (19.7 ± 2.8 vs. 26.0 ± 1.9; $p = 0.02$) Educator routinely played with children during active free play time (23.4 ± 2.2 vs. 26.0 ± 1.7; $p = 0.01$) Education about PA was offered to parents (21.6 ± 2.7 vs. 26.7 ± 2.1; $p = 0.04$) 4≥ significant PPA characteristics (21.1 ± 1.1 vs. 33.5 ± 3.0; $p <0.00$)	
Kang et al. 2021 Rhode Island and Massachusetts, US	118 FDC educators 342 aged 2-5 years	Triaxial GT3XTM ActiGraph accelerometers worn for 2 days 5 sec epochs Freedson et al. cut-points *naptime included in analysis Correlates were reported for the full dataset and the upper median-half of wear	Survey assessed age, sex and ethnicity (Hispanic vs. non-Hispanic)	% time sedentary positively associated with: Younger children aged 2-years compared to 4-5 year olds (66.3% vs. 62.6%, $p = 0.03$) % time in moderate physical activity positively associated with: Older children- 2-year olds vs. 3-year olds vs. 4-5yr olds (5.1% vs. 6.0% vs. 6.7%; $p < 0.00$) Males vs. females (6.3 ± 2.1 vs. 5.5 ± 2.0, $p = 0.01$) % time in MVPA positively associated with: Older children- 2-year olds vs. 2-year olds vs. 4-5yr olds (7.4% vs. 9.1% vs. 10.6%, $p < 0.00$) Males vs. females (9.7 ± 3.4 vs. 8.1 ± 3.3, $p = 0.00$)	Intrapersonal

		time data set however only significant findings from the full dataset are reported in this review		% time in vigorous activity positively associated with: Older children 2-year olds vs. 3-year olds vs. 4-5yr olds (2.3% vs. 3.1% vs. 3.9%, $p < 0.00$) Males vs. females (3.4 ± 1.5 vs. 2.7 ± 1.4, $p = 0.00$)	
Rice et al. 2014 Oregon, US	47 FDC educators 114 children aged 2-5 years	ActiGraph GT1M accelerometer worn for 2-5 days. Van Cauwnberghe et al. cut-points	Gender, body mass index and age group (2-3 year olds and 4-5 year olds)	Higher MVPA associated with: Gender - boys compared to girls Age- healthy weight 4-5 year olds compared to healthy weight 2-3 years old BMI- Healthy weight children aged 4-5 years compared to overweight and obese children aged 4-5 year age category Higher total physical activity associated with: Gender- boys compared to girls Age- healthy weight 4-5 years old compared to healthy weight 2-3 years BMI- Healthy weight children aged 4-5 years compared to overweight and obese children aged 4-5 year age category (exact values not reported)	Intrapersonal
Temple et al. 2009 British Columbia, Canada	23 FDC educators 65 children aged 3-5 years	Actical™ accelerometers worn for 1-4 days 15 sec epochs Pfeiffer et al. cut-points	Gender	No gender-related differences were detected sedentary behavior and light, moderate-vigorous and vigorous physical activity	Intrapersonal
Delaney et al., 2014 Washington, US	31 FDC educators 144 children aged 3-6 years	Actigraph GT1M accelerometers worn over a 5-day period 10 sec epochs Pfeiffer et al. cut-points Wear-time ≥ 3hours	NAP SACC	Higher MVPA associated with: >120 minutes per day of active play time compared to <45 minutes per day (7.9 ± 0.3 vs. 9.3 ± 2.5) TV used rarely or never compared to TV on 5 or more hours per week (8.7 ± 1.0 vs. 6.8 ± 1.7) Higher sedentary behavior associated with:	Interpersonal Organizational

				TV used rarely or never compared to TV on 5 or more hours per week (33.5 ± 1.3 vs. 36.1 ± 3.1) Significance levels not tested	
Gunter et al. 2012 Oregan, US	45 FDC educators 136 children aged 2-5 years	ActiGraph GT1M accelerometers worn 2 or more days. Pate et al. cut-points. Epochs not reported	NAP SACC Categories condensed to promoting physical activity or not promoting physical activity	Higher total activity associated with FDC classified as promoting physical activity for the following categories compared to non-PPA: Daily outdoor active play (32.2 (1.0) vs. 28.6 (1.3) min/hr, $p = 0.00$) Variety of fixed play equipment (32.2 (1.0) vs. 28.9 (1.3) 0.002, $p = 0.00$) Active play using portable play equipment provided daily (31.7 (1.0) vs. 29.3 (1.4), $p = 0.04$) Indoor play space is available and suitable for all activities (33.6 (1.4) vs. 31.0 (1.0), $p = 0.03$) Educator often or always plays with children during active (free) play time (32.1 (1.1) vs. 29.6 (1.2), $p = 0.01$) Educator receives training or attends workshops on PA 1 or more times per year (33.1 (1.2) vs. 30.3 (1.1), $p = 0.01$) Four or more significant PPA characteristics (32.3 (1.1) vs. 28.8 (1.2), $p = 0.00$)	Interpersonal Organizational
Mazzucca, et al. 2018 North Carolina, US	165 FDC educators rs 495 children aged 1.5–4.0 years	ActiGraph GT3X+ accelerometers for 2 non-consecutive days. 15-second epoch. Pate et al. cut-points	EPAO	No associations reached statistical significance	Interpersonal Organizational
Tucker et al. 2015 London, Ontario, Canada	11 FDC educators 20 children aged 2.5–5 years	Actical™ accelerometers worn for 3-5 days during childcare hours. 15 sec epochs Pfeiffer et al. cut-points	EPAO - five sedentary behavior subscales examined during 1-day observation period	Sedentary time positively associated with staff behavior scores* (β 1.45; 95% CI: -0.17, 2.91; p = 0.03) * Higher scores indicated more sedentary environments	Interpersonal Organizational

Vanderloo et al. 2015 London, Ontario, Canada	11 FDC educators 20 children aged 2.5–5 years	Actical™ accelerometers worn for 3-5 days during childcare hours. 15 sec epochs Pfeiffer et al. cut-points	EPAO - eight physical activity subscales examined during 1-day observation period	No significant relationships were observed between the 8 EPAO subscales and children's physical activity	Interpersonal Organizational
Neshteruk al. 2018, North Carolina, US	166 FDC educators 496 children aged 1.5-4 years	ActiGraph GT3X+ accelerometers for 2 non-consecutive days 15-second epoch Evenson et al. and Pate et al. cut-points	EPAO Indoor environment, portable play equipment, and the outdoor environment	Higher MVPA associated with indoor space available in the adjusted model ($\beta = 0.33$ (SE=0.16); $p = 0.03$)	Organizational

Abbreviations: BMI- body mass index, DOCC- Diet Observation at Child Care, EPAO- Environment and Policy Assessment and Observation, FDC- family day care, HEI- healthy eating index, MVPA- moderate-to-vigorous physical activity, NAP SACC- Nutrition and Physical Activity Self- Assessment for Child Care, PPA- promoting physical activity

3.2. Summarizing the outcome findings related to children's dietary intake

3.2.1. Dietary intake

All studies that measured children's dietary intake used the Diet Observation at Child Care methodology (Table 3.3). Two studies used baseline data from the Keys to Healthy Family Child Care Homes (Keys) intervention (Benjamin-Neelon et al., 2018; Tovar et al., 2018a), one study used follow-up data from the Keys intervention (Tovar et al., 2018b) and three studies used baseline data from the Healthy Start/Comienzos Sanos (Healthy Start) intervention (Cuadrado-Soto et al., 2019; Ramirez et al., 2020; Tovar et al., 2020). Educators provided food for children in all the studies. Eleven correlates of children's dietary intake were identified (Table 3.4), one at an intrapersonal level, three at an interpersonal level and seven at an organisational level.

Table 3. 3 Summary of reported correlates – children's dietary intake

Correlate	Significant association between sub-groups	Association (±)	No association
Intrapersonal			
Age	2-3 years compared to 4-5 years (Cuadrado-Soto et al., 2019)[a]	+ B12 + Potassium + Zinc	(Cuadrado-Soto et al., 2019)[a] No associations for 11 vitamins or 8 minerals
Interpersonal			
Educator ethnicity	Latino compared to non-Latino (Ramirez et al., 2020)a (Tovar et al., 2020)[a]	+ Legumes + Oils + Vegetable oils - Total grain serves + Diet quality + Total vegetables + Greens/beans + Total protein foods + Seafood and plant proteins + Lower refined grains	(Ramirez et al., 2020)[a] No associations with 50 food group and food item variables (Tovar et al., 2020)[a] No associations with 8 HEI-2015 component scores
Educator income	Lower income compared to higher income (Tovar et al., 2020)[a]	+ Greens/beans + Total protein foods + Seafood and plant proteins	(Tovar et al., 2020)[a] No associations with 10 HEI-2015 components and overall diet quality score
Educator feeding practices	Higher autonomy support scores (Tovar et al., 2018b)[b]	+ Diet quality	(Benjamin-Neelon et al., 2018)[b] Feeding practices scores (Tovar et al., 2018b)[b] Coercive control/indulgent feeding practices and negative role modelling
Organisational			
Overall nutrition environment	EPAO total nutrition score (Benjamin-Neelon et al., 2018)[b]	+ Diet quality	
Nutritional quality of food provided	Higher nutrition quality (Benjamin-Neelon et al., 2018; Tovar et al., 2018a)[b,c]	+ Diet quality	

Nutrition education and professional development	Higher nutrition educations scores (Benjamin-Neelon et al., 2018)[b]	+ Diet quality	
Nutrition policy	Higher nutrition policy scores (Benjamin-Neelon et al., 2018)[b]	+ Diet quality	
Beverages provided			(Benjamin-Neelon et al., 2018)[b] No associations with beverage scores and overall diet quality score
Feeding environment			(Benjamin-Neelon et al., 2018)[b] No associations with feeding environment scores and overall diet quality score
Menus and variety			(Benjamin-Neelon et al., 2018)[b] No associations with menus and variety scores and overall diet quality score

EPAO- Environment and Policy Assessment and Observation; HEI-Healthy Eating Index
[a]Data from the Healthy Start/Comienzos Sanos intervention
[b]Data from the Keys to Healthy Family Child Care Homes intervention
[c]Food provided were assessed using the EPAO (Benjamin-Neelon et al., 2018) and Diet Observation at Child Care (Tovar et al., 2018a)

3.2.2. Intrapersonal variables

Age was the only intrapersonal correlate assessed. Younger children consumed higher nutrient densities for three vitamins and minerals (vitamin B12, potassium, and zinc) out of 19 micronutrients assessed compared to older children (Cuadrado-Soto et al., 2019).

3.2.3. Interpersonal variables

Three interpersonal variables were assessed. Two studies assessed educator ethnicity (Ramirez et al., 2020; Tovar et al., 2020) and educators' feeding practices (Benjamin-Neelon et al., 2018; Tovar et al., 2018b) and one study assessed educators' income (Tovar et al., 2020). Ethnicity was positively associated with several food groups and food items (Ramirez et al., 2020; Tovar et al., 2020) and overall diet quality (Tovar et al., 2020). One study found that lower-income educators were positively associated with children's

intake of green beans, total protein foods and seafood/plant proteins (Tovar et al., 2020). However, there was no difference in overall diet quality between lower- and higher-income educators after adjusting for educators' participation in the Child and Adult Food Program (Tovar et al., 2020). Out of the two studies that assessed educators' feeding practices, one study found that autonomy support practices (whereby educators encouraged children to eat according to their satiety) were positively associated with children's diet quality (Tovar et al., 2018b), and the other study found no association with educators' feeding practice scores and children's diets (Benjamin-Neelon et al., 2018).

3.2.4. Organisational variables

Seven organisational variables were assessed using baseline data from the Keys intervention (Benjamin-Neelon et al., 2018; Tovar et al., 2018b). Children's diet quality was positively associated with the FDC nutrition environment (Benjamin-Neelon et al., 2018), foods provided (Benjamin-Neelon et al., 2018; Tovar et al., 2018a), nutrition education and professional development (Benjamin-Neelon et al., 2018) and FDC nutrition policy (Benjamin-Neelon et al., 2018) scores. Children's diet quality was not associated with beverages provided, feeding environment, menus or variety scores (Benjamin-Neelon et al., 2018).

3.3. Summarising the outcome findings related to children's physical activity and sedentary behaviour

3.3.1. Physical activity and sedentary behaviour

All studies that measured children's physical activity or sedentary behaviour used accelerometers; six used ActiGraphs, and three used Acticals. The number of days that children wore an accelerometer ranged from one to five days. The epochs and cut-points used to analyse the accelerometry data varied (Table 3.3). Thirty-seven correlates for

children's physical activity were identified (Table 3.5), four at an intrapersonal level and 33 at an organisational level. Twenty-nine correlates for children's sedentary behaviour were identified (Table 3.6), three at an intrapersonal level and 26 at an organisational level. Two tools assessed the organisational environment: a self-assessment survey, the Nutrition and Physical Activity Self-Assessment for Child Care instrument (NAP SACC) (Chai et al., 2020; Delaney et al., 2014; Gunter et al., 2012) and a direct observation tool, the Environment and Policy Assessment and Observation (EPAO) (Mazzucca et al., 2018; Neshteruk et al., 2018; Tucker et al., 2015; Vanderloo et al., 2015).

Table 3. 4 Summary of reported correlates – children's physical activity

Correlate	Found association with children's physical activity in FDC service (reference)	Association (±)	Found no association with children's physical activity in ECEC service (reference)	Summary coding for row (n/N for row; %)	Summary code for association (–/+/0/?)
Intrapersonal					
Age	Older children compared to younger children (Kang et al., 2021)[a] (Rice and Trost, 2014)[a,c] (Rice and Trost, 2014)[c]	+	(Kang et al., 2021)[b] (Rice and Trost, 2014)[a,d] (Rice and Trost, 2014)[d]	3/6	?
Sex	Boys compared to girls (Kang et al., 2021)[a] (Rice and Trost, 2014)[a] (Rice and Trost, 2014)	+	(Kang et al., 2021)[b] (Temple et al., 2009)[b] (Temple et al., 2009)[a]	3/6 50%	?
BMI	Healthy weight compared to overweight/obese children aged 4-5 years (Rice and Trost, 2014) (Rice and Trost, 2014)[a]	+ +	Healthy weight compared to overweight/obese children aged 2-3 year old (Rice and Trost, 2014) (Rice and Trost, 2014)[a]	2/4 (50%)	?
Ethnicity			Hispanic compared to non-Hispanic (Kang et al., 2021)[a] (Kang et al., 2021)[b]	0/2	0
Interpersonal					
Educator's physical activity practices/ behaviours			(Mazzucca et al., 2018)[a] (Vanderloo et al., 2015) (Vanderloo et al., 2015)[a]	0/2 (0%)	0
Educator plays with children during active free play time	(Gunter et al., 2012)	+	(Delaney et al., 2014)[a]	1/2 (50%)	?

Educator never restricts active play time for children who misbehave			(Gunter et al., 2012)	0/1 (0%)	0
Organisational					
Physical activity opportunities					
Time provided for physical activity	(Delaney et al., 2014) [a]	+	(Mazzucca et al., 2018)[a] (Vanderloo et al., 2015) (Vanderloo et al., 2015)[a]	1/4 (25%)	0
Structured physical activity provided daily			(Gunter et al., 2012)	0/1 (0%)	0
Active (free) play time is provided for all children for 60 min/day			(Gunter et al., 2012)	0/1 (0%)	0
Outdoor play frequency			(Delaney et al., 2014) [a]	0	0
Outdoor playtime	(Gunter et al., 2012)	+	(Mazzucca et al., 2018)[a]	1/2 (50%)	?
Active play using portable play equipment provided daily	(Gunter et al., 2012)	+		1/1 (100%)	+
Physical activity environment					
Outdoor play environment			(Mazzucca et al., 2018)[a]	0/1 (0%)	0
Outdoor space			(Neshteruk et al., 2018)[a]	0/1 (0%)	0
Landscape attractiveness			(Neshteruk et al., 2018)[a]	0/1 (0%)	0
Active landscape			(Neshteruk et al., 2018)[a]	0/1 (0%)	0
Indoor play space	(Gunter et al., 2012) (Neshteruk et al., 2018) [a]	+ +		2/2 (100%)	+
Physical activity equipment					
Portable play equipment			(Vanderloo et al., 2015)	0/6 (0%)	00

			(Vanderloo et al., 2015)[a] (Gunter et al., 2012) (Neshteruk et al., 2018)[a,i] (Neshteruk et al., 2018)[a,j] (Neshteruk et al., 2018)[a,k]		
Fixed play equipment available	(Gunter et al., 2012)	+	(Mazzucca et al., 2018)[a] (Neshteruk et al., 2018)[a,g] (Neshteruk et al., 2018)[a,h] (Vanderloo et al., 2015) (Vanderloo et al., 2015) [a]	1/6 (17%)	0
Indoor play equipment			(Mazzucca et al., 2018)[a]	0/1 (0%)	0
Physical activity promotion and education					
Displays posters, pictures, or books about physical activity			(Gunter et al., 2012) (Neshteruk et al., 2018)[a]	0/2 (0%)	0
Educator reads books or plays games about physical activity			(Gunter et al., 2012)	0/1 (0%)	0
Education about physical activity is offered to parents through flyers, handouts, brochures, newsletters			(Gunter et al., 2012)	0/1 (0%)	0
Sedentary and screen time practices					
Sedentary opportunities			(Vanderloo et al., 2015) (Vanderloo et al., 2015) [a]	0/1 (0%)	0
Sedentary environment			(Vanderloo et al., 2015)	0/1 (0%)	0

			(Vanderloo et al., 2015) [a]		
Children are seated (excluding nap time) more than 30 min at a time once per week or less			(Gunter et al., 2012) (Delaney et al., 2014)	0/2 (0%)	0
Screen time			(Mazzucca et al., 2018) [a]	0/1 (0%)	0
Screen time practices			(Mazzucca et al., 2018) [a]	0/1 (0%)	0
Children are allowed to use a computer for educational purposes or games less than 4 times per week			(Gunter et al., 2012)	0/1 (0%)	0
Children are allowed to watch TV, videos or play video games less than 4 times per week			(Gunter et al., 2012)	0/1 (0%)	0
Television on 5 or more hours per week	(Delaney et al., 2014)	-		1/1 (100%)	-
Television used rarely and only viewing for educational programs			(Gunter et al., 2012)	0/1 (0%)	0
Media			(Delaney et al., 2014)[a]	0/1 (0%)	0
Professional development					
Physical activity education and professional development			(Mazzucca et al., 2018) [a] (Vanderloo et al., 2015) (Vanderloo et al., 2015) [a]	0/2 (0%)	0
Physical activity professional	(Gunter et al., 2012)	+	(Delaney et al., 2014)	1/2 (50%)	?

development 1 or more times per year				
Policy				
Physical activity policy			(Gunter et al., 2012) (Mazzucca et al., 2018)[a] (Vanderloo et al., 2015) (Vanderloo et al., 2015)[a]	0/1 (0%)	0
Screen time policy			(Mazzucca et al., 2018)[a]	0/1 (0%)	0
Overall physical activity environment					
4≥ significant promoting physical activity characteristics	(Gunter et al., 2012)	+		1/1 (100%)	+

a- MVPA, b- light physical activity, c- healthy weight categories, d- Overweight or obese categories, e- Healthy weight compared to overweight/obese children aged 4-5 years, f - healthy weight compared to overweight/obese children aged 2-3 year old, g- active fixed play equipment, h- creative fixed play equipment, i- availability, j- accessibility, k- variety
Summary code: 0 no association, ? indeterminate association, + positive association, – negative association

Table 3. 5 Summary of reported correlates – children's sedentary behaviour

Correlate	Found association with children's sedentary behaviour in FDC service (reference)	Association (±)	Found no association with children's sedentary behaviour in ECEC service (reference)	Summary coding for row (n/N for row; %)	Summary code for association (–/+)
Intrapersonal					
Age			(Kang et al., 2021)	0/1 (0%)	0
Sex	Boys compared to girls (Chai et al., 2020)[a] (Chai et al., 2020)[b] (Chai et al., 2020)[f]	-	(Temple et al., 2009) (Kang et al., 2021) (Chai et al., 2020)[c] (Chai et al., 2020)[d] (Chai et al., 2020)[e] (Chai et al., 2020)[g] (Chai et al., 2020)[h] (Chai et al., 2020)[i]	3/11 (27%)	00
Ethnicity			Hispanic compared to non-Hispanic (Kang et al., 2021)	0/1 (0%)	?
Interpersonal					
Educator's physical activity practices/ behaviours	(Tucker et al., 2015)[j]	-	(Mazzucca et al., 2018)	1/2 (50%)	?
Educator routinely played with children during active free play time	(Chai et al., 2020)[a] (Chai et al., 2020)[f] (Chai et al., 2020)[g]	-	(Delaney et al., 2014)	3/4 (75%)	-
Organisational					
Physical activity opportunities					
Time provided for physical activity			(Mazzucca et al., 2018) (Delaney et al., 2014)	0/2 (0%)	0
Structured physical activity provided daily			(Chai et al., 2020)[a]	0/3 (0%)	0

			(Chai et al., 2020)[f] (Chai et al., 2020)[g]		
Daily outdoor active play	(Chai et al., 2020)[a] (Chai et al., 2020)[f]	-	(Chai et al., 2020)[g]	2/3 (67%)	-
Outdoor play frequency			(Delaney et al., 2014)	0/1 (0%)	0
Outdoor playtime			(Mazzucca et al., 2018)		0
Active play using portable play equipment provided daily	(Chai et al., 2020)[a] (Chai et al., 2020)[f] (Chai et al., 2020)[g]	-		3/3 (100%)	-
Physical activity environment					
Outdoor play environment			(Mazzucca et al., 2018)	0/1 (0%)	0
Indoor play space available for all activities	(Chai et al., 2020)[g]	-	(Chai et al., 2020)[a] (Chai et al., 2020)[f]	1/3 (33%)	0
Physical activity equipment					
Portable play environment			(Tucker et al., 2015)	0/1 (0%)	0
Fixed play equipment	(Chai et al., 2020)[a]	-	(Chai et al., 2020)[f] (Chai et al., 2020)[g] (Tucker et al., 2015)	1/4 (25%)	0
Indoor play equipment			(Mazzucca et al., 2018)	0/1 (0%)	0
Physical activity professional development					
Physical activity education and professional development			(Mazzucca et al., 2018)	0/1 (0%)	0
Educator receives training or attend workshops on physical activity at least once a year			(Chai et al., 2020)[a] (Chai et al., 2020)[f] (Chai et al., 2020)[g] (Delaney et al., 2014)	0/4 (0%)	0
Physical activity promotion and education					
Educator read books or plays	(Chai et al., 2020)[a]	-	(Chai et al., 2020)[g]	2/3 (67%)	-

games about physical activity	(Chai et al., 2020)[f]				
Education about physical activity was offered to parents	(Chai et al., 2020)[a] (Chai et al., 2020)[f] (Chai et al., 2020)[g]	-		3/3 (100%)	-
Sedentary and screen time practices					
Sedentary Opportunities			(Tucker et al., 2015)	0/1 (0%)	0
Sedentary Environment			(Tucker et al., 2015)	0/1 (0%)	0
Children are seated (excluding nap time) for more than 30 min at a time once per week or less	(Chai et al., 2020)[a] (Chai et al., 2020)[f] (Chai et al., 2020)[g]	+	(Delaney et al., 2014)	3/4 (75%)	+
Screen time			(Mazzucca et al., 2018)	0/0 (0%)	0
Screen time practices			(Mazzucca et al., 2018)	0/1 (0%)	0
Children are allowed to use a computer for educational purposes or games less than 4 times per week	(Chai et al., 2020)[a] (Chai et al., 2020)[f]	-	(Chai et al., 2020)[g]	2/3 (67%)	-
Children are allowed to watch TV, videos or play video games less than 4 times per week			(Chai et al., 2020)[a] (Chai et al., 2020)[f] (Chai et al., 2020)[g]	0/3 (0%)	0
Television on 5 or more hours per week	(Delaney et al., 2014)	+		1/1	+
Policy					
Physical activity policy			(Mazzucca et al., 2018) (Chai et al., 2020)[a] (Chai et al., 2020)[f] (Chai et al., 2020)[g]	0/4 (0%)	0
Screen time policy			(Mazzucca et al., 2018)	0/1 (0%)	0

Overall physical activity environment				
4≥ significant promoting physical activity characteristics	(Chai et al., 2020)[a] (Chai et al., 2020)[f] (Chai et al., 2020)[g]	-	3/3 (100%)	-

a- Number of total sedentary bouts, b-number of short sedentary bouts, c- number of medium sedentary bouts, d- number of long sedentary bouts, e- number of extended sedentary bouts, f – time spend in short sedentary bouts, g- time spend in medium sedentary bouts, h- time spend in long sedentary bouts, i- time spend in extended sedentary bouts, j- Study reported a positive association; however, higher educators behaviour scores indicated a more sedentary environment so the association was revered in the table
Summary code: 0 no association, ? indeterminate association, + positive association, – negative association

3.3.2. Intrapersonal variables

Four intrapersonal variables were assessed; three correlates were identified for physical activity, and one correlate was identified for sedentary behaviour. Two studies found children's age, sex, and body mass index (BMI) were associated with physical activity; however, the strength of associations was inconclusive. One study reported that girls had more short sedentary bouts and total sedentary bouts than boys (Chai et al., 2020) however these findings were not supported in other studies (Chai et al., 2020; Kang et al., 2021; Temple et al., 2009). Children's age and ethnicity were not associated with sedentary behaviour (Kang et al., 2021).

3.3.3. Interpersonal variables

Three interpersonal variables were assessed; one correlate was identified for physical activity, and two correlates were identified for sedentary behaviour. The two studies that assessed educators' physical activity practices reported no association with physical activity (Mazzucca et al., 2018; Vanderloo et al., 2015) and were negatively associated with sedentary behaviour in one (Tucker et al., 2015) out of two studies (Mazzucca et al., 2018). Educators' regular participation in active play was positively associated with children's physical activity levels in one (Gunter et al., 2012) out of two studies (Delaney

et al., 2014) and negatively associated with the number of sedentary bouts and sedentary time in short and medium bouts (Chai et al., 2020).

3.3.4. Organisational variables

Thirty-three correlates were assessed at the organisational level. The correlates were grouped into the following categories: physical activity opportunities, physical activity environment, physical activity equipment, physical activity promotion and education, sedentary and screen time practices, professional development, policy and overall physical activity environment.

Seven variables relating to physical activity opportunity were assessed, three associations were identified for physical activity, and one association was identified for sedentary behaviour. Time provided for physical activity was associated with physical activity in one (Delaney et al., 2014) of three studies (Mazzucca et al., 2018; Vanderloo et al., 2015). Outdoor play was associated with total physical activity in one (Gunter et al., 2012) out of two studies (Mazzucca et al., 2018). Providing daily active play using portable play equipment was associated with physical activity in the one study that it was assessed (Gunter et al., 2012). Daily outdoor activity play was associated with fewer sedentary bouts and less sedentary time in shorter bouts (Chai et al., 2020).

Five variables relating to the physical activity environment were assessed. Indoor play space was positively associated with physical activity in the only two studies that it was assessed (Gunter et al., 2012; Neshteruk et al., 2018) and negatively associated with sedentary time spent in medium bouts (Chai et al., 2020). No other aspects of the physical activity environment, such as outdoor space, were associated with physical activity. Three variables assessed physical activity equipment. The availability of fixed play equipment was positively associated with physical activity in one (Gunter et al., 2012) out of four

studies, and negatively associated with sedentary behaviour in one (Chai et al., 2020) out of two studies (Tucker et al., 2015).

Three variables relating to physical activity promotion and education were assessed; two associations were identified for sedentary behaviour. One study assessed reading books and playing games about physical activity and offering parents education about physical activity. This study reported negative associations with sedentary behaviour (Chai et al., 2020). Ten variables assessed sedentary and screen time practices; one association was identified for physical activity, and three associations were identified for sedentary behaviour. Watching television for five or more hours per week was negatively associated with physical activity and positively associated with sedentary behaviour (Delaney et al., 2014). Limiting computer use was negatively associated with sedentary behaviour (Chai et al., 2020), and seated time was positively associated with sedentary behaviour in one (Chai et al., 2020) out of two studies (Delaney et al., 2014).

Two variables relating to physical activity professional development were assessed. One out of two studies found that physical activity professional development was associated with physical activity (Gunter et al., 2012). Physical activity or screen time policies were not associated with children's physical activity or sedentary behaviour (Chai et al., 2020; Gunter et al., 2012; Mazzucca et al., 2018; Vanderloo et al., 2015). The two studies that assessed FDC services' physical activity practices using the NAP SACC survey created a new category to include FDC with four or more significant promoting physical activity characteristics. Both studies found a positive association with physical activity (Gunter et al., 2012) and a negative association with sedentary behaviour (Chai et al., 2020).

3.4. Risk of bias

The risk of bias results are summarised in Table 3.7 and supplementary file 3. 2 provides additional details for each rating (Appendix K). For the nutrition studies, all studies were rated 'probably low risk' or 'definitely low risk'. The Diet Observation at Child Care methodology was rated probably low risk for the outcome detection bias due to the subjectivity of estimating foods and beverages, which is not as accurate as weighing foods (Sambell et al., 2019). All physical activity and sedentary behaviour studies were rated low risk of detection bias for the outcome variable because they used accelerometers. The studies that used the NAP SACC survey scored probably high risk of bias because of self-report and being subject to self-reporting bias (Chai et al., 2020; Delaney et al., 2014; Gunter et al., 2012). The two studies that had the overall lowest risk of bias used the baseline data from the Keys intervention (Mazzucca et al., 2018; Neshteruk et al., 2018).

Table 3. 6 Risk of bias

Nutrition – Diet intake	**Selection bias**	**Confounding bias**	**Attrition/ exclusion bias**	**Detection bias (exposure)**	**Detection bias (outcome)**	**Selective reporting bias**	**Conflict of Interest**	**Other bias**
Benjamin-Neelon et al. 2018	+	++	+	++	+	++	++	X*
Cuadrado-Soto et al. 2019	+	–	NR	++	+	++	++	X*
Ramirez et al 2020	+	++	+	++	+	++	++	X*
Tovar et al., 2018a	+	++	+	+	+	++	++	X*
Tovar et al., 2018b	+	++	+	+	+	++	++	X*
Tovar et al. 2020	+	+	+	++	+	++	++	X*
Physical activity and sedentary behaviours								
Chai et al., 2020	++	–	–	–	++	–	++	+
Delaney et al., 2014	–	––	–	–	++	––	+	––
Gunter et al., 2012	++	++	+	–	++	++	++	+
Kang et a. 2021	+	–	–	++	++	++	++	–
Mazzucca, et al. 2018	+	++	+	++	++	++	++	X*
Neshteruk et al. 2018	+	+	+	++	++	++	++	X*
Rice et al. 2014	++	–	++	++	++	+	+	+
Temple et al. 2009	+	–	+	++	++	–	++	–
Tucker et al. 2015	–	+	+	++	++	++	++	–
Vanderloo et al. 2015	–	+	+	++	++	++	++	–

++ Definitely low risk + Probably low risk – Probably high risk –– Definitely high risk NR Not reported

***** No other bias identified

3.2.4 Discussion

This systematic review examined the correlates of children's dietary intake, physical activity and sedentary behaviour in FDC. The findings suggest that FDC services are associated with children's health-related behaviours. However, no strong associations for children's dietary intake, physical activity, or sedentary behaviour in FDC were found due to the heterogeneity of the correlations and outcome variables assessed.

All the studies that assessed children's dietary intake were conducted in the USA as part of the Keys and Healthy Start interventions (Benjamin-Neelon et al., 2018; Cuadrado-Soto et al., 2019; Ramirez et al., 2020; Tovar et al., 2020, 2018a, 2018b). At the intrapersonal level, younger children had higher nutrient densities than older children for three out of the 22 micronutrients assessed. Consistent with these findings, a study assessing the food provided to children in Australian FDC services found that younger children (aged 11-23 months compared to those aged 2-5 years) were more likely to be provided with food that met the dietary requirements for their age group (Kerr et al., 2020). This Australian study was excluded from the current review as it assessed food provision rather than consumption. Further, national dietary surveillance studies from the USA and Australia have found that children aged 2-3 years are more likely to meet dietary guidelines compared to children aged 4-8 years (Australian Institute of Health and Welfare., 2018; Martin et al., 2021).

At the interpersonal level, educators' ethnicity, income and feeding practices were associated with dietary intake. Two studies from the Healthy Start intervention reported positive associations between educator's ethnicity and children's diet quality (Tovar et al., 2020), and food group components (Ramirez et al., 2020; Tovar et al., 2020). Legumes predominantly contributed to increased diet quality, which is unsurprising because

legumes are an integral food component in the traditional Latino diet (Cuy Castellanos, 2015). Latino FDC educators have reported stronger values and motivation to provide children with healthy foods compared with non-Latino educators (Lindsay et al., 2017; Tovar et al., 2015). However, it is important to note that the average serve of legumes consumed by children from Latino educators' homes was small and any difference may not be meaningful (Ramirez et al., 2020). Future studies should explore the influence of different ethnic backgrounds because other studies have found that ethnicity is associated with better diet quality (van der Velde et al., 2019) and higher levels of childhood obesity (Hardy et al., 2019; Ogden et al., 2014).

Educators with lower incomes provided children with more green beans, total protein foods and seafood and plant proteins; however, there was no association with overall diet quality when adjusted for Child and Adult Care Food Program participation and ethnicity. Other FDC studies have also found that FDC educators who were Child and Adult Care Food Program participants (Erinosho et al., 2018; Lazarus et al., 2018; Monsivais et al., 2011; Williams et al., 2021) or from areas of low socio-economic status (SES) (Kerr et al., 2020) were more likely to provide healthy food. Nevertheless, social deprivation has been associated with poorer dietary behaviours (Mahmood et al., 2021; Spence et al., 2018) and higher levels of obesity in children (Woo Baidal et al., 2016), and interventions should prioritise reaching children from low SES backgrounds.

Two studies from the Keys intervention assessed the influence of educators' feeding practices on children's dietary intake. Autonomy support practices were associated with increased diet quality (Tovar et al., 2018b) but not overall feeding practice scores (Benjamin-Neelon et al., 2018), coercive feeding practices or role modelling (Tovar et al., 2018b). Other systematic reviews have reported that centre-based ECEC educators'

practices (Ward et al., 2015) and parental feeding practices (Mahmood et al., 2021; Shloim et al., 2015) influence children's eating behaviours. Therefore, promoting positive feeding practices should be an integral component of nutrition interventions for FDC services.

The overall nutrition environment, nutrition education and professional development, and nutrition policies of FDCs were all associated with diet quality. However, the two studies that assessed these organisational correlates used baseline data from the Keys intervention (Benjamin-Neelon et al., 2018; Tovar et al., 2018a). Therefore, it is important that future research is conducted to determine if these findings are replicated in different population groups. Research in centre-based ECEC services has also found that children's diet intake is positively associated with the foods provided (Barnes et al., 2021; Nicklas et al., 2013). Nutrition policies have also been positively associated with the food provided in centre-based studies (Bussell et al., 2018). FDC interventions that include nutrition professional development for educators have found significant improvements in nutrition-related practices (Bravo et al., 2008; De Silva-Sanigorski et al., 2011; Dev et al., 2018; Trost et al., 2011; Woodward-Lopez et al., 2018) and children's overall diet quality (Ward et al., 2020). However, Ward et al., (2020) also found that the Keys intervention resulted in a reduction of children's vegetable intake. Likewise, mixed results have been reported in centre-based ECEC services, with some nutrition interventions reporting a positive impact on children's diet quality (Bell et al., 2015; Seward et al., 2018), while others reported no impact (Jones et al., 2015; Sharma et al., 2019).

Consistent with other reviews in centre-based ECEC services, this review identified multiple correlates of children's physical activity and sedentary behaviour, particularly at the organisational level of the social-ecological model (Terrón-Pérez et al., 2021; Tonge

et al., 2016). While this review found inconclusive results related to age, sex and BMI, a review conducted in centre-based services found a strong association between physical activity and children's age and sex, but inconclusive findings related to BMI and ethnicity (Tonge et al., 2016). Similar to this review, the influence of educators' behaviours on children's physical activity was mixed in centre-based studies (Tonge, 2019). However, none of the included studies assessed the quality of educator-to-child interactions in FDC services, which has been associated with children's physical activity in centre-based ECEC services (Tonge et al., 2019; Zhang et al., 2019).

At the organisational level, indoor play space was the only correlate that was positively associated with physical activity in more than one study (Gunter et al., 2012; Neshteruk et al., 2018) and was negatively associated with medium bouts of sedentary activity (Chai et al., 2020). Similarly, children's physical activity has been associated with indoor space (Terrón-Pérez et al., 2021; Tonge et al., 2016; Zhang et al., 2021) but not indoor play equipment (Zhang et al., 2021) or indoor play environment in centre-based services. Although many FDC educators may not be able to change their indoor space, educators can use strategies to promote movement and activity in small indoor spaces. This review identified no strong associations for physical activity or sedentary behaviour; however, four studies identified associations for outdoor playtime, active play using portable play equipment, fixed play equipment, television time and more than four significant promoting physical activity characteristics (Chai et al., 2020; Delaney et al., 2014; Gunter et al., 2012; Neshteruk et al., 2018). Increased sedentary behaviour was also negatively associated with physical activity promotion and education and positively associated with extended sitting time and computer use (Chai et al., 2020). Reviews in centre-based services have identified that physical activity was strongly associated with the outdoor environment (Terrón-Pérez et al., 2021; Tonge et al., 2016), large play spaces (Terrón-

Pérez et al., 2021; Tonge et al., 2016) and active opportunities (Tonge et al., 2016). In contrast, mixed findings have been identified for portable and fixed play equipment (Terrón-Pérez et al., 2021; Tonge et al., 2016). Similar to our study, policies were not associated with any changes in children's physical activity or sedentary behaviour and mixed findings were found for professional development in centre-based studies (Tonge et al., 2016). The current review found that professional development was only associated with physical activity in one study and not associated with reduced sedentary behaviour. Similarly, the Keys professional development intervention did not increase children's physical activity or reduce sedentary behaviour (Ward et al., 2020). These findings support the need for further exploration into the FDC environment.

Overall, the nutrition studies had a lower risk of bias compared to the studies assessing physical activity or sedentary behaviour. However, the six nutrition articles were from two main studies. For the physical activity and sedentary behaviour studies, most of the significant correlates identified were assessed from the NAP SACC survey. Only two significant associations were identified for children's physical activity and sedentary behaviour out of the four studies that used direct observation methods. One study found that indoor space was positively associated with MVPA (Neshteruk et al., 2018), and one study found that educators' behaviours was negatively associated with sedentary time (Tucker et al., 2015).

This systematic review has some limitations. First, we found few studies that assessed the same correlates, thereby limiting the potential for pooling the data in meta-analyses. Secondly, most of the studies were conducted in the USA and from the same population, limiting the generalisability of the findings.Further, no studies assessed children younger

than 1.5 years old. Another limitation is the exclusion of studies not written in English. It should also be noted that cross-sectional studies cannot determine causal relationships.

3.2.5 Conclusion

This systematic review summarises the evidence on the multiple influences of children's dietary intake, physical activity and sedentary behaviour in the FDC setting, particularly at an organisational level. The findings highlight the need for high-quality studies conducted in different countries that assess the nutrition and physical activity environments in FDC using reliable and consistent methods of assessment to enable direct comparison of results. The FDC setting provides an ideal environment for educators to facilitate improvements to the nutrition and physical activity behaviours of young children. Health-related professional development and interventions should target the multiple layers of the socio-ecological model. In particular, interventions should include an array of strategies to enhance educators' practices and their environment to support healthy eating and physical activity. Further, strategies should also address the challenges and structural barriers experienced by educators. Despite the finding that children's consumption of nutritious foods were associated with low income and Latino educators, interventions should still be appropriate for low socio-economic and culturally diverse groups.

3.3 Correlates of FDC educators' nutrition, physical activity and sedentary behaviour practices and environments

The below section comprises evidence on the correlates of educators' nutrition and physical activity practices and environment, which was not included in the published literature review presented in this Chapter.

3.3.1 Correlates of food provision and feeding practices in FDC

Eleven studies conducted in the USA assessed the factors associated with the food provided to children or educator's feeding practices in FDC at the interpersonal, organisational, community and policy levels of the socio-ecological model (Brann, 2010; Erinosho et al., 2019, 2018; Fortin-Miller et al., 2021; Gans et al., 2019; Lazarus et al., 2018; Loth et al., 2019; Monsivais et al., 2011; Monsivais and Johnson, 2012; Tovar et al., 2015; Williams et al., 2021).

Interpersonal correlates

One study assessed differences in food provision between Hispanic and non-Hispanic FDC educators using the EPAO (Gans et al., 2019). Non-Hispanic educators were more likely to provide children over two years with reduced-fat milk, offer fruit at least two times per day and never serve flavoured milk or sugary drinks (Gans et al., 2019). However, non-Hispanic providers were also more likely to prepare vegetables with fat and add syrup or sugar to fruit (Gans et al., 2019).

Two studies reported significant differences in positive feeding practices between Hispanic and non-Hispanic educators (Gans et al., 2019; Tovar et al., 2015). For example, Hispanic educators were more likely to report sitting with children during mealtimes (Tovar et al., 2015), being highly motivated to serve children healthy foods (Tovar et al., 2015) and waiting until children finished their meal before giving them more food (Gans et al., 2019). Conversely, non-Hispanic educators were significantly more likely to report asking children if they were hungry before serving more food, encouraging them to wait a few minutes before serving more food, letting children decide how much food they want to eat, and talking to about healthy eating (Gans et al., 2019). Negative feeding practices also differed significantly between Hispanic and non-Hispanic educators. Hispanic

educators were more likely to report encouraging children to finish all the food on their plate (Gans et al., 2019; Tovar et al., 2015) and rewarding children for eating (Gans et al., 2019). On the other hand, non-Hispanic educators were more likely to report calming children with food when they were upset, eating and drinking unhealthy foods in front of children, playing the TV or videos during meals (Gans et al., 2019). Out of the nine feeding practices observed via the EPAO, the only practice that significantly differed by ethnicity was that Hispanic educators were more likely to pressure children to eat more food than desired (Gans et al., 2019).

Another study looked at the influence of educators' characteristics and perceptions on their feeding practices (Brann, 2010). FDC educators who reported pressuring a child to eat were more likely to have lower education levels and to be concerned about children's weight (Brann, 2010). FDC educators that reported restricting particular foods were more likely to be concerned about children's weight and have high levels of responsibility in feeding children (Brann, 2010). Monitoring food intake was associated with responsibility in feeding and restricting particular foods (Brann, 2010).

Organisational correlates

Two studies assessed the impact of organisational correlates (food expenditure and nutrition training) on FDC educators' food provision and feeding practices. One study found that higher food expenditure positively influenced the nutritional quality of food provided, assessed by analysing menus and food shopping receipts (Monsivais and Johnson, 2012). Higher food expenditures were associated with more protein, wholegrains, fresh fruit and vegetables, overall menu adequacy ratio and lower energy density (Monsivais and Johnson, 2012). Loth et al., (2019) examined the effect of three different training programs on FDC educators' nutrition practices. Participation in the

parent AWARE program and other nutrition training opportunities were positively associated with overall nutrition best practice scores (Loth et al., 2019). However, this was not significant when adjusting for the impact of participation in multiple nutrition support programs (Loth et al., 2019). Another study found that FDC services in Minnesota that participated in a Statewide Health Improvement Partnership (SHIP) program implemented more infant feeding best practices and breastfeeding policies (Pelletier et al., 2019). However, participation in the program did not influence FDC educators' implementation of nutrition best practices and policies (Pelletier et al., 2019).

Community correlates

One study compared the food provided to children and educators' feeding practices in rural and urban FDC services; however, no significant differences were identified (Erinosho et al., 2019). Another study found that FDC services in "food desert" areas were less likely to serve children fresh produce (Fortin-Miller et al., 2021).

Policy correlates

Six cross-sectional studies assessed the impact of the Child and Adult Care Food Program (CACFP) on the food provided to children and on educators' nutrition practices (Erinosho et al., 2018; Lazarus et al., 2018; Loth et al., 2019; Monsivais et al., 2011; Tovar et al., 2015; Williams et al., 2021). CACFP is a federal US program that reimburses ECEC services for providing nutritious foods to children from low-income families (Liu et al., 2016). One study found that the nutritional quality of menus was greater with higher-reimbursement CACFP educators compared to lower-reimbursement CACFP educators (Monsivais et al., 2011).

Three studies found that CACFP FDC educators were more likely to have positive feeding and mealtime practices than non-CACFP educators (Erinosho et al., 2018; Lazarus et al.,

2018; Williams et al., 2021). In the first study, CACFP FDC educators were more likely to report sitting with children during mealtimes and promoting healthy eating by teaching children about foods they were eating, talking about the importance of healthy eating, the food children were eating, and the taste of fruits or vegetables (Erinosho et al., 2018). In the second study, CACFP FDC educators had higher supportive eating environment scores (which included food service style, allowing children to decide when to eat, not using food as a reward, social meals and not consuming sweet food in front of children) (Lazarus et al., 2018). In the third study, CACFP FDC educators were more likely to role model healthy eating and serve family-style meals (Williams et al., 2021). Other studies involving ECEC center-based services and FDC services have found that CACFP services were significantly more likely to meet nutrition standards for food provision than non-CACFP services (Gurzo et al., 2020; Lee et al., 2018; Liu et al., 2016). However, the results were not reported separately for FDC services. Conversely, two studies reported no associations in nutrition best practice between CACFP and non-CACFP FDC services (Loth et al., 2019; Tovar et al., 2015).

3.3.2 Correlates of physical activity and sedentary practices and environments in FDC

Several studies in the US have assessed the factors associated with educators' physical activity practices and environment in FDC using surveys (Dinkel et al., 2020; Figueroa and Wiley, 2016; Liu et al., 2016; Loth et al., 2019; Pelletier et al., 2019).

Interpersonal correlates

One study found that the educators' self-efficacy to be physically active was positively associated with the time provided for children's physical activity (Figueroa and Wiley, 2016).

Organisational correlates

One study reported that the time provided to children for physical activity in FDC was positively associated with the amount of space available for physical activity but negatively associated with general health training (Figueroa and Wiley, 2016). This negative association was likely because the training was not specifically related to physical activity. In contrast, two other studies have reported significant associations between physical activity training and educators' reported physical activity practices (Loth et al., 2019; Pelletier et al., 2019).

Community correlates

One study assessed the differences in physical activity practices between urban and rural FDC services using the NAP SAC survey (Dinkel et al., 2020). Urban FDC's had significantly higher scores (indicating better physical activity practices) for daily educator-led physical activity, availability of indoor and outdoor portable play equipment, the quantity of outdoor portable play equipment, supervising, verbal encouragement and participation in children's physical activity, using physical activity during daily routines, transitions, and planned activities, and offering families information on children's physical activity (Dinkel et al., 2020).

Policy correlates

One study conducted in the USA state of Minnesota found that FDC educators' participation in a state-wide Quality Rating and Improvement program, called Parent AWARE, was positively associated with improved physical activity practices (Loth et al., 2019). The same study also found that participation in CACFP was not associated with FDC educators' physical activity practices (Loth et al., 2019). Another study also found no associations with CACFP participation and educators' physical activity practices in

ECEC services, including FDC (Liu et al., 2016). This could be because the CACFP program has a larger focus on nutrition and has no requirements for physical activity or screen time.

3.4 Conclusion

This chapter synthesised the current literature on children's dietary intake, physical activity and sedentary behaviour and FDC educators' nutrition and physical activity practices and environments according to the socio-ecological model. A variety of correlates were identified; however, the review identified the need for high-quality Australian studies to understand what factors influence educators' practices and environments, and children's nutrition, physical activity and sedentary behaviours in Australian FDC services.

3.5 References

Australian Government (2020) Child Care in Australia report March quarter 2020, *Australian Government Department of Education Skills and Employment*. Available at: https://www.dese.gov.au/key-official-documents-about-early-childhood/early-childhood-and-child-care-reports/child-care-australia/child-care-australia-report-march-quarter-2020.

Australian Institute of Health and Welfare. (2018) *Physical activity across the life stages*. Cat. no. P. Canberra: AIHW. Available at: https://www.aihw.gov.au/reports/physical-activity/physical-activity-across-the-life-stages/contents/table-of-contents.

Barnes, C. *et al.* (2021) 'The association between Australian childcare centre healthy eating practices and children's healthy eating behaviours: A cross-sectional study within lunchbox centres', *Nutrients*, 13(4). doi: 10.3390/nu13041139.

Bell, L. K. *et al.* (2015) 'Impact of a nutrition award scheme on the food and nutrient intakes of 2- to 4-year-olds attending long day care', *Public Health Nutrition*, 18(14), pp. 2634–2642. doi: 10.1017/S1368980014003127.

Benjamin-Neelon, S. E. *et al.* (2018) 'The family child care home environment and children's diet quality', *Appetite*, 126, pp. 108–113. doi: 10.1016/j.appet.2018.03.024.

Brann, L. S. (2010) 'Child-feeding practices and child overweight perceptions of family day care providers caring for preschool-aged children', *Journal of Pediatric Health Care*, 24(5), pp. 312–317. doi: 10.1016/j.pedhc.2009.09.001.

Bravo, A., Cass, Y. and Tranter, D. (2008) 'Good food in family day care: Improving nutrition and food safety in family day care', *Nutrition and Dietetics*, 65(1), pp. 47–55. doi: 10.1111/j.1747-0080.2007.00136.x.

Bussell, K. *et al.* (2018) 'Examining Nutrition and Physical Activity Policies and Practices in Maryland's Child Care Centers', *Childhood Obesity*, 14(6), pp. 403–411. doi: 10.1089/chi.2018.0085.

Chai, L. K., Rice-McNeil, K. and Trost, S. G. (2020) 'Patterns and Correlates of Sedentary Behavior in Children Attending Family Child Care', *International journal of environmental research and public health*, 17(2), pp. 1–10. doi: 10.3390/ijerph17020549.

Cuadrado-Soto, E. *et al.* (2019) 'Micronutrient adequacy in preschool children attending

family child care homes', *Nutrients*, 11(9), pp. 1–15. doi: 10.3390/nu11092134.

Cuy Castellanos, D. (2015) 'Dietary Acculturation in Latinos/Hispanics in the United States', *American Journal of Lifestyle Medicine*, 9(1), pp. 31–36. doi: 10.1177/1559827614552960.

Delaney, S. L., Monsivais, P. and Johnson, D. B. (2014) 'Physical activity levels in family child care homes', *Journal of Physical Activity and Health*, 11(7), pp. 1362–1366. doi: 10.1123/jpah.2012-0297.

Dev, D. A. *et al.* (2018) 'Improving the nutrition and screen time environment through self-assessment in family childcare homes in Nebraska', *Public Health Nutrition*, 21(13), pp. 2351–2359. doi: 10.1017/S1368980018001416.

Dinkel, D. *et al.* (2020) 'Comparison of Urban and Rural Physical Activity and Outdoor Play Environments of Childcare Centers and Family Childcare Homes', *Family and Community Health*, 43(4), pp. 264–275. doi: 10.1097/FCH.0000000000000267.

Erinosho, T. *et al.* (2018) 'Participation in the Child and Adult Care Food Program Is Associated with Healthier Nutrition Environments at Family Child Care Homes in Mississippi', *Journal of Nutrition Education and Behavior*, 50(5), pp. 441–450. doi: 10.1016/j.jneb.2017.11.004.

Erinosho, T. *et al.* (2019) 'The Quality of Nutrition and Physical Activity Environments of Family Child-Care Homes in a State in the Southern United States', *Journal of the Academy of Nutrition and Dietetics*, 119(6), pp. 991–998. doi: 10.1016/j.jand.2018.11.012.

Fees, B. *et al.* (2009) 'Physical Activity Programming in Family Child Care Homes: Providers' Perceptions of Practices and Barriers', *Journal of Nutrition Education and Behavior*, 41(4), pp. 268–273. doi: 10.1016/j.jneb.2008.01.013.

Figueroa, R. and Wiley, A. (2016) 'Factors associated with time provided to children for physical activity in family child care: a cross-sectional study', *SpringerPlus*, 5(1). doi: 10.1186/s40064-016-3450-4.

Fortin-Miller, S. A. *et al.* (2021) 'The effect of the food environment on fresh produce served in family child care homes', *Nutrition and Health*. doi: 10.1177/0260106021992663.

Francis, L. *et al.* (2018) 'Examining the Obesogenic Attributes of the Family Child Care Home Environment: A Literature Review', *Journal of Obesity*, 2018, pp. 1–20. doi:

10.1155/2018/3490651.

Gans, K. M. *et al.* (2019) 'Nutrition-related practices of family child care providers and differences by ethnicity', *Childhood Obesity*, 15(3), pp. 167–184. doi: 10.1089/chi.2018.0083.

Gunter, K. B. *et al.* (2012) 'Factors associated with physical activity in children attending family child care homes', *Preventive Medicine*, 54(2), pp. 131–133. doi: 10.1016/j.ypmed.2011.12.002.

Gurzo, K. *et al.* (2020) 'Child Care Sites Participating in the Federal Child and Adult Care Food Program Provide More Nutritious Foods and Beverages', *Journal of Nutrition Education and Behavior*, 52(7), pp. 697–704. doi: 10.1016/j.jneb.2020.02.009.

Hardy, L. L. *et al.* (2019) 'Trends in overweight, obesity, and waist-to-height ratio among Australian children from linguistically diverse backgrounds, 1997 to 2015', *International Journal of Obesity*, 43(1), pp. 116–124. doi: 10.1038/s41366-018-0139-5.

Hinkley, T. *et al.* (2010) 'Correlates of sedentary behaviours in preschool children: a review', *International Journal of Behavioral Nutrition and Physical Activity*, 7, pp. 1–10. Available at: http://www.ijbnpa.org/content/7/1/66%5Cnhttp://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed9&NEWS=N&AN=2010537605.

Jones, J. *et al.* (2015) 'Effectiveness of an intervention to facilitate the implementation of healthy eating and physical activity policies and practices in childcare services: A randomised controlled trial', *Implementation Science*, 10(1), pp. 1–15. doi: 10.1186/s13012-015-0340-z.

Kang, A. W. *et al.* (2021) 'Physical Activity Levels among Preschool-Aged Children in Family Child Care Homes: A Comparison between Hispanic and Non-Hispanic Children Using Accelerometry', *Children*, 8(5), p. 349. doi: 10.3390/children8050349.

Kerr, E. M. *et al.* (2020) 'Foods provided to children in family day care: An observational study', *Public Health Nutrition*, 24(11), pp. 3196–3204. doi: 10.1017/S1368980021001506.

Layzer, J. I. and Burstein, N. (2007) *National study of child care for low-income families patterns of child care use among low-income families: final report, Abt*

Associates Inc. Available at: https://www.acf.hhs.gov/sites/default/files/opre/patterns_cc_execsum.pdf.

Lazarus, M. A., Tandon, P. S. and Otten, J. J. (2018) 'Examining Relationships between Food Procurement Characteristics and Nutritional Quality in Washington State Child Care Settings', *Childhood Obesity*, 14(6), pp. 429–439. doi: 10.1089/chi.2018.0090.

Lee, D. L. *et al.* (2018) 'Compliance with the New 2017 Child and Adult Care Food Program Standards for Infants and Children before Implementation', *Childhood Obesity*, 14(6), pp. 393–402. doi: 10.1089/chi.2018.0092.

Lindsay, A. C. *et al.* (2017) 'Easier said than done: A qualitative study conducted in the USA exploring Latino family child care home providers as role models for healthy eating and physical activity behaviours', *BMJ Open*, 7(11). doi: 10.1136/bmjopen-2017-018219.

Liu, S. T. *et al.* (2016) 'Obesity Prevention Practices and Policies in Child Care Settings Enrolled and Not Enrolled in the Child and Adult Care Food Program', *Maternal and Child Health Journal*, 20(9), pp. 1933–1939. doi: 10.1007/s10995-016-2007-z.

Loth, K. A. *et al.* (2019) 'Does adherence to child care nutrition and physical activity best practices differ by child care provider's participation in support programs and training?', *Children and Youth Services Review*, 105. doi: 10.1016/j.childyouth.2019.104417.

Mahmood, L. *et al.* (2021) 'The influence of parental dietary behaviors and practices on children's eating habits', *Nutrients*, 13(4), pp. 1–13. doi: 10.3390/nu13041138.

Martin, C. L. *et al.* (2021) 'Usual intakes of food pattern components by U.S. children: WWEIA, NHANES 2013–2016', *Journal of Food Composition and Analysis*, 102(June), p. 104063. doi: 10.1016/j.jfca.2021.104063.

Mazzucca, S. *et al.* (2018) 'Physical activity and sedentary behaviors of children in family child care homes: Are there opportunities for improvement?', *Pediatric Exercise Science*, 30(4), pp. 529–536. doi: 10.1123/pes.2018-0040.

Mcleroy, K. R. *et al.* (1988) 'An Ecological Perspective on Health Promotion Programs', *Health Education Quarterly*, 15(4), pp. 351–377. doi: 10.1177/109019818801500401.

Monsivais, P. and Johnson, D. B. (2012) 'Improving nutrition in home child care: Are food costs a barrier?', *Public Health Nutrition*, 15(2), pp. 370–376. doi:

10.1017/S1368980011002382.

Monsivais, P., Kirkpatrick, S. and Johnson, D. B. (2011) 'More Nutritious Food Is Served in Child-Care Homes Receiving Higher Federal Food Subsidies', *Journal of the American Dietetic Association*, 111(5), pp. 721–726. doi: 10.1016/j.jada.2011.02.007.

National Center on Early Childhood Quality Assurance (2016) *Characteristics of Home-Based Early Care and Education Providers: Initial Findings from the National Survey of Early Care and Education*. Washington, DC.

Neshteruk, C. D. *et al.* (2018) 'The physical environment in family childcare homes and children's physical activity', *Child: Care, Health and Development*, 44(5), pp. 746–752. doi: 10.1111/cch.12578.

Nicklas, T. A. *et al.* (2013) 'Characterizing lunch meals served and consumed by pre-school children in Head Start', *Public Health Nutrition*, 16(12), pp. 2169–2177. doi: 10.1017/S1368980013001377.

O'Connor, J. P. and Temple, V. A. (2005) 'Constraints and Facilitators for Physical Activity in Family Day Care', *Australasian Journal of Early Childhood*, 30(4), pp. 1–9. doi: 10.1177/183693910503000402.

OECD (2021) *PF3 . 2 : Enrolment in childcare and pre-school, OECD Family Database*. Available at: https://data.oecd.org/students/enrolment-rate-in-early-childhood-education.htm.

Office of Health Assessment and Translation (2019) *Handbook for conducting a literature-based health assessment using OHAT approach for systemic review and evidence integration, Division of the National Toxicology Program*. Available at: https://ntp.niehs.nih.gov/ntp/ohat/pubs/handbookmarch2019_508.pdf.

Ogden, C. L. *et al.* (2014) 'Prevalence of childhood and adult obesity in the United States, 2011-2012', *JAMA - Journal of the American Medical Association*, 311(8), pp. 806–814. doi: 10.1001/jama.2014.732.

Ouzzani, M. *et al.* (2016) 'Rayyan-a web and mobile app for systematic reviews', *Systematic Reviews*, 5(210), pp. 1–10. doi: 10.1186/s13643-016-0384-4.

Page, M. J. *et al.* (2021) 'PRISMA 2020 explanation and elaboration: Updated guidance and exemplars for reporting systematic reviews', *The BMJ*, 372. doi: 10.1136/bmj.n160.

Pelletier, J. E. *et al.* (2019) 'Public Health Support for Weight-Related Practices in

Child Care Settings in Minnesota', *Health Promotion Practice*, 20(3), pp. 419–428. doi: 10.1177/1524839918781523.

Ramirez, A. *et al.* (2020) 'Dietary Contributors to Food Group Intake in Preschool Children Attending Family Childcare Homes: Differences between Latino and Non-Latino Providers', *Nutrients*, 12, pp. 1–15.

Rice, K. R. and Trost, S. G. (2014) 'Physical Activity Levels Among Children Attending Family Day Care', *Journal of Nutrition Education and Behavior*, 46(3), pp. 197–202. doi: 10.1016/j.jneb.2013.09.001.

Sambell, R. *et al.* (2019) 'Measuring food provision in Western Australian long day care (LDC) services: a weighed food record method/protocol at a service level', *Nutrition Journal*, 18(1), pp. 1–11. doi: 10.1186/s12937-019-0462-2.

Seward, K. *et al.* (2018) 'Improving the implementation of nutrition guidelines in childcare centres improves child dietary intake: Findings of a randomised trial of an implementation intervention', *Public Health Nutrition*, 21(3), pp. 607–617. doi: 10.1017/S1368980017003366.

Sharma, S. V. *et al.* (2019) 'Impact of the coordinated approach to child health early childhood program for obesity prevention among preschool children: The Texas childhood obesity research demonstration study', *Childhood Obesity*, 15(1), pp. 1–13. doi: 10.1089/chi.2018.0010.

Shloim, N. *et al.* (2015) 'Parenting styles, feeding styles, feeding practices, and weight status in 4-12 year-old children: A systematic review of the literature', *Frontiers in Psychology*, 6(DEC). doi: 10.3389/fpsyg.2015.01849.

De Silva-Sanigorski, A. *et al.* (2011) 'Obesity prevention in the family day care setting: Impact of the Romp & Chomp intervention on opportunities for children's physical activity and healthy eating', *Child: Care, Health and Development*, 37(3), pp. 385–393. doi: 10.1111/j.1365-2214.2010.01205.x.

Spence, A. C. *et al.* (2018) 'Early Childhood Vegetable, Fruit, and Discretionary Food Intakes Do Not Meet Dietary Guidelines, but Do Show Socioeconomic Differences and Tracking over Time', *Journal of the Academy of Nutrition and Dietetics*, 118(9), pp. 1634–1643. doi: 10.1016/j.jand.2017.12.009.

Statistics Canada (2020) *Survey on Early Learning and Child Care Arrangements, 2020, Statistics Canada*. Available at: https://www150.statcan.gc.ca/n1/daily-quotidien/210407/t001b-eng.htm.

Stitou, M., Bourgeault, I.-L. and Kohen, D. (2018) 'The job content, context, and requirements of regulated home-based childcare workers', *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*, 27(4), pp. 607–628. doi: 10.1177/1048291117739417.

Swyden, K. *et al.* (2017) 'Association of childcare arrangement with overweight and obesity in preschool-aged children: A narrative review of literature', *International Journal of Obesity*, 41(1), pp. 1–12. doi: 10.1038/ijo.2016.198.

Temple, V. A. *et al.* (2009) 'Physical activity of children in family child care', *Applied Physiology, Nutrition, and Metabolism*, 34(4), pp. 794–798. doi: 10.1139/H09-061.

Terrón-Pérez, M. *et al.* (2021) 'Relationship Between the Physical Environment and Physical Activity Levels in Preschool Children: A Systematic Review', *Current Environmental Health Reports*, 8(2), pp. 177–195. doi: 10.1007/s40572-021-00318-4.

Tonge, K. L. (2019) *The Relationship between Educator Engagement & Interaction and Children ' s Physical Activity in Early Childhood Education and Care Services The Relationship between Educator Engagement & Interaction and Children ' s Physical Activity in Early Childhood E*.

Tonge, K. L., Jones, R. A. and Okely, A. D. (2016) 'Correlates of children's objectively measured physical activity and sedentary behavior in early childhood education and care services: A systematic review', *Preventive Medicine*, 89, pp. 129–139. doi: 10.1016/j.ypmed.2016.05.019.

Tonge, K. L., Jones, R. A. and Okely, A. D. (2019) 'Quality Interactions in Early Childhood Education and Care Center Outdoor Environments', *Early Childhood Education Journal*, 47(1), pp. 31–41. doi: 10.1007/s10643-018-0913-y.

Tonyan, H. A., Paulsell, D. and Shivers, E. M. (2017) 'Understanding and Incorporating Home-Based Child Care Into Early Education and Development Systems', *Early Education and Development*, 28(6), pp. 633–639. doi: 10.1080/10409289.2017.1324243.

Tovar, A. *et al.* (2015) 'An Assessment of Nutrition Practices and Attitudes in Family Child-Care Homes: Implications for Policy Implementation', *Preventing Chronic Disease*, 12, p. E88. doi: 10.5888/pcd12.140587.

Tovar, A., Vaughn, A. E., *et al.* (2018) 'Modifying the Environment and Policy Assessment and Observation (EPAO) to better capture feeding practices of family

childcare home providers', *Public Health Nutrition*, 22(2), pp. 223–234. doi: 10.1017/s1368980018002665.

Tovar, A., Benjamin-Neelon, S. E., *et al.* (2018) 'Nutritional Quality of Meals and Snacks Served and Consumed in Family Child Care', *Journal of the Academy of Nutrition and Dietetics*, 118(12), pp. 2280–2286. doi: 10.1016/j.jand.2018.08.154.

Tovar, A. *et al.* (2020) 'Exploring the Provider-Level Socio-Demographic Determinants of Diet Quality of Preschool-Aged Children Attending Family Childcare Homes', *Nutrients*, 12(5), p. 1368. doi: 10.3390/nu12051368.

Trost, S. G. *et al.* (2011) 'A nutrition and physical activity intervention for family child care homes', *American Journal of Preventive Medicine*, 41(4), pp. 392–398. doi: 10.1016/j.amepre.2011.06.030.

Tucker, P. *et al.* (2015) 'Prevalence and influences of preschoolers' sedentary behaviors in early learning centers: A cross-sectional study', *BMC Pediatrics*, 15(1). doi: 10.1186/s12887-015-0441-5.

Vanderloo, L. M. *et al.* (2015) 'Environmental influences on preschoolers' physical activity levels in various early-learning facilities', *Research Quarterly for Exercise and Sport*, 86(4), pp. 360–370. doi: 10.1080/02701367.2015.1053105.

van der Velde, L. A. *et al.* (2019) 'Diet quality in childhood: the Generation R Study', *European Journal of Nutrition*, 58(3), pp. 1259–1269. doi: 10.1007/s00394-018-1651-z.

Wallace, R. and Mills, B. (2019) 'A study of the food environment at Australian family day care', *Nutrients*, 11(10), p. 2395. doi: 10.3390/nu11102395.

Ward, D. S. *et al.* (2020) 'Keys to healthy family child care homes: Results from a cluster randomized trial', *Preventive Medicine*, 132(October 2019), p. 105974. doi: 10.1016/j.ypmed.2019.105974.

Ward, S. *et al.* (2015) 'Systematic review of the relationship between childcare educators' practices and preschoolers' physical activity and eating behaviours', *Obesity Reviews*, 16(12), pp. 1055–1070. doi: 10.1111/obr.12315.

WHO (2017) *Report of the Commission on Ending Childhood Obesity., Implementation Plan: Executive summary,*. doi: 10.1016/j.jhep.2013.02.018.

Williams, B. D. *et al.* (2021) 'Food Program Participation Influences Nutrition Practices in Early Care and Education Settings', *Journal of Nutrition Education and Behavior*, 53(4), pp. 299–308. doi: 10.1016/j.jneb.2021.01.012.

Williamson, L. *et al.* (2011) 'Australian family day care educators: A snapshot of their qualifications, training and perceived support', *Australian Journal of Early Childhood*, 36(4), pp. 63–68.

Wolfenden, L. *et al.* (2020) 'Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within childcare services (Review)'. doi: 10.1002/14651858.CD011779.pub3.www.cochranelibrary.com.

Woo Baidal, J. A. *et al.* (2016) 'Risk Factors for Childhood Obesity in the First 1,000 Days: A Systematic Review', *American Journal of Preventive Medicine*, 50(6), pp. 761–779. doi: 10.1016/j.amepre.2015.11.012.

Woodward-Lopez, G. *et al.* (2018) 'Changes in Nutrition Policies and Dietary Intake in Child Care Homes Participating in Healthy Eating and Active Living Initiative', *American Journal of Preventive Medicine*, 54(5), pp. S170–S177. doi: 10.1016/j.amepre.2018.01.007.

Yoong, S. L. *et al.* (2020) 'A systematic review of interventions to improve the dietary intake, physical activity and weight status of children attending family day care services', *Public Health Nutrition*, 23(12), pp. 2211–2220. doi: 10.1017/S1368980019005275.

Zhang, Z. *et al.* (2018) 'Environmental characteristics of early childhood education and care centres and young children's weight status: A systematic review', *Preventive Medicine*, 106(September 2017), pp. 13–25. doi: 10.1016/j.ypmed.2017.10.002.

Zhang, Z. *et al.* (2019) 'The associations between environmental characteristics of early childhood education and care centers and 1-year change in toddlers' physical activity and sedentary behavior', *Journal of Physical Activity and Health*, 16(11), pp. 1000–1006. doi: 10.1123/jpah.2019-0066.

Zhang, Z. *et al.* (2021) 'Associations Between the Child Care Environment and Children's In-Care Physical Activity and Sedentary Time', *Health Education and Behavior*, 48(1), pp. 42–53. doi: 10.1177/1090198120972689.

Chapter 4: Methods

Chapter 2 reviewed the evidence on the prevalence of healthy eating, physical activity and sedentary behaviours in ECEC services. Chapter 3 used a socio-ecological model to examine the correlates of FDC children's nutrition, physical activity, and sedentary behaviours. Chapter 3 also examined factors associated with FDC educators' healthy eating, physical activity and sedentary behaviour practices and the environments within FDC. These chapters identified a gap in the literature on the associations between nutrition and physical activity practices in Australian FDC services and children's nutrition, physical activity and sedentary behaviours. This chapter describes how a socio-ecological model informed the study design and research methods used in this thesis. This chapter also provides a brief description and justification of the research design, methods and theoretical frameworks applied to answer the research questions outlined in Chapter 1. Chapters 4 to 7 provide additional information about the methods used in each individual study.

4.1 Socio-ecological model

A socio-ecological model guided the information collected in this thesis to explore the correlates of children's healthy eating, physical activity and sedentary behaviour. This thesis captured information across five levels of the socio-ecological model shown in Figure 4.1. The intrapersonal level included children's characteristics, such as age and gender (Mcleroy et al., 1988). The next level involved the interpersonal relationships children have with educators and their families. For example, educators' practices that influence children's behaviours, such as engaging or playing with children during physical activity and sitting and talking with children during mealtimes. Family characteristics, such as language spoken at home, also fit under this level.

Figure 4. 1 Potential influences of children's nutrition physical activity and sedentary behaviour in family day care categorised according to Mcleroy's socio-ecological model (Mcleroy et al., 1988)

At the organisational level, information was captured at both the service provider level and the educator level of the FDC sector. Information collected at the service provider level included policies, professional development, and resources offered to educators and families. Information collected at the FDC educator level included the physical environment at FDC (such as outdoor space, equipment, and mealtime environment), program structure (such as time provided for physical activity), and education provided to children. It also included the types of food available during FDC attendance, supplied by either the educator or families. Finally, this level also encompassed the educators' ECEC experience, qualifications, and participation in professional development.

Data collected at the community level included the educators' and children's postcode of residence. Postcode was used to determine the educator's and child's socio-economic status, based on their area of residence (Australian Bureau of Statistics, 2018).

Finally, the policy level included the government regulations and policies at local, state, and national levels that influence the healthy eating and physical activity environments and practices in ECEC services. For example, the National Quality Framework, Get Up and Grow Guidelines, Australian Dietary Guidelines and Australian 24-hour Movement Guidelines.

4.2 Research design

A cross-sectional study design was used with data collected across two phases to: 1) capture information at the service provider level and; 2) capture information at the educator level in FDC services. Phase 1 examined the FDC service providers' practices and policies, which operate at the higher organisational level. Phase 1 also aimed to build a relationship with the service providers to aid the recruitment of educators, given individual educators' contact details are not publicly available. Phase two examined the practices and environments at the educator level.

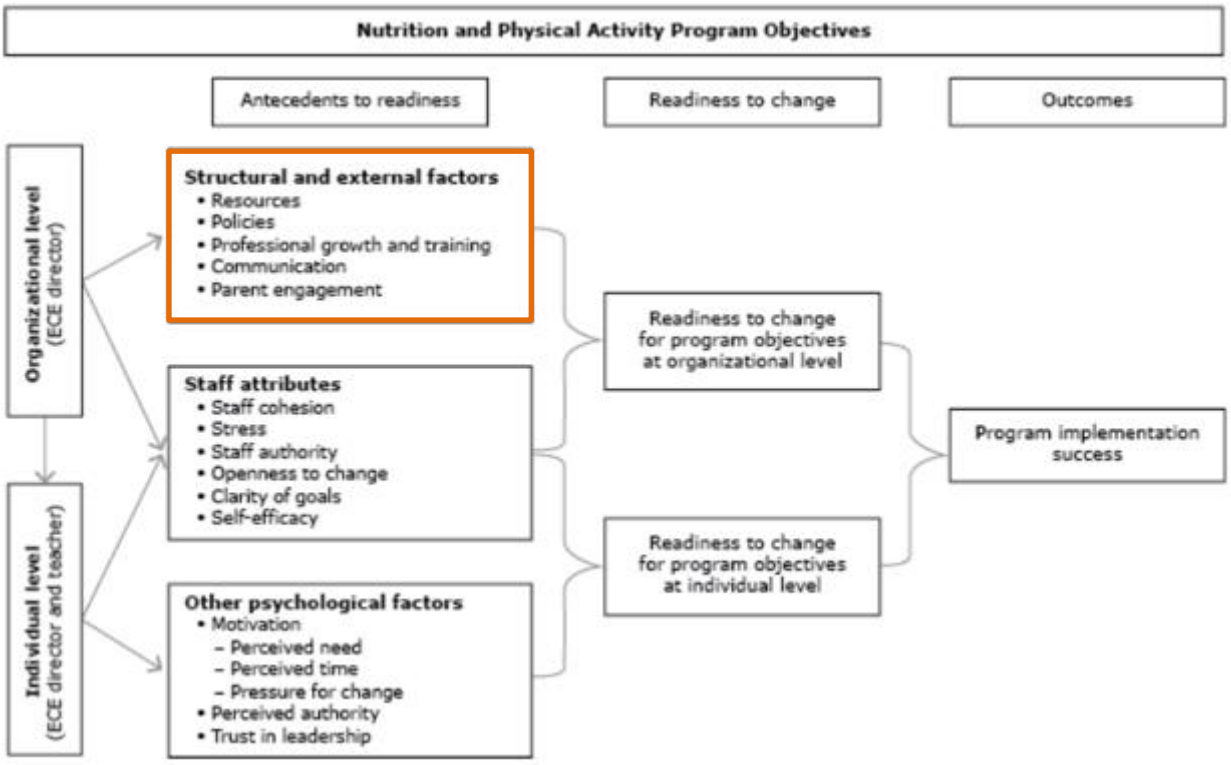
As part of the NSW Health Prevention Research Support Program funding, an expert advisory group was established to inform the research design and discuss and translate the research findings into policy and practice changes as the project evolved. The expert advisory group held monthly meetings involving 12 researchers and public health practitioners from the University of Wollongong, NSW Ministry of Health, Illawarra Shoalhaven Local Health District and South Western Sydney Local Health District. Collectively, the group had expertise in health promotion and nutrition and physical

activity in ECEC settings. Four members also had specific experience working on the *Munch & Move* program, including the state-wide *Munch & Move* program manager.

4.3 Phase 1: service provider policies, resources and professional development

The first phase of this research (Chapter 5) consisted of one study that explored Research Question 2. All FDC service providers in the South Western Sydney (n = 78) and the Illawarra Shoalhaven (n = 7) Local Health Districts were invited to participate in a telephone or face-to-face survey and policy review (from February to September 2018). The development of the survey was guided by the validated Conceptual Framework for Organizational Readiness to Implement Nutrition and Physical Activity Programs in Early Childhood Education Settings (Figure 4.2) (Sharma et al., 2014).

Figure 4. 2 Conceptual Framework for Organizational Readiness to Implement Nutrition and Physical Activity Programs in Early Childhood Education Settings



Ethics approval was obtained from the University of Wollongong Human Research Ethics Committee (HREC/17/WGONG/139) (Appendix L). Service providers completed a written consent before completing the survey (Appendix M). The survey captured the structural and external information at the organisational level of ECEC settings, including resources, policies, professional development, communication and parent engagement (Appendix N). The survey was reviewed by the FDC advisory group and assessed service providers' policies, resources provided to families and educators, and the type of professional development accessed by educators about infant feeding, nutrition, physical activity, and screen time for children aged 0-5 years. At the end of the survey, the interviewer provided information about the planned observation study.

Before undertaking the policy review, a literature search was conducted to identify existing policy review tools. The literature review identified two validated ECEC nutrition and physical activity policy review tools from the USA: the Environment and Policy Assessment and Observation (Vaughn et al., 2017; Ward et al., 2008) and Wellness Child Care Assessment Tool (Falbe et al., 2011). The policy review tools contained detailed criteria on the quantities of food to provide children and specific physical activity recommendations. However, there are no national standards or guidelines in Australia specifying the quantities of food to provide children or how much time children should spend being physically active or outside while attending ECEC services. Therefore, as part of this research, policy review criteria were developed to assess the alignment of service providers' policies to existing national guidelines and standards.

Four separate policy review tools were developed to separately assess policies containing guidelines about nutrition, infant feeding and breastfeeding, physical

activity, and screen time. The policy review criteria were based on the National Quality Framework (Australian Children's Education and Care Quality Authority, 2018), Get Up & Grow Guidelines (Australian Government Department of Health and Ageing, 2013), Australian Dietary Guidelines (National Health and Medical Research Council, 2013), Australian Infant Feeding Guidelines (National Health and Medical Research Council, 2012), Australian 24-Hour Movement Guidelines for the Early Years (Australian Government: Department of Health, 2017), Early Childhood Australia Statement on young children and digital technologies (Early Childhood Australia, 2018) and the NSW Health *Munch & Move* program adoption indicators (NSW Ministry of Health, 2017). Supplementary tables 5.1-5.4 outline the criteria in each policy review tool and where each criterion was sourced (Appendices O-R). Each policy was independently reviewed by two researchers and each individual criterion was categorised as either 'no information provided'; 'topic is partially covered;' or 'topic is fully covered'; and given scores of zero, 0.5, or 1.0, respectively. Examples of policy statements classed as not covered, partially covered and fully covered are provided in Appendix S. At the end of the study, all service providers were provided with a feedback and outcomes report (Appendix T).

4.4 Phase 2: Influences of children's healthy eating and physical activity in FDC

4.4.1 Study population, sampling and recruitment

The second phase of this thesis (Chapters 6-8) contained three studies that explored Research Questions 3 to 5. Ultimately, this research aimed to explore the influences of children's healthy eating and physical activity in FDC. FDC service providers who participated in Phase 1 were invited to participate in an observational study exploring the FDC educators' nutrition and physical activity practices and environments. Educators were eligible if their service provider was in the sampling areas, and they

cared for at least three children aged 0-5-years.

A power calculation assessed that approximately 220 children would be required to estimate children's physical activity, based on the sample of 28 service providers from the first phase (with 700 eligible educators and approximately 2200 children). The target sample size was calculated using an intraclass correlation of 0.33 and a mean of 8.1 (SD 3.1) minutes per hour in physical activity from baseline data of children's physical activity levels in family child care homes (Mazzucca et al., 2018). The calculation used a design effect of 1.99 and a cluster size of three children per service.

The research initially planned to select a random proportional sample of educators from each service provider. Participating service providers were asked to provide a list of all their eligible FDC educators' contact details to be invited to the study. However, most service providers did not want to provide the contact details of their educators. After discussion with the advisory group, it was decided to invite all eligible educators. If the service providers did not want to provide their educators' contact details, they were asked to email their educators an invitation to participate.

Due to recruitment challenges, multiple strategies were used to recruit educators, including speaking to FDC educators at FDC organisation meetings, the development of a brief video to explain the study (Appendix U) and a $100 voucher provided to participating FDC educators. Educators were also offered feedback after the visit to support them in their quality improvement plan (Appendix V). Nine out of the 28 service providers participated in the study. Of the remaining service providers, four service providers closed down, 12 declined, and three agreed to recruit educators, but no educators were willing to participate. Reasons for educators declining to participate were: not eligible (no children under five years), educators not comfortable with having

someone in their home, parents not comfortable, and unsettled babies in their care. Ethics approval was obtained by the University of Wollongong Human Research Ethics Committee (2019/ETH10743) (Appendix W). Educators and parents/caregivers provided informed consent via an online survey (Appendix X).

4.4.2 Demographic characteristics

A parent survey collected child level characteristics, including: sex and date of birth, postcode of residence and the main language spoken at home (Appendix Y). Educators also completed an online survey that included information on their postcode of residence, language spoken at home, ECEC experience (including FDC) and qualifications and nutrition-related professional development undertaken in the past 2 years (Appendix Z).

4.4.3 Dietary assessment

A variety of methods have assessed the food provided to and consumed by children in ECEC services, including weighed food records (Barnes et al., 2021; Kelly et al., 2010; Pearson et al., 2020; Sambell et al., 2014), direct observation (Jones et al., 2017; Ramirez et al., 2020; Tovar et al., 2018), menu assessments (Monsivais and Johnson, 2012; Yoong et al., 2014) and digital photography (Kenney et al., 2020). The Dietary Observation for Child Care protocol is a validated dietary observation method that has assessed the foods provided and consumed in FDC services (Tovar et al., 2018). However, weighing food is the gold standard and most precise dietary assessment method (Burrows et al., 2020; Sambell et al., 2019). After pilot testing the feasibility of using weighed food records in this study, it was determined that weighing food was feasible at the start of the day or before a meal but not after a meal. Further, between

two and five years of age children's daily food intake varies considerably, due to changes in appetite and growth, and may fluctuate from day-to-day (Leung et al., 2012). Therefore, the food consumed by children in one day at FDC may not be indicative of typical intake.

4.4.4 Physical activity assessment

Accelerometers provide a valid, reliable and feasible measure of children's physical activity (Cliff et al., 2009). ActiGraph accelerometers are light and unobtrusive devices (38 x 37 x 18mm, 27g) worn on a belt around the waist (Cliff et al., 2009). The Actigraph accelerometer has been validated and calibrated in toddlers and preschoolers (Janssen et al., 2013; Pate et al., 2006; Van Cauwenberghe et al., 2011). The Actigraph is also designed to validly measure the intermittent activity patterns of young children by capturing movement in shorter epochs, such as 15-seconds (Cliff et al., 2009). However, the Actigraph has limitations. As identified in Chapter 2, studies have used different cut-points and epochs that make study comparison challenging. Despite this limitation, accelerometers were used because they were: (1) considered the gold standard; and (2) were feasible, easy to administer, imposed a low burden, and allowed the researcher to spend time observing the environment and educators' practices (Ward et al., 2013). The cut-points used in this study for children aged 1-5 years were ≤ 25 counts/15 seconds for sedentary behaviour (Janssen et al., 2013) , $\geq$200 counts/15 seconds for total physical activity (light-, moderate-, and vigorous-intensity physical activity) (Pate et al., 2015) and $\geq$420 counts/15 seconds for moderate- to vigorous-intensity physical activity (MVPA) (Janssen et al., 2013). The Actigraph has only been validated for toddlers and preschoolers. Therefore, the GENEActiv was available to measure infant physical activity levels (Hewitt et al., 2021). However, only one infant

(11 months) participated in the study and the infant refused to wear the monitor.

4.4.5 Environmental observation methods

Chapter 2 identified several nutrition and physical activity assessment methods used to assess children's dietary intake and physical activity, and educators' healthy eating and physical activity practices and environment. Methods involving direct observation using validated tools are more objective and have a lower risk of bias than surveys (Ward et al., 2013). Several observation instruments have been validated to assess the mealtime (Dev et al., 2020; Swindle et al., 2017) and physical activity environments (Kazmierska-Kowalewska et al., 2021; Moore, 2007) in ECEC services. Mealtime observation tools include the Mealtime Observation in Childcare toolkit (Dev et al., 2020) and the Table Talk observation tool (Swindle et al., 2017). Observation tools that assess the physical activity environment include the Children's Physical Environments Rating Scale (Moore, 2007) and the MOVERS Movement Environmental Rating Scale (Kazmierska-Kowalewska et al., 2021). These tools have only been validated in ECEC centre-based services. The Family Child Care Environment Rating Scale is a quality assessment tool used to assess the overall quality of FDC services, such as interactions, activities and resources (Harms, Thelma; Cryer, Debby; Clifford, 2007). The tool assesses broad elements of the healthy eating and physical activity environment, such as meals and snacks, health practices, and active physical play (Harms, Thelma; Cryer, Debby; Clifford, 2007). However, the tool does not capture a comprehensive assessment of the healthy eating and physical activity environment.

To our knowledge, the EPAO is the only validated nutrition and physical activity observation tool in FDC services (Vaughn et al., 2017). The EPAO tool is a valid and reliable instrument developed to assess the healthy eating and physical activity

environments in centre-based ECEC settings (Ward et al., 2008). The tool has been modified specifically for FDC environments (Vaughn et al., 2017). The observation tool collects information at the interpersonal (educator) and the organisational (educators and service provider) level of the socio-ecological model (Appendix AA). For example, educators' feeding practices, the nutrition environment (for example, TV on during meals, how foods are served), active play opportunities, sedentary behaviour opportunities, educator-led nutrition and physical activities and the physical activity environment (for example, fixed and portable equipment and outdoor space) (Vaughn et al., 2017).

In Phase 1, multiple service providers advised that educators would be less likely to participate in a two-day observation study. Therefore, to maximise the sample size, only one day of observation was planned instead of two days outlined in the protocol (Vaughn et al., 2017). Previous studies have also used the EPAO for one observation day (Martyniuk et al., 2015; Peden et al., 2017; Tucker et al., 2015; Vanderloo et al., 2015, 2014; Zhang et al., 2021). Since the findings were based on a one-day observation, we did not report the data on nutrition education for children as intentional healthy eating experiences are unlikely to occur every day.

4.5 References

Australian Bureau of Statistics (2018) *Socio-Economic Indexes for Areas Australia*. Commonwealth of Australia. Available at: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by Subject/2033.0.55.001~2016~Main Features~SOCIO-ECONOMIC INDEXES FOR AREAS (SEIFA) 2016~1 (Accessed: 16 April 2021).

Australian Children's Education and Care Quality Authority (2018) *Guide to the National Quality Framework*. Available at: https://www.acecqa.gov.au/sites/default/files/2020-09/Guide-to-the-NQF-September-2020.pdf.

Australian Government: Department of Health (2017) *Australian 24-Hour Movement Guidelines for the Early Years (birth to 5 years): An Integration of Physical Activity, Sedentary Behaviour, and Sleep*. Available at: http://www.health.gov.au/internet/main/publishing.nsf/content/FCE78513DAC85E08CA257BF0001BAF95/$File/Birthto5years_24hrGuidelines_Brochure.pdf.

Australian Government Department of Health and Ageing (2013) *Get Up & Grow: Healthy Eating and Physical Activity for Early Childhood*. Available at: https://www1.health.gov.au/internet/main/publishing.nsf/Content/EA1E1000D846F0AFCA257BF0001DADB3/$File/HEPA - A4 Book - Directors Book - LR.pdf.

Barnes, C. *et al.* (2021) 'The association between australian childcare centre healthy eating practices and children's healthy eating behaviours: A cross-sectional study within lunchbox centres', *Nutrients*, 13(4). doi: 10.3390/nu13041139.

Burrows, T., Goldman, S. and Rollo, M. (2020) 'A systematic review of the validity of dietary assessment methods in children when compared with the method of doubly labelled water', *European Journal of Clinical Nutrition*, 74(5), pp. 669–681. doi: 10.1038/s41430-019-0480-3.

Van Cauwenberghe, E. *et al.* (2011) 'Feasibility and validity of accelerometer measurements to assess physical activity in toddlers', *International Journal of Behavioral Nutrition and Physical Activity*, 8, pp. 1–12. doi: 10.1186/1479-5868-8-67.

Cliff, D. P., Reilly, J. J. and Okely, A. D. (2009) 'Methodological considerations in using accelerometers to assess habitual physical activity in children aged 0-5 years', *Journal of Science and Medicine in Sport*, 12(5), pp. 557–567. doi:

10.1016/j.jsams.2008.10.008.

Dev, D. *et al.* (2020) 'P28 Validation of an Observational Measure to Capture Feeding Practices in Child Care Centers', *Journal of Nutrition Education and Behavior*, 52(7), pp. S28–S29. doi: 10.1016/j.jneb.2020.04.073.

Early Childhood Australia (2018) 'Statement on young children and digital technologies'. Available at: http://www.earlychildhoodaustralia.org.au/wp-content/uploads/2018/10/Digital-policy-statement.pdf.

Falbe, J., Henderson, K. and Schwartz, M. (2011) 'Wellness Child Care Assessment Tool (WellCCAT) How to Rate Policy Statements How to Score Policies', *Journal American Dietetic Association*, 111(2), pp. 1–26. Available at: http://www.uconnruddcenter.org/files/Pdfs/WellnessChildCareAssessmentToolForResearch.pdf.

Harms, Thelma; Cryer, Debby; Clifford, R. M. (2007) *Family Child Care Environment Rating Scale Revised Edition (FCCERS-R)*. New York, NY: Teacher's College Press.

Hewitt, L. *et al.* (2021) 'Validity of GENEActiv accelerometer wear and nonwear time for use in infants', *Journal of Physical Activity and Health*, 18(5), pp. 488–494. doi: 10.1123/JPAH.2019-0486.

Janssen, X. *et al.* (2013) 'Predictive validity and classification accuracy of actigraph energy expenditure equations and cut-points in young children', *PLoS ONE*, 8(11). doi: 10.1371/journal.pone.0079124.

Jones, J. *et al.* (2017) 'Dietary intake and physical activity levels of children attending Australian childcare services', *Nutrition and Dietetics*, 74(5), pp. 446–453. doi: 10.1111/1747-0080.12375.

Kazmierska-Kowalewska, K. M. *et al.* (2021) 'A validation and reliability study of the Movement Environmental Rating Scale (MOVERS)', *European Early Childhood Education Research Journal*, 29(5), pp. 733–746. doi: 10.1080/1350293X.2021.1968464.

Kelly, B. *et al.* (2010) 'Opening up Australian preschoolers' lunchboxes', *Australian and New Zealand Journal of Public Health*, 2334(3), pp. 288–292. doi: 10.1111/j.1753-6405.2010.00528.x.

Kenney, E. L. *et al.* (2020) 'Impact of changes to the Child and Adult Care Food Program on children's dietary intake in family child care homes', *Public Health*

Nutrition, 23(11), pp. 2016–2023. doi: 10.1017/S1368980019004646.

Leung, A. K. C. *et al.* (2012) 'The "picky eater": The toddler or preschooler who does not eat', *Paediatrics and Child Health (Canada)*, 17(8), pp. 455–457. doi: 10.1093/pch/17.8.455.

Martyniuk, O. J. M. *et al.* (2016) 'Comparing the nutrition environment and practices of home- and centre-based child-care facilities', *Public Health Nutrition*, 19(4), pp. 575–584. doi: 10.1017/S1368980015003535.

Mazzucca, S. *et al.* (2018) 'Physical activity and sedentary behaviors of children in family child care homes: Are there opportunities for improvement?', *Pediatric Exercise Science*, 30(4), pp. 529–536. doi: 10.1123/pes.2018-0040.

Mcleroy, K. R. *et al.* (1988) 'An Ecological Perspective on Health Promotion Programs', *Health Education Quarterly*, 15(4), pp. 351–377. doi: 10.1177/109019818801500401.

Monsivais, P. and Johnson, D. B. (2012) 'Improving nutrition in home child care: Are food costs a barrier?', *Public Health Nutrition*, 15(2), pp. 370–376. doi: 10.1017/S1368980011002382.

Moore, G. T. (2007) 'The Children ' s Physical Environment Rating Scale (CPERS): Reliability and Validity for Assessing the Physical Environment of Early Childhood Educational Facilities', *Children, Youth and Environments*, 17(4).

National Health and Medical Research Council (2012) *Infant Feeding Guidelines Information for health workers*, *National Health and Medical Research Council*. Canberra. Available at: http://www.ncbi.nlm.nih.gov/pubmed/4055304.

National Health and Medical Research Council (2013) *Australian Dietary Guidelines*. Canberra: National Health and Medical Research Council. Available at: www.nhmrc.gov.au/guidelines-publications/n55%0Ahttps://www.nhmrc.gov.au/_files_nhmrc/file/publications/n55_australian_dietary_guidelines1.pdf.

NSW Ministry of Health (2017) 'Munch & Move Monitoring Guide for Family Day Care Service Provider Practices', pp. 1–5.

Pate, R. R. *et al.* (2006) 'Validation and Calibration of an Accelerometer in Preschool Children', *Obesity*, 14(11), pp. 152–157. doi: 10.1249/01.mss.0000183219.44127.e7.

Pate, R. R. *et al.* (2015) 'Prevalence of compliance with a new physical activity

guideline for preschool-age children', *Childhood Obesity*, 11(4), pp. 415–420. doi: 10.1089/chi.2014.0143.

Pearson, N. *et al.* (2020) 'A cross-sectional study of packed lunchbox foods and their consumption by children in early childhood education and care services', *Nutrition and Dietetics*, (June), pp. 1–9. doi: 10.1111/1747-0080.12632.

Peden, M. E. *et al.* (2017) 'Relationship between children's physical activity, sedentary behavior, and childcare environments: A cross sectional study', *Preventive Medicine Reports*, 6, pp. 171–176. doi: 10.1016/j.pmedr.2017.02.017.

Ramirez, A. *et al.* (2020) 'Dietary Contributors to Food Group Intake in Preschool Children Attending Family Childcare Homes: Differences between Latino and Non-Latino Providers', *Nutrients*, 12, pp. 1–15.

Sambell, R. *et al.* (2019) 'Measuring food provision in Western Australian long day care (LDC) services: a weighed food record method/protocol at a service level', *Nutrition Journal*, 18(1), pp. 1–11. doi: 10.1186/s12937-019-0462-2.

Sambell, R., Devine, A. and Lo, J. (2014) 'Does the food group provision in early years' education and care settings in metropolitan Perth, Western Australia, meet national dietary requirements; and how can Home Economics support this?', *Journal of the Home Economics Institute of Australia*, 21(2), p. 20.

Sharma, S. V. *et al.* (2014) 'A conceptual framework for organizational readiness to implement nutrition and physical activity programs in early childhood education settings', *Preventing Chronic Disease*, 11(10), pp. 1–6. doi: 10.5888/pcd11.140166.

Swindle, T. *et al.* (2017) 'Table Talk: Development of an observational tool to assess verbal feeding communications in early care and education settings', *Public Health Nutrition*, 20(16), pp. 2869–2877. doi: 10.1017/S1368980017001896.

Tovar, A. *et al.* (2018) 'Nutritional Quality of Meals and Snacks Served and Consumed in Family Child Care', *Journal of the Academy of Nutrition and Dietetics*, 118(12), pp. 2280–2286. doi: 10.1016/j.jand.2018.08.154.

Tucker, P. *et al.* (2015) 'Prevalence and influences of preschoolers' sedentary behaviors in early learning centers: A cross-sectional study', *BMC Pediatrics*, 15(1). doi: 10.1186/s12887-015-0441-5.

Vanderloo, L. M. *et al.* (2014) 'The influence of centre-based childcare on preschoolers' physical activity levels: A cross-sectional study', *International Journal of*

Environmental Research and Public Health, 11(2), pp. 1794–1802. doi: 10.3390/ijerph110201794.

Vanderloo, L. M. *et al.* (2015) 'Environmental influences on preschoolers' physical activity levels in various early-learning facilities', *Research Quarterly for Exercise and Sport*, 86(4), pp. 360–370. doi: 10.1080/02701367.2015.1053105.

Vaughn, A. E. *et al.* (2017) 'Assessment of nutrition and physical activity environments in family child care homes: Modification and psychometric testing of the Environment and Policy Assessment and Observation', *BMC Public Health*, 17(1), p. 680. doi: 10.1186/s12889-017-4686-9.

Ward, D. *et al.* (2008) 'An Instrument to Assess the Obesogenic Environment of Child Care Centers', *American Journal of Health Behavior*, 32(4), pp. 380–386. Available at: https://www.lib.uwo.ca/cgi-bin/ezpauthn.cgi?url=http://search.proquest.com/docview/211893057?accountid=15115%5Cnhttp://vr2pk9sx9w.search.serialssolutions.com/?ctx_ver=Z39.88-2004&ctx_enc=info:ofi/enc:UTF-8&rfr_id=info:sid/ProQ%3Apsychologyshell&rft_val_fm.

Ward, D. S., Vaughn, A. and Story, M. (2013) 'Expert and stakeholder consensus on priorities for obesity prevention research in early care and education settings.', *Childhood obesity (Print)*, 9(2), pp. 116–24. doi: 10.1089/chi.2013.9204.

Yoong, S. L. *et al.* (2014) 'Do childcare services provide foods in line with the 2013 Australian Dietary guidelines? A cross-sectional study', *Australian and New Zealand Journal of Public Health*, 38(6), pp. 595–596. doi: 10.1111/1753-6405.12312.

Zhang, Z. *et al.* (2021) 'Associations Between the Child Care Environment and Children's In-Care Physical Activity and Sedentary Time', *Health Education and Behavior*, 48(1), pp. 42–53. doi: 10.1177/1090198120972689.

Chapter 5: Nutrition, physical activity and screen time policies and practices in family day care in NSW

The previous chapter provided an overview of the methodological approach used in this thesis, including the theoretical framework, study design and methods to collect data at the FDC service provider level and educator level. In this chapter, the findings from Phase 1 of the research (service provider level) are presented. Chapters 2 and 3 identified that there has been limited research conducted with family day care service providers. As discussed in Chapter 1, the *Munch & Move* program offers training to family day care service providers who are encouraged to provide training to the educators in their service.

This chapter addresses Research Question 2:

i. Is *Munch & Move* training associated with FDC service providers' nutrition, physical activity and screen time policies, resources and professional development?

ii. To what extent do the service provider's policies adhere to national guidelines and relevant guidelines?

This chapter has been published as:

Kerr, E., Kelly, B., Norman, J., Furber, S., Hernandez, L., Hammersley, M.L., Ryan, S., Franco, L., Vuong, C., Okely, A.D., 2021. 'Nutrition, physical activity and screen time policies and practices in Family Day Care in Australia.' *Public Health Research and Practice*. 1–5.

5.1 Introduction

In Australia, family day care (FDC) is an approved Early Childhood Education and Care (ECEC) service where educators provide education and care for up to seven children aged 0-12 years but only four children younger than school age (0–5 years) in a home environment (Australian Children's Education and Care Quality Authority, 2020). More than 130 000 Australian children aged 0–12 years attended FDC in 2018; comprising 12% of the ECEC sector (excluding outside school hours care services) (Australian Government, 2018). Australian FDC services operate under a two-tiered structure: the service provider operates at the first tier at the organisational level and educators are registered through the service provider at the second tier providing education and care to children. The service providers act as coordination units, monitoring and supporting educators to ensure they comply with service providers' policies as well as and the National Quality Framework (New South Wales Government, 2018). The National Quality Framework is comprised of the National Quality Standard (NQS), the Education and Care Services National Regulations and the Early Years Learning Framework (Australian Children's Education and Care Quality Authority, 2020).

The promotion of healthy eating and physical activity are key elements in the NQS (Australian Children's Education and Care Quality Authority, 2018). Under the Education and Care Services National Regulations, all ECEC services must have a policy relating to nutrition, however, there is no specific guidance regarding the content of the policy (New South Wales Government, 2018). Policies relating specifically to infant feeding, physical activity and screen time are not compulsory (New South Wales Government, 2018). Nutrition policies have been associated with children's dietary intake (Benjamin-Neelon et al., 2018); however, physical activity policies have not been

associated with children's physical activity or sedentary behaviour (Chai et al., 2020; Gunter et al., 2012; Mazzucca et al., 2018).

Munch & Move is a New South Wales (NSW) Government-funded, state-wide capacity-building program designed to promote healthy eating, physical activity and reduced screen time in the ECEC sector (Lockeridge et al., 2015). The program began in 2008 and was enhanced in 2016 with health promotion officers providing additional support to service providers (NSW Government, 2020), to help disseminate training, resources and information to educators and/or families. Development work for *Munch & Move* was conducted with centre-based services, with adaptations appropriate to FDC, however, the impact of the program has only been evaluated in preschools (Hardy et al., 2010).

Most studies related to nutrition, physical activity and screen time policy and practice in ECEC services have been conducted in centre-based ECEC services and there has been much less research in Australian FDC services (Francis et al., 2018; Yoong et al., 2021). The aim of this study was to examine the effect of *Munch & Move* training on the existing policies, resources and professional development used by FDC service providers that were designed to promote healthy eating and physical activity and reduce screen time for children aged 0–5 years. The study also aimed to examine the extent to which service providers' policies adhere to national standards and relevant guidelines.

5.2 Methods

5.2.1 Study design and setting

A cross-sectional study was conducted with FDC service providers from South Western Sydney Local Health District and Illawarra Shoalhaven Local Health District in New

South Wales, Australia from February to September 2018. All FDC service providers in the South Western Sydney (n = 78) and the Illawarra Shoalhaven (n = 7) Local Health Districts were invited to participate in a telephone or face-to-face survey and policy review. The list of service providers was obtained from the Australian Children's Education & Care Quality Authority (ACECQA) (Australian Children's Education and Care Quality Authority, 2019).

5.2.2 Data collection measures: policy review and survey

Service providers' practices and policies were assessed in two ways: policy review and survey. Copies of the service providers' policies were requested to ensure objective assessment and eliminate self-reporting bias. We defined a service provider policy as a formal written policy owned by the service provider. To undertake the policy review, four separate policy review tools were developed to assess policies containing guidelines about nutrition, infant feeding and breastfeeding, physical activity and screen time. The policy review criteria were based on the National Quality Framework (Australian Children's Education and Care Quality Authority, 2018), Get Up & Grow Guidelines (Australian Government Department of Health and Ageing, 2013), Australian Dietary Guidelines (National Health and Medical Research Council, 2013), Australian Infant Feeding Guidelines (National Health and Medical Research Council, 2012), Australian 24-Hour Movement Guidelines for the Early Years (Australian Government: Department of Health, 2017), Early Childhood Australia Statement on young children and digital technologies (Early Childhood Australia, 2018) and the NSW Health *Munch & Move*® program adoption indicators (NSW Ministry of Health, 2017). Supplementary tables 5.1-5.4 outlines the criteria in each policy review tool and where each criterion is sourced.

Researchers independently reviewed each policy twice and each individual criterion was categorised as either ‘no information provided’; ‘topic is partially covered;’ or ‘topic is fully covered’; and given scores of zero, 0.5, or 1.0, respectively. Policy scores were compared and inconsistent scores were determined by consensus. The total number of criteria covered were summed to give an overall score for each individual policy. Policies were classed as comprehensive if more than two-thirds of the criteria were covered. The reviewers also took note of information written in each policy that was not consistent with the national guidelines.

A 25-item survey was developed by the authors focusing on policies, resources provided to families and educators, and the type of professional development accessed about infant feeding, nutrition, physical activity and screen time for children aged 0-5 years. The survey was reviewed by 12 members of an expert working group experienced in health promotion and research in ECEC settings from the University of Wollongong and NSW Health. The survey was tested with two FDC service providers from another Local Health District. The lead author and a research assistant conducted the 30-minute survey with first tier FDC employees on the phone or in person. Service providers’ postcodes were used to determine socioeconomic status (Australian Bureau of Statistics, 2018a) and remoteness using standardised indices (Australian Bureau of Statistics, 2018b). Ethics approval was obtained from the University of Wollongong Human Research Ethics Committee (HREC/17/WGONG/139).

5.2.3 Data Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 23 (IBM Corp, Armonk, NY, USA). Descriptive statistics were calculated for all variables.

Fisher's exact test was used to test for associations between service providers trained or not trained in *Munch & Move*, their provision of resources and professional development to educators and families, and their possession of policies. Independent t-tests (parametric data) and Mann-U Whitney test (nonparametric data) were used to test for differences between policy scores and service providers trained or not trained in *Munch & Move*. Average policy scores were calculated for each policy held by service providers. Significance levels were set at $p<0.05$.

5.3 Results

Thirty-four (40%) service providers from the ACECQA list had closed down during the study period. Of the remaining 51 service providers, 28 participated in the study (55%). These 28 service providers had 885 registered educators in total, ranging from 5 to 91 each. All service providers enrolled children aged 0–12 years. Most service providers (22 of 28) were located in the most disadvantaged areas (SEIFA quintiles 1 and 2) and most providers (25 of 28) were in major cities. Table 5.1 shows nutrition, physical activity and screen time information, and resources and professional development, offered by service providers that were trained and not trained in *Munch & Move*. Service providers trained *in Munch & Move* were more likely to offer professional development to educators on healthy eating (90% vs. 25%, $p = 0.002$) and physical activity (90% vs 13%, $p = 0.002$), and to have more comprehensive nutrition policies (average policy score out of 17: 11.8 vs. 9.0, $p = 0.03$). Service provider policies and practices were more likely to promote healthy eating compared with infant feeding, physical activity and screen time.

Policies

Twenty-seven of 28 service providers submitted policies for review. All service providers had nutrition policies and most had policies that contained guidelines on infant feeding (24 out of 27); about one-third (11 out of 27) had a physical activity policy and approximately half (14 out of 27) had a screen time policy. About half (14 out of 27) the service providers had a comprehensive nutrition policy, whereas less than a quarter had a comprehensive infant feeding policy (6 out of 27) or physical activity policy (4 out of 27) and only two service providers had a comprehensive screen time policy (2 out of 27). Four service providers had policies with incorrect information about the safe storage and handling of infant formula, for example, instructions to microwave formula. One nutrition policy stated that diluted fruit juice was an acceptable drink to provide children regularly. Supplementary tables 5.1-5.4 show the number of service providers that provided partial, complete or no information for each criterion (Appendices O-R).

Information to families

Service providers were most likely to provide families information about healthy eating (provided by 26 out of 28 service providers), promoting physical activity (19 out of 28) and limiting screen time (18 out of 28) (Table 5.1). Less than one-third of service providers gave families information about supervised floor-based play (9 out of 28) and information about introducing solids (8 out of 28).

Resources provided to educators

Over two-thirds of service providers gave educators educational resources about healthy eating (25 out of 28), fundamental movement skills (21 out of 28), physical activity equipment (20 out of 28) and supervised floor-based play (21 out of 28) (Table 5.1).

Less than one-third of service providers gave educators a ‘Breastfeeding Welcome Here’ sign (9 out of 28).

Professional development

Three-quarters of service providers (21 out of 28) reported participating in professional development related to nutrition and physical activity (Table 5.1). Half of the service providers had completed professional development in nutrition and physical activity in 2016-18 (13 completed *Munch & Move*® webinar training and one completed other training) and one-quarter (7 out of 28) completed *Munch & Move*® face to face training in 2011-12. Less than three-quarters of service providers had offered professional development to educators in nutrition (20 out of 28) or physical activity (19 out of 28).

Table 5. 1 Service provider practices of resource provision and educator professional development and policy quality by service providers trained or not trained in *Munch & Move*

Service provider practices	Number n (%)	Trained in *Munch & Move* (n = 20) *n* (%)	Not trained in *Munch & Move* (n = 8) *n* (%)	*p*-value
Resources supplied to families[a]				
Healthy eating	26 (93)	18 (90)	8 (100)	1.00
Promoting physical activity	19 (68)	15 (75)	4 (50)	0.37
Limiting screen time	18 (64)	14 (70)	4 (50)	0.40
Breastfeeding	16 (57)	13 (65)	3 (38)	0.23
Fussy eating	13 (46)	12 (60)	1 (13)	0.06
Supervised floor-based play	9 (32)	8 (40)	1 (13)	0.21
Introducing solids	8 (29)	7 (35)	1 (13)	0.37
Fundamental movement skills	6 (21)	6 (30)	0 (0)	0.14
Resources supplied to educators[a]				
Healthy eating learning experiences	25 (89)	19 (95)	6 (75)	0.19
Supervised floor-based play	21 (75)	17 (85)	4 (50)	0.14
Fundamental movement skills	21 (75)	17 (85)	4 (50)	0.14
List of physical activity equipment	20 (71)	14 (70)	6 (75)	1.00
'Breastfeeding Welcome Here' sign	9 (32)	8 (40)	1 (13)	0.21
Professional development offered to educators[a]				
Healthy eating	20 (71)	18 (90)	2 (25)	0.00
Physical activity	19 (68)	18 (90)	1 (13)	0.00

Service provider policies[b]	Total	Trained in *Munch & Move* (n = 20)	Not trained in *Munch & Move* (n = 7)	*p*-value
Nutrition policy[a]				
n (%)	27 (100)	20 (100)	7 (100)	NA
Average policy score (out of a total of 17 points)[c]	11.1	11.8	9.0	0.03
Infant feeding policy				
n (%)	24 (89)	19 (95)	5 (71)	0.16
Average policy score[c] (out of a total of 6 points)	3.1	3.2	2.7	0.52
Physical activity policy				
n (%)	11 (41)	7 (35)	4 (57)	0.39
Average policy score[d,e] (out of a total of 4 points)	2.3	2.5	1.9	0.56
Screen time policy				
n (%)	14 (52)	9 (45)	5 (71)	0.39
Average policy score[d,e] (out of a total of 6 points)	2.3	2.9	1.2	0.06

NA = not applicable
[a] Fisher's exact tests
[b] 27 service providers provided policies to review
[c] Independent t-tests
[d] Mann-U Whitney test
[e] Average policy score was calculated from service providers with a policy

5.4 Discussion

Differences were found between FDC service providers trained or not trained in *Munch & Move* regarding professional development and nutrition, physical activity and screen time policies but not in the resources provided. Other studies have generally found that professional development has improved both policies and resources (Woodward-Lopez

et al. 2018; Kao et al. 2018; Trost et al. 2011), however a recent USA study, which focused on educator professional development, found no difference in nutrition, physical activity or screen time policies between intervention and control (Ward et al. 2020). The strong focus *Munch & Move* places on training educators and implementing policies (Lockeridge et al., 2015) provides a possible explanation for the finding that service providers trained in the *Munch & Move* program were more likely to provide healthy eating and physical activity professional development and have comprehensive nutrition policies.

Previous studies have reported that less than half of FDC educators had participated in nutrition professional development (Daniels et al., 2003; Gunter et al., 2012; Trost et al., 2009) and one-quarter to half of FDC educators had participated in physical activity professional development (Gunter et al., 2012; Trost et al., 2009). While our study found that over two-thirds of service providers offered professional development to educators in nutrition or physical activity, we did not capture information about the number of educators who participated in the professional development. Further, educators in the USA do not have an overarching support service to organise professional development opportunities and the *Munch & Move* program encourages service providers to train educators using a *Munch & Move* Staff Development Kit.

Our study found most FDC service providers promoted nutrition and healthy eating messages through policies and resources provided to families and educators. However less information was provided on infant feeding, physical activity and screen time. Similar to our findings, studies in the USA have demonstrated that family child care homes (equivalent to FDC) were more likely to provide families with information relating to nutrition than physical activity, and also hold more comprehensive nutrition

policies than physical activity policies (Gunter et al., 2012; Trost et al., 2009). It is unsurprising that fewer service providers in our study had comprehensive policies relating to infant feeding, physical activity and screen time as these are not mandated under the Education and Care Services National Regulations (New South Wales Government, 2018). Comprehensive nutrition policies have been positively associated with the nutrition quality of food consumed by children in family child care homes in the US (Benjamin-Neelon et al., 2018). However, comprehensive physical activity policies have not been associated with children's physical activity levels (Gunter et al., 2012; Mazzucca et al., 2018) or sedentary behaviour (Chai et al., 2020) in family child care homes in the USA. In the USA, family child care home educators are not registered with an overarching service provider; policies and resources are the responsibility of individual educators and, as such, are not directly comparable with Australian FDC services (Benjamin-Neelon et al., 2018). Of the limited studies conducted in Australian FDC services, Lum et al., (2020) found that over two-thirds of FDC service providers in the Hunter New England region of NSW had comprehensive nutrition policies but less than one-third had comprehensive physical activity and screen time policies and none had comprehensive breastfeeding policies. Bravo et al., (2008) found that nutrition policies lacked detail and only covered one-third of the policy review criteria that were based on the Health and Safety in Child Care Centres, Model Policy and Practices. McGuire et al., (2018) qualitatively analysed infant feeding policies in centre-based and FDC services in Australia and found most policies focused on minimising risk within child care environments, however many policies did not include accurate information in line with the Australian Infant Feeding Guidelines. Our study also found that most service providers' infant feeding policies mentioned information about safe preparation, storage and handling of breastmilk and formula however some included incorrect

information. A possible explanation for this may be the lack of specific terminology and limited practice examples in relation to infant feeding in the National Quality Framework that was highlighted by McGuire et al., (2018).

It is important to note differences in our policy review criteria compared with other policy reviews. Two policy review tools suitable for FDC have been validated and published in the literature: the Environment and Policy Assessment and Observation for the family child care home setting (Vaughn et al., 2017) and Wellness Child Care Assessment Tool (Falbe et al., 2012). These tools were developed in the USA and did not include guidelines for infants. While similarities exist, our policy criteria did not include specific information regarding the quantity of food to provide children while in care or the recommended time children should spend being physically active or sedentary (including screen time) in FDC. In Australia, the National Quality Framework and Get Up and Grow guidelines state that a 'wide variety of nutritious food consistent with the Australian Dietary Guidelines should be offered,' 'food should be adequate in quantity' and 'offer an appropriate amount of food', however, these documents do not specify how much food should be provided (Australian Children's Education and Care Quality Authority, 2020; Australian Government Department of Health and Ageing, 2013). Similarly, the only national guidelines on physical activity and sedentary behaviour (including screen time) come from the Australian 24-hour Movement Guidelines that do not provide specific guidelines on children's physical activity in ECEC services (Australian Government: Department of Health, 2017). It is also important to note the absence of information on screen time in the National Quality Framework.

Limitations of our study include potential bias from the self-reported data, and the survey and policy audit instruments not being validated. However, written policies were obtained to cross-check reporting and the policies were reviewed by two different researchers. The sample may not be representative of the FDC sector due to the low sample size and a high proportion of services providers had participated in *Munch & Move*® training (71% of participating service providers had completed the *Munch & Move* training compared with 53% of all service providers who were invited to participate). The sample may not be adequately powered because of its small size. The low recruitment rate can be partly explained by recent legislative changes in the FDC sector due to fraudulent activity and non-compliance to national standards and regulations which saw the closure of a high proportion of service providers (Family Day Care Australia, 2018). In addition, the introduction of a new child care subsidy had reportedly caused increased administrative pressure on the sector and likely contributed to the difficulties engaging and recruiting service providers (Family Day Care Australia, 2018).

5.5 Conclusion

Our findings suggest that *Munch & Move* training had a positive association with FDC service providers' policies and educators' professional development but service providers need additional support to adopt policies and to provide resources to educators and families, specifically targeting infant feeding, physical activity and screen time. Further research should investigate whether policies, resources and professional development provided by service providers to educators and families are associated with improvements in educator practices and whether they have a positive impact on children's physical activity and eating behaviours. Development of the policy review

tool also highlighted that ECEC public policies such as the NQF and Get Up and Grow lack specific details that may be needed to cause specific change at the educator level. Further research exploring the need for, and acceptability and effectiveness of, national sector-specific guidelines for children attending ECEC services is warranted. Future studies are also needed to validate the policy review tool that could be used to assess other Australian ECEC services' policies.

5.6 References

Australian Bureau of Statistics (2018a) *Socio-Economic Indexes for Areas Australia*. Commonwealth of Australia. Available at: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by Subject/2033.0.55.001~2016~Main Features~SOCIO-ECONOMIC INDEXES FOR AREAS (SEIFA) 2016~1 (Accessed: 16 April 2021).

Australian Bureau of Statistics (2018b) *The Australian Statistical Geography Standard (ASGS) Remoteness Structure*. Commonwealth of Australia. Available at: https://www.abs.gov.au/websitedbs/d3310114.nsf/home/remoteness+structure (Accessed: 12 August 2019).

Australian Children's Education and Care Quality Authority (2018) *Guide to the National Quality Framework*. Available at: https://www.acecqa.gov.au/sites/default/files/2020-09/Guide-to-the-NQF-September-2020.pdf.

Australian Children's Education and Care Quality Authority (2019) *National registers, Australian Children's Education and Care Quality Authority website*. Available at: https://www.acecqa.gov.au/resources/national-registers (Accessed: 23 September 2019).

Australian Children's Education and Care Quality Authority (2020) 'Guide to the National Quality Framework', (January), pp. 1–634. Available at: https://www.acecqa.gov.au/sites/default/files/2020-09/Guide-to-the-NQF-September-2020.pdf.

Australian Government: Department of Health (2017) *Australian 24-Hour Movement Guidelines for the Early Years (birth to 5 years): An Integration of Physical Activity, Sedentary Behaviour, and Sleep*. Available at: http://www.health.gov.au/internet/main/publishing.nsf/content/FCE78513DAC85E08CA257BF0001BAF95/$File/Birthto5years_24hrGuidelines_Brochure.pdf.

Australian Government (2018) *Child Care in Australia, Department of Education and Training*. Available at: https://www.education.gov.au/child-care-australia (Accessed: 26 April 2019).

Australian Government Department of Health and Ageing (2013) *Get Up & Grow: Healthy Eating and Physical Activity for Early Childhood*. Available at: https://www1.health.gov.au/internet/main/publishing.nsf/Content/EA1E1000D846

F0AFCA257BF0001DADB3/$File/HEPA - A4 Book - Directors Book - LR.pdf.

Benjamin-Neelon, S. E. *et al.* (2018) 'The family child care home environment and children's diet quality', *Appetite*, 126, pp. 108–113. doi: 10.1016/j.appet.2018.03.024.

Bravo, A., Cass, Y. and Tranter, D. (2008) 'Good food in family day care: Improving nutrition and food safety in family day care', *Nutrition and Dietetics*, 65(1), pp. 47–55. doi: 10.1111/j.1747-0080.2007.00136.x.

Chai, L. K., Rice-McNeil, K. and Trost, S. G. (2020) 'Patterns and Correlates of Sedentary Behavior in Children Attending Family Child Care', *International journal of environmental research and public health*, 17(2), pp. 1–10. doi: 10.3390/ijerph17020549.

Daniels, L. A., Franco, B. and McWhinnie, J. A. (2003) 'An assessment of the potential of Family Day Care as a nutrition promotion setting in South Australia', *Nutrition & Dietetics*, 60(1), pp. 30–37.

Early Childhood Australia (2018) 'Statement on young children and digital technologies'. Available at: http://www.earlychildhoodaustralia.org.au/wp-content/uploads/2018/10/Digital-policy-statement.pdf.

Falbe, J. *et al.* (2012) 'The Wellness Child Care Assessment Tool: A Measure to Assess the Quality of Written Nutrition and Physical Activity Policies', *Journal American Dietetic Association*, 1(3), pp. 233–245. doi: 10.1016/j.dcn.2011.01.002.The.

Family Day Care Australia (2018) *Family Day Care Australia Submission to the Senate Select Committee on Red Tape Inquiry into the effect of red tape on child care*. Available at: www.familydaycare.com.au/representing-you/submissions (Accessed: 23 May 2019).

Francis, L. *et al.* (2018) 'Examining the Obesogenic Attributes of the Family Child Care Home Environment: A Literature Review', *Journal of Obesity*, 2018, pp. 1–20. doi: 10.1155/2018/3490651.

Gunter, K. B. *et al.* (2012) 'Factors associated with physical activity in children attending family child care homes', *Preventive Medicine*, 54(2), pp. 131–133. doi: 10.1016/j.ypmed.2011.12.002.

Gunter, K. B., Rice, K. R. and Trost, S. (2012) 'Nutrition and physical activity policies and practices in child care homes in Oregon: Baseline findings from the health home child care project', *Extension Journal*, 50(3), p. 3FEA3. Available at:

http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed9&NEWS=N&AN=2009605265.

Hardy, L. L. *et al.* (2010) 'Munch and Move: Evaluation of a preschool healthy eating and movement skill program', *International Journal of Behavioral Nutrition and Physical Activity*, 7(1), p. 80. doi: 10.1186/1479-5868-7-80.

Lockeridge, A. *et al.* (2015) *Munch & Move: Evidence and Evaluation Summary. NSW Ministry of Health*. Available at: https://healthykids.nsw.gov.au/wp-content/uploads/2020/05/FINALMunchMoveSummary.pdf (Accessed: 22 May 2019).

Lum, M. *et al.* (2020) 'Assessing the implementation of healthy eating and physical activity policies and practices in the family day care setting: A cross sectional study', *Health Promotion Journal of Australia*, (September), pp. 1–10. doi: 10.1002/hpja.420.

Mazzucca, S. *et al.* (2018) 'Physical activity and sedentary behaviors of children in family child care homes: Are there opportunities for improvement?', *Pediatric Exercise Science*, 30(4), pp. 529–536. doi: 10.1123/pes.2018-0040.

McGuire, J., Gallegos, D. and Irvine, S. (2018) 'Infant feeding nutrition policies in Australian early childhood education and care services: a content and qualitative analysis', *International Journal of Child Care and Education Policy*, 12(1), p. 14. doi: 10.1186/s40723-018-0053-2.

National Health and Medical Research Council (2012) *Infant Feeding Guidelines Information for health workers, National Health and Medical Research Council*. Canberra. Available at: http://www.ncbi.nlm.nih.gov/pubmed/4055304.

National Health and Medical Research Council (2013) *Australian Dietary Guidelines*. Canberra: National Health and Medical Research Council. Available at: www.nhmrc.gov.au/guidelines-publications/n55%0Ahttps://www.nhmrc.gov.au/_files_nhmrc/file/publications/n55_australian_dietary_guidelines1.pdf.

New South Wales Government (2018) *Education and Care Services National Regulations*. Available at: https://www.legislation.nsw.gov.au/#/view/regulation/2011/653/chap4/part4.2/div1 (Accessed: 6 February 2019).

NSW Government (2020) *Munch & Move Support*. Available at:

https://healthykids.nsw.gov.au/munch-move-support/ (Accessed: 27 August 2020).

NSW Ministry of Health (2017) 'Munch & Move Monitoring Guide for Family Day Care Service Provider Practices', pp. 1–5.

Sharma, S. V. *et al.* (2014) 'A conceptual framework for organizational readiness to implement nutrition and physical activity programs in early childhood education settings', *Preventing Chronic Disease*, 11(10), pp. 1–6. doi: 10.5888/pcd11.140166.

Trost, S. G. *et al.* (2009) 'Nutrition and Physical Activity Policies and Practices in Family Child Care Homes', *American Journal of Preventive Medicine*, 37(6), pp. 537–540. doi: 10.1016/j.amepre.2009.09.020.

Vaughn, A. E. *et al.* (2017) 'Assessment of nutrition and physical activity environments in family child care homes: Modification and psychometric testing of the Environment and Policy Assessment and Observation', *BMC Public Health*, 17(1), p. 680. doi: 10.1186/s12889-017-4686-9.

Yoong, S. L. *et al.* (2021) 'An overview of research opportunities to increase the impact of nutrition intervention research in early childhood and education care settings according to the re-aim framework', *International Journal of Environmental Research and Public Health*, 18(5), pp. 1–19. doi: 10.3390/ijerph18052745.

Chapter 6: Foods provided to children in family day care: An observational study

The previous chapter examined the effect of *Munch & Move* training on the existing policies, resources and professional development used by FDC service providers. An important finding was that *Munch & Move* training was associated with more comprehensive policies and provision of training to educators. This chapter examined the food provided to children in FDC and assessed the impact of service provider, educator, parent/caregiver and child level characteristics on the food and beverages provided to children.

This chapter addresses Research Question 3:

i. What is the nutritional quality of food provided to children during FDC?

ii. Are the policies, practices and environments at a service provider and educator level associated with the type of food provided to children by parents or educators during FDC?

This chapter has been published as:

Kerr, E.M., Kelly, B., Hammersley, M.L., Hernandez, L., Norman, J., Furber, S., Vuong, C., Ryan, S., Wardle, K., Okely, A.D., 2020. 'Foods provided to children in family day care: An observational study'. *Public Health Nutrition*. 24(11), pp. 3196-3204. https://doi.org/10.1017/S1368980021001506

6.1 Introduction

In the early years, nutrition is vital for optimal health and cognitive, emotional and physical development and can reduce the risk of developing chronic diseases in later life (Dalwood et al., 2020). Australian children's diets are far from ideal with only 20% of children aged 2-3 years and 3% of children aged 4-8 years meeting the recommended intake of vegetables (Australian Bureau of Statistics, 2018a). Further, discretionary food and beverages contribute to 30% and 38% of energy intake in children aged 2-3 and 4-8 years respectively, contributing to excess intakes of total and saturated fat, added sugars and sodium (Australian Bureau of Statistics, 2014a).

Systematic reviews have found that Early Childhood Education and Care (ECEC) services can improve children's dietary intake (Golley and Bell, 2015; Stacey et al., 2017). They can also communicate health messages to support families to make positive changes at home (Hardy et al., 2010). Nutrition guidelines in NSW recommend that children in ECEC services be provided with at least 50% of the Australian Dietary Guidelines recommended daily intake of all nutrients when attending an ECEC services for more than eight hours or when they receive morning tea, lunch and afternoon tea while in attendance (NSW Ministry of Health, 2014).

In Australia, family day care (FDC) is a form of ECEC service where educators provide education and care for up to four children below school age (0-5 years) and an additional three school-aged children (5-12 years) in a home environment (Australian Children's Education and Care Quality Authority, 2018). FDC educators must be registered through an approved service provider to work as a FDC educator in Australia and receive government subsidies (Australian Children's Education and Care Quality Authority, 2018). The service provider monitors and supports educators to ensure they comply with

the service providers' policies and the National Quality Framework (Australia's ECEC regulatory system comprised of the National Quality Standard, the Education and Care Services National Regulations and the Early Years Learning Framework) (Australian Children's Education and Care Quality Authority, 2018). Over 125,000 Australian children aged between zero and 12 years attended FDC in 2019 (Australian Government, 2018).

Most research exploring the nutrition environment in ECEC services has been conducted with centre-based services, with little research among FDC (Francis et al., 2018; Yoong et al., 2020). Studies involving direct observation in family child care homes (equivalent to FDC) in the USA have found children's diet quality has been associated with the food provided (Benjamin-Neelon et al., 2018; Tovar et al., 2018), nutrition education (Benjamin-Neelon et al., 2018), nutrition policy (Benjamin-Neelon et al., 2018), educator income (Tovar et al., 2020), ethnicity (Tovar et al., 2020) and main language spoken at home (Tovar et al., 2020). Additionally, children were not being provided with, or consuming, adequate amounts of vegetables, total protein foods, seafood and plant-based proteins and wholegrains (Tovar et al., 2018). Unlike the USA where all food is provided by educators, in Australia food can be provided by parents/carers, educators, or a combination of both, depending on the preference of the individual educator (Wallace and Mills, 2019). To our knowledge, only four studies have been published in Australia that explore healthy eating in FDC, however, all have involved self-reported data and no studies captured information on the quantity of food provided (Bravo et al., 2008; Daniels et al., 2003; De Silva-Sanigorski et al., 2011; Wallace and Mills, 2019). Therefore, the present study aimed to: 1) assess the quality and quantity of food and beverages provided to children aged 0-5 years in FDC services in two large geographic areas in New South Wales (NSW), Australia; and 2) identify structural and socio-demographic factors

associated with the nutritional quality of foods provided to children.

6.2 Methods

Setting and design

A cross-sectional study involving direct observation within 33 FDC services was conducted between April 2019 and February 2020 in the south west Sydney and Illawarra Shoalhaven regions of NSW.

Study sample and recruitment

Educators were recruited through their FDC service provider who had previously participated in a survey and policy review (Kerr et al., 2021). Based on the sample of 28 service providers from the previous study, 700 educators were eligible to participate with approximately 2200 children. A sample size of approximately 220 children was calculated to be sufficient to estimate children's physical activity levels, which was an outcome of interest in the larger study. The calculation used baseline data of children's physical activity levels in family child care homes, with an intraclass correlation of 0.33, a mean of 8.1 (SD 3.1) minutes per hour in physical activity and a design effect of 1.99 (using a cluster size of 3 children per service). Once the service provider agreed to participate, they were asked to provide a list of all their eligible educators' contact details (email and/or telephone number) to be invited to participate in the study as this information is not publicly available. Where service providers did not want to provide their educators' contact details without their permission, the service providers emailed their educators an invitation to participate, including the participant information sheet and consent forms. Educators were eligible if they cared for at least three children aged 0-5 years, and their service provider was situated in the sampling areas. If an educator consented to participate, a data collector contacted them to confirm their eligibility,

introduce themselves and explain what the observation would entail.

Multiple recruitment strategies were utilised, including face-to-face recruitment at FDC meetings and the development of a brief video to explain the study (which was sent to service providers and educators via email). Educators were informed of the date of the observation 24-hours in advance and asked not to inform parents about the scheduled observation so parents would not alter the types of food provided to their child (if applicable). Children were included in the current study if food data were collected for lunch and at least one snack (morning or afternoon tea). As a thank you for participating in the study, an AUD$100 educational resource voucher was provided to educators who completed the observation.

Measurements

Parent/caregivers completed a short online survey that was attached to the consent form to capture information on their child's sex, date of birth, postcode of residence and the main language spoken at home. Educators also completed an online survey when they provided consent that included information on their postcode of residence, language spoken at home, ECEC experience (including FDC), qualifications and nutrition-related professional development undertaken in the past two years. Data collection was scheduled between one week and one month after the educator provided consent and completed the survey.

Postcode of residence was used as a proxy for socioeconomic status (SES), based on the Australian Bureau of Statistics' (ABS) Index of Relative Socioeconomic Disadvantage, categorised into quintiles (quintile 1 contains the most disadvantaged areas and 5 contains the most advantaged areas) (Australian Bureau of Statistics, 2018b). Educators and children were categorised into English-speaking or non-English-speaking backgrounds

based on their main language spoken at home (using the ABS Australian Standard Classification of Languages) (Australian Bureau of Statistics, 2016a).

Food audit

A food audit tool (appendix BB) was developed in Research Electronic Data Capture (REDCap) to record the amount and type of foods provided to children at FDC by families and educators based on a tool used by Kelly et al., (2010). REDCap is a secure online web application used to build and manage surveys and databases for research studies (Harris et al., 2019). The tool classified foods into one of nine food and beverage categories (fruit, vegetables, dairy, grain (cereal) foods, meat and meat alternatives, sweet discretionary foods, savoury discretionary foods, discretionary beverages and main meals. Main meals were classified into mixed dishes; sandwich/wrap/roll; take away. A mixed dish was defined as a main meal that was provided by the educators or parent/caregiver that included more than one food group and was not a sandwich, wrap or roll or take away. The tool also recorded the ingredients in the mixed dishes and sandwich/wrap/rolls. Data collectors recorded details of packaged foods including brand name and product description. Food was weighed using Salter scales (model number 1035 SSBKDR) and photographed on an A3 grid at a 45° angle (centimetre increments) (Sabinsky et al., 2013). To minimise handling of food, it was weighed in the serving container or plate, when appropriate. In these cases, the audit tool captured information on total weight and container weight, which was subtracted from the relevant food items. Food and beverages provided by the family were weighed and photographed in the morning before the first meal and food and beverages provided by the educator were weighed and photographed before each meal.

A dietitian (EK) calculated the number of serves of each of the foods provided comparing

the assessed weight of the foods with the Australian Guide to Healthy Eating standard serving sizes (AUSNUT, 2016). The serves of each food group from mixed meals were calculated using Australian food composition data on Foodworks (AUSNUT, 2016; Xyris Software, 2018). The food photographs were used to assist in the calculation of food serves for mixed foods, whereby the photographs were used to estimate the proportion of the total weight attributed to individual items. Shared food platters were divided by the number of children who were provided with the food as an estimation of individual serving sizes.

Discretionary foods and beverages were determined based on the Australian Guide to Health Eating (National Health and Medical Research Council, 2013) and the Australian Bureau of Statistics Discretionary Food List (Australian Bureau of Statistics, 2014b). Kilojoule content of the foods were calculated using the nutrition information panel of packaged food or Australian food composition data, if the nutrition information panel was not available. The number of serves of discretionary food was calculated by dividing the kilojoules of the food by 600 kilojoules (1 serve of discretionary food = 600 kilojoules) (National Health and Medical Research Council, 2013).

Healthy food provision index score

A healthy food provision index score of provided foods was created to measure the alignment of the food provided in FDC services to the Australian Guide to Health Eating. The score was adapted from other scores (Guenther et al., 2014; Voortman et al., 2015), however, it was simplified as it was based on the food provided on one day in FDC and therefore could not capture overall diet quality, such as variety of vegetables or inclusion of fish or legumes in the diet that are not typically consumed daily. For each food group, a score out of 1 was assigned to indicate the degree that the child was provided with at

least 50% of the recommended serves of the food group for their age while in FDC (Table 6.1), with a maximum of five points allocated in total for all food groups. A score of 0 indicated the food was not provided at the recommended guidelines and a score of 1 indicated the food was provided at or above recommendations. For example, a 3 year old child provided with 0.75 serves of vegetables would receive a score of 0.6 (0.75 divided by 1.25 serves) for this food group. Scores exceeding minimum recommendations were truncated at 1. The Australian Guide to Health Eating recommends mostly wholegrain and/or high cereal fibre varieties. Therefore, up to 0.5 points were given if they were provided with 50% of the recommended number of serves of grains and up to another 0.5 if at least 1 of these serves was wholegrain. For discretionary foods and beverages, this scoring system was reversed, with higher scores reflecting lower amounts provided. If more than half a serve of discretionary food was provided then the category received a negative score up to the value of -1 and if no serves were provided then the category was scored at 1. Children that had between 0.1 and 0.5 serves of discretionary foods received a score of 0. For example, 0.3 serves of discretionary foods resulted in a score of 0 and 1.5 serves of discretionary foods resulted in a score of -1 (0.5 – 1.5 serves). Scores of the individual food categories were summed, resulting in a healthy food provision index score ranging from -1 to 6 on a continuous scale, with a higher score indicating better food provision quality.

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 25 (IBM Corp, Armonk, NY, USA). Descriptive statistics were calculated using means and standard deviations for continuous variables, and frequencies and percentages for categorical variables. Linear mixed models were used to examine the difference between healthy food provision index scores by child, educator and service provider and family covariates (SES, main language spoken at home, educator experience, food provider (i.e.

FDC or parent), educator qualification, nutrition professional development, ECEC experience, presence of a comprehensive nutrition policy (at the service provider level), type of main meal (for example, sandwich or mixed dish), or number of meals provided. To account for the clustered nature of the data, the models included the FDC educator as a random effect. Fixed effects such as age of child, sex of child, SES, and cultural background were included as covariates in the mixed models. Significance levels were set at $P<0.05$.

Table 6. 1 Healthy food provision index score components and standards for scoring

Food category	Number of serves for maximum score (1-2 years)	Number of serves for maximum score (2-3 year olds)	Number of serves for maximum score (4-8 year olds)	Maximum points awarded	Minimum points awarded
Vegetables	1[(a)]	1.25	2.25	1	0
Fruit	0.25	0.5	0.75	1	0
Dairy	0.5[(a)]	0.75	0.75[(a)]	1	0
Total grains/cereals	2.0	2.0	2.0	0.5	0
Wholegrains	1.0	1.0	1.0	0.5	0
Lean meat and meat alternatives	0.5	0.50	0.75	1	0
Discretionary food and beverages	0	0	0	1	-1

[(a)] Where the Australian Guide to Healthy Eating recommendations were reported as a range, the lower range was used

6.3 Results

The study was intended to finish once the sample size was reached however, data collection ended in March 2020 due to COVID-19 restrictions coming into force. During the possible data collection period, ten service providers agreed to participate, four had closed down and fourteen declined. Thirty-three observation visits were conducted and data were collected on 104 children. Thirty-two children had all their food provided from home, 31 children had all their food provided by educators and 42 children had food provided by both educators and from home. Twenty-eight children had lunch and one snack and 76 children had lunch and two snacks. Educator and child characteristics are described in Table 6.2. More than half of educators (n=19) spoke a language other than English as their main language, while half of the children came from homes where a

language other than English was the main language spoken. Children were aged from 11 months to 5.3 years and the mean age of children was 3.2 (SD 1.2) years. Twenty-five educators were registered with a service provider who had a comprehensive nutrition policy.

Most children were provided with fruit (n=103) and grains (n=101) followed by dairy (n=77), vegetables (n=74), discretionary foods (n=74), lean meats and meat alternatives (n=64) and wholegrains (n=27) (Table 6.3). Fifty-nine children were provided with a mixed dish (n=59) and 42 children were provided with a sandwich, wrap or roll (n=42). Sweet discretionary foods were more common than savoury discretionary foods and discretionary beverages. Sweet biscuits were the most common sweet discretionary food (n= 30), followed by cakes, muffins, scones, cake-type desserts (n= 12) and muesli, cereal, nut and seed style bars (n= 30). Savoury biscuits were the most common savoury discretionary food (n= 18), followed by processed meats (n= 16) and chips and extruded snacks (n= 11).

Table 6. 2 Sociodemographic characteristics of family day care educator and children

Educator characteristics	**N (%)**
Main language spoken at home	
English	14 (42)
Language other than English	19 (58)
Socioeconomic status	
Low (Quintiles 1-2)	15 (46)
Medium/High (Quintiles 3-5)	18 (54)
Sex, female	33 (100)
Years worked in Early Childhood Education and Care	
< 10 years	17 (52)
≥10 years	16 (48)
Years working in family day care	
< 10 years	24 (73)
≥10 years	9 (27)
Early Childhood Education and Care Qualification	
Certificate III	7 (21)
Diploma	23 (70)
University	3 (9)
Nutrition-related professional development in past 2 years	
Yes	10 (30)
No	23 (70)
Child characteristics	
Age	
11 – 23 months	22 (21)
2 - 3 years	49 (47)
4 - 5 years	33 (32)
Sex, female	59 (57)
Main language spoken at home	
English	53 (51)
Language other than English	51 (49)
Socioeconomic status	
Low (Quintiles 1-2)	44 (42)
Medium/High (Quintiles 3-5)	60 (58)

Table 6. 3 Frequency of children provided with food groups and discretionary food and beverage items in family day care and average serve size of food groups if the foods were provided

Food category	Number (%) of children provided	Number (%) of children meeting 50% of the recommended serves of the food group for their age	Serves per child (if food provided) (mean, SD)
Fruit	103 (99)	92 (89)	1.3 (0.8)
Total grains/cereals	101 (97)	56 (36)	2.1 (1.1)
Wholegrains	27 (26)	N/A	1.5 (0.9)
Dairy	77 (74)	41 (25)	0.8 (0.5)
Vegetables	74 (71)	18 (17)	1.1 (0.6)
Lean meat and meat alternatives	64 (61)	20 (19)	0.5 (0.3)
Discretionary (total)	74 (71)	N/A	1.5 (1.1)
Sweet discretionary foods	49 (47)	N/A	1.4 (0.8)
Savoury discretionary foods	45 (43)	N/A	0.8 (0.7)
Discretionary beverages	3 (3)	N/A	0.7 (1.9)

Children's age, SES and the type of main meal provided were significantly associated with the healthy food provision index score (Table 6.4). Children aged 11-23 months had the highest nutritional quality of food provided compared to children aged 2-3 years and 4-5 years (3.5 vs. 3.0 vs. 2.4, p=0.01). Despite the fact that their dietary requirements were lower, on average children aged 11-23 months were provided with more serves of dairy and wholegrains and fewer serves of discretionary foods compared to the other age groups. The primary food groups associated with differences in food quality were dairy and wholegrains. Children living in low SES suburbs were significantly more likely to have a higher healthy food provision index score compared to children living in medium/high SES areas (3.1 vs. 2.8, p=0.03). More vegetable serves contributed to the higher healthy food provision index score in children from lower SES areas. Children provided with mixed dishes had a higher healthy food provision index score compared to children provided with a sandwich, wrap or bread roll (3.5 vs. 2.7, p=0.01). The higher score in mixed dishes was associated with the increased provision of vegetables and lean meat and meat alternatives and less discretionary foods.

Table 6. 4 Factors associated with healthy food provision index scores of food provided to children

Independent variables		Healthy food provision index score	
		Mean (SD)	*P* value
Age	11 - 23 months	3.5 (1.3)	0.01*
	2 - 3 years	3.0 (1.2)	
	4 - 5 years	2.4 (1.2)	
Gender	Female	2.7 (1.3)	0.69
	Male	3.2 (1.2)	
Child SES†	Low	3.1 (1.4)	0.03*
	Medium/High	2.8 (1.2)	
Child language	English speaking	2.8 (1.2)	0.59
	Non-English speaking background	3.0 (1.4)	
Educator SES†	Low	3.1 (1.4)	0.34
	Medium/High	2.8 (1.2)	
Educator language	English speaking	2.9 (1.2)	0.69
	Non-English speaking background	2.9 (1.4)	
Food provider	Family	2.3 (0.9)	0.17
	Educator	3.7 (1.1)	
	Family and educator	2.8 (1.4)	
Nutrition policy	Comprehensive	3.0 (1.3)	0.69
	Not comprehensive	2.7 (1.3)	
Nutrition-related professional development (last 2 years)	Yes	3.4 (1.3)	0.50
	No	2.7 (1.2)	
ECEC‡ experience	<10 years	2.6 (1.2)	0.78
	≥ 10 years	3.3 (1.3)	
ECEC qualification	Certificate III	3.6 (1.1)	0.35
	Diploma	2.9 (1.4)	
	University	3.3 (1.1)	
Type of main meal	Mixed dish	3.4 (1.2)	0.01*
	Sandwich/wrap/roll	2.2 (1.1)	
Number of meals	Lunch and 1 snack	3.5 (1.1)	0.08
	Lunch and 2 snacks	2.7 (1.3)	

†Socioeconomic status
‡Early childhood education and care

6.4 Discussion

This is the first known Australian study to assess the nutritional quality and quantity of food provided to children in FDC using weighed food records and observations. Most children were not provided with recommended amounts of vegetables, wholegrains, dairy, and lean meat or meat alternatives but were provided with excess discretionary foods. Additionally, children's age, SES and type of main meal were associated with the healthy food provision index score.

Our findings are consistent with other research in FDC conducted in Australia (Bravo et al., 2008; Daniels et al., 2003) and internationally (Tovar et al., 2018), and from Australian ECEC centre-based services (Bell et al., 2015; Jones et al., 2017; Kelly et al., 2010; Sambell et al., 2014; Yoong et al., 2014). For example, using diet recalls with FDC educators in South Australia for 367 children aged 1-5 years, researchers found that most children in FDC between 5-8 hours were provided with bread/cereals (94%), fruit (89%) and discretionary foods (87%) but only 15% of children were provided with vegetables (Daniels et al., 2003). Similar to our study, a combination of food providers were observed, including parents or educators or both (Daniels et al., 2003). One Australian intervention, Good Food in Family Day Care (1998-2000), reported over 90% of children were provided with fruit and grains/cereals (pre- and post-nutrition intervention), however, less than two-fifths of children aged 1-5 years old were provided with vegetables after the intervention (Bravo et al., 2008). The intervention was conducted with educators from seven service providers and parents supplied most of the food (Bravo et al., 2008). Dietary observations in family child care homes (equivalent to FDC) in the USA also reported that children were not provided with enough vegetables and wholegrains but were close to meeting the American guidelines for fruit (Tovar et al.,

2018). However, unlike our study, children were close to meeting the American dairy recommendations and all food was provided by the educators (Tovar et al., 2018). Studies from Australian ECEC centre-based services where parents (Jones et al., 2017) and centres (Sambell et al., 2014; Yoong et al., 2014) provided food also found that children are not being provided (Sambell et al., 2014; Yoong et al., 2014) or consuming foods (Jones et al., 2017) in line with dietary recommendations, particularly for vegetables (Jones et al., 2017; Sambell et al., 2014; Yoong et al., 2014) lean meat and meat alternatives (Jones et al., 2017; Sambell et al., 2014; Yoong et al., 2014) and dairy (Jones et al., 2017; Sambell et al., 2014). Furthermore, compared to our study, a lunchbox audit assessing the food provided by parents to Australian preschool children in 2010 found that fewer children were provided with fruit (75%), vegetables (5%) and dairy (5%) but when they were provided with these foods, the mean number of serves were similar (Kelly et al., 2010). Similar proportions of children were provided with discretionary foods (69%) but our study found that children were provided with slightly fewer serves (1.8 serves) (Kelly et al., 2010).

Our study found that children aged 4-5 years had lower healthy food provision index scores compared to younger children. This was primarily driven by children in the older age category receiving more discretionary foods and less dairy, as well as their increased dietary requirements. The increase in discretionary foods in older children is comparable with other studies (Australian Bureau of Statistics, 2014a; Spence et al., 2018) and could be attributed to older children being able to clearly vocalise and communicate their food desires compared to younger children (Coxon et al., 2020). Furthermore, despite vegetable provision remaining similar for each age group, vegetable recommendations almost double between the 2-3 and 4-8 year age groups (from 2 ½ serves/day to 4 ½ serves/day) (National Health and Medical Research Council, 2013). These findings are

supported by a longitudinal study of Victorian children's daily intake that found vegetable intake did not change considerably from 9 months to 5 years (Spence et al., 2018). Many parents may be unaware of the increase in requirements at this age or may find the recommendations overwhelming (Glasson et al., 2011).

Contrary to previous research that found children from low SES backgrounds consumed more discretionary foods and less vegetables than children from high SES backgrounds (Spence et al., 2018), our study found that children living in a lower SES area were more likely to have higher healthy food provision index scores. Tovar et al. (2020) also found that US children attending FDC where educators had had lower incomes had higher diet quality scores (Tovar et al., 2020). Conversely, Australian centre-based studies have reported no associations between SES (using postcode as a proxy) and food provided by parents (Kelly et al., 2010) or centres (Yoong et al., 2014). It is important to note that postcode was the proxy for SES in our study and other factors such as parental education and income were not assessed which may have a greater impact on food provision.

We found that mixed dishes were also associated with higher healthy food provision index scores compared with a sandwich, wrap or roll. Mixed dishes included dhal, spaghetti Bolognese and mixed food platters, and generally contained more vegetables and lean meat/meat alternatives. On the other hand, children provided with sandwiches generally had more wholegrains. While sandwiches/wraps/rolls generally contained less vegetables and lean meat and meat alternatives in this study, they can be a healthy, easy and convenient lunch option, particularly when served with healthy snack options.

Nutrition interventions in ECEC centre-based services appear to be more effective in improving the food when centres provide food compared to centres where families provide food. Australian ECEC nutrition interventions targeting the food provided by

centre-based services have found significant improvements in the provision of all food groups (Bell et al., 2015; Seward et al., 2018) and the consumption of fruit (Bell et al., 2015; Seward et al., 2018), vegetables (Bell et al., 2015; Seward et al., 2018), grains/cereals (Seward et al., 2018; Yoong et al., 2019), lean meat/meat alternatives (Bell et al., 2015; Seward et al., 2018), dairy (Bell et al., 2015), and overall diet quality scores (Yoong et al., 2019). However, healthy eating and physical activity interventions involving ECEC centre-based services where families provide food, demonstrated no significant improvements in the provision (Hardy et al., 2010) or consumption (Jones et al., 2015) of food groups and discretionary foods.

This could be because policy and practice changes at the ECEC level may be more likely to influence educators, cooks and directors compared to parents. Furthermore, FDC educators have expressed challenges in communicating with families about food (Daniels et al., 2003; Wallace and Mills, 2019). One study reported that almost half (46%) of educators did not feel confident telling parents that the quality of the food supplied was unsatisfactory (Daniels et al., 2003). Educators have also reported many barriers to communicating with parents including fear of losing business or damaging trust and relationships with families, low confidence, knowledge or skills to have challenging conversations and that parents are too busy to listen (Daniels et al., 2003). There are many factors that may contribute to educators providing more nutritious foods in comparison with families, including that ECEC qualifications involve nutrition training, educator opportunities for nutrition-related professional development, and that Education and Care Services National Regulations state that food provided by educators must be nutritious and adequate in quantity (New South Wales Government, 2018). Despite these positive influences, Wallace (2019) found that educators' nutrition knowledge and attitudes can be barriers to providing healthy eating environments (Wallace and Mills, 2019).

Parents/caregivers experience a range of barriers to providing children with healthy food. There are many strong interpersonal and environmental factors that affect what food children are provided, including time, children's food preferences and fussy eating, parental-guilt for sending them to ECEC services (which include FDC), wanting their children to feel loved, fear of children not eating enough or being hungry, not wanting to waste food, and misleading food marketing (Boyd, 2015; Goldsborough et al., 2016; Wallace and Mills, 2019). Intervention strategies should target the complex barriers parents and educators experience. Future interventions should focus on supporting families and educators to provide children with healthy and easy to prepare lunch and snack options by replacing discretionary foods with vegetables, meat/meat alternatives and wholegrains. FDC educators should also be provided with professional development, support from their service provider and resources on communicating with families about food provision and nutrition. It should be noted that FDC educators have a number of responsibilities and many educators experience difficulties with compliance to the national regulations and quality standards (Family Day Care Australia, 2019). Educators should be upskilled to embed healthy eating into their pedagogical practices and utilise the service provider's nutrition policy and national policies to promote healthy eating. For example, in Australia, the promotion of healthy eating can be used to demonstrate how regulatory requirements and outcomes of the National Quality Framework are being met (Australian Children's Education and Care Quality Authority, 2018; NSW Government, 2020).

Several limitations are present in this study. The small sample size (due to recruitment challenges and COVID-19 restrictions) means that caution must be applied as the findings might not be representative of the wider population. However, this remains the first Australian study to collect food data in FDC using weighed food records and

observations. Second, the study only assessed the food provided to children on one day. The present study also only measured food provision, not intake. Baseline findings from the Keys to a Healthy Family Child Care Homes randomised controlled trial found that food provided was significantly associated with the diet quality of food consumed (Benjamin-Neelon et al., 2018) however studies have also found that children generally consume less food than provided (Bell et al., 2015; Seward et al., 2018; Tovar et al., 2018). Furthermore, we only captured food data for part of a day and do not know what children were provided for the remainder of the day. Nonetheless, these findings are still concerning, and are consistent with Australian national dietary data for children's intake, which also highlight that vegetables, lean meat and meat alternatives and dairy are not being consumed in adequate amounts in children's overall diet (Australian Bureau of Statistics, 2016b). We did not capture any anthropometric measurements for children or educator/parent health indicators for non-communicable diseases that could have possibly contributed to the types of food provided. Postcode was used as an indicator of SES for educators and children/families, however information on parental education and income were not assessed which may have a greater impact on food provision. Finally, the healthy food provision index score we developed is not validated.

6.6 Conclusion

The findings of our study suggest there is opportunity to improve the nutritional quality and quantities of food provided to children attending FDC, particularly replacing discretionary foods with vegetables, meat and meat alternatives, and dairy and choosing wholegrain alternatives over refined grains. Due to the complex and multifaceted factors contributing to the high provision of discretionary foods and suboptimal provision of food groups, many strategies are required to improve the food provided to children in FDC targeting the service provider, educators and parents. Further research to investigate the

barriers and potential solutions to providing nutritious foods to young children attending FDC is warranted.

6.5 References

Australian Bureau of Statistics (2014a) 'Australian Health Survey: Nutrition First Results – Food and Nutrients , 2011-12', *4364.0.55.007*, pp. 1–78. Available at: https://www.abs.gov.au/statistics/health/health-conditions-and-risks/australian-health-survey-nutrition-first-results-foods-and-nutrients/latest-release.

Australian Bureau of Statistics (2014b) *Australian Health Survey: Users' Guide, 2011-13 — Discretionary Food List*, *Australian Health Survey: Users' Guide, 2011-13 — Discretionary Food List*. Available at: https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4363.0.55.0012011-13?OpenDocument.

Australian Bureau of Statistics (2016a) 'Australian Health Survey: Consumption of food groups from the Australian dietary guidelines', *Cat no. 4364.0.55.012*, (May), pp. 1–65. doi: 4364.0.55.012.

Australian Bureau of Statistics (2016b) *Australian Standard Classification of Languages (ASCL), 2016, Canberra, Australia*. Available at: https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1267.0Main+Features12016?OpenDocument.

Australian Bureau of Statistics (2018a) *National Health Survey: First Results, 2017-18, 4364.0.55.001*. Available at: https://www.abs.gov.au/statistics/health/health-conditions-and-risks/childrens-risk-factors/latest-release.

Australian Bureau of Statistics (2018b) *Socio-Economic Indexes for Areas Australia*. Commonwealth of Australia. Available at: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by Subject/2033.0.55.001~2016~Main Features~SOCIO-ECONOMIC INDEXES FOR AREAS (SEIFA) 2016~1 (Accessed: 16 April 2021).

Australian Children's Education and Care Quality Authority (2018) *Guide to the National Quality Framework*. Available at: https://www.acecqa.gov.au/sites/default/files/2020-09/Guide-to-the-NQF-September-2020.pdf.

Australian Government (2018) *Child Care in Australia*, *Department of Education and Training*. Available at: https://www.education.gov.au/child-care-australia (Accessed: 26 April 2019).

Bell, L. K. *et al.* (2015) 'Impact of a nutrition award scheme on the food and nutrient

intakes of 2- to 4-year-olds attending long day care', *Public Health Nutrition,* 18(14), pp. 2634–2642. doi: 10.1017/S1368980014003127.

Benjamin-Neelon, S. E. *et al.* (2018) 'The family child care home environment and children's diet quality', *Appetite,* 126, pp. 108–113. doi: 10.1016/j.appet.2018.03.024.

Boyd, W. (2015) 'The tensions between food choices and sustainable practices in early childhood centres', *Australasian Journal of Early Childhood*, 40(4), pp. 58–65. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84954454619&partnerID=40&md5=d0c2fc46320ba7c50ff945e489f59f04.

Bravo, A., Cass, Y. and Tranter, D. (2008) 'Good food in family day care: Improving nutrition and food safety in family day care', *Nutrition and Dietetics*, 65(1), pp. 47–55. doi: 10.1111/j.1747-0080.2007.00136.x.

Coxon, C. *et al.* (2020) 'Sources and determinants of discretionary food intake in a cohort of Australian children aged 12–14 months', *International Journal of Environmental Research and Public Health*, 17(1), pp. 1–17. doi: 10.3390/ijerph17010080.

Dalwood, P. *et al.* (2020) *Diet quality indices and their associations with health-related outcomes in children and adolescents: an updated systematic review, Nutrition Journal*. Nutrition Journal. doi: 10.1186/s12937-020-00632-x.

Daniels, L. A., Franco, B. and McWhinnie, J. A. (2003) 'An assessment of the potential of Family Day Care as a nutrition promotion setting in South Australia', *Nutrition & Dietetics,* 60(1), pp. 30–37.

Family Day Care Australia (2019) *Attracting the next generation of family day care educators*. Available at: https://uploads.prod01.sydney.platformos.com/instances/97/assets/public-pdf/Supporting-You/FDCA_EducatorResearchReportUpdate_online.pdf?updated=1585270019.

Food Standards Australia and New Zealand AUSNUT 2011-2013. (2016) *Australian Food, Supplement and Nutrient Database.* Available at: https://www.foodstandards.gov.au/science/monitoringnutrients/ausnut/pages/default.aspx.

Francis, L. *et al.* (2018) 'Examining the Obesogenic Attributes of the Family Child Care Home Environment: A Literature Review', *Journal of Obesity*, 2018, pp. 1–20. doi:

10.1155/2018/3490651.

Glasson, C., Chapman, K. and James, E. (2011) 'Fruit and vegetables should be targeted separately in health promotion programmes: Differences in consumption levels, barriers, knowledge and stages of readiness for change', *Public Health Nutrition*, 14(4), pp. 694–701. doi: 10.1017/S1368980010001643.

Goldsborough, N. *et al.* (2016) 'Healthy eating in the early years: A qualitative exploration of food provision in the childminder setting', *British Food Journal*, 118(4), pp. 992–1002. doi: 10.1108/BFJ-01-2015-0014.

Golley, R. and Bell, L. (2015) 'Interventions for Improving Young Children's Dietary Intake through Early Childhood Settings: A Systematic Review', *International Journal of Child Health and Nutrition*, 4(1), pp. 14–32. doi: 10.6000/1929-4247.2015.04.01.2.

Guenther, P. M. *et al.* (2014) 'The Healthy Eating Index-2010 Is a Valid and Reliable Measure of Diet Quality According to the 2010 Dietary Guidelines for Americans', *The Journal of Nutrition*, 144(3), pp. 399–407. doi: 10.3945/jn.113.183079.

Hardy, L. L. *et al.* (2010) 'Munch and Move: Evaluation of a preschool healthy eating and movement skill program', *International Journal of Behavioral Nutrition and Physical Activity*, 7(1), p. 80. doi: 10.1186/1479-5868-7-80.

Harris, P. A. *et al.* (2019) 'The REDCap consortium: Building an international community of software platform partners', *Journal of Biomedical Informatics*, 95(May), p. 103208. doi: 10.1016/j.jbi.2019.103208.

Jones, J. *et al.* (2015) 'Effectiveness of an intervention to facilitate the implementation of healthy eating and physical activity policies and practices in childcare services: A randomised controlled trial', *Implementation Science*, 10(1), pp. 1–15. doi: 10.1186/s13012-015-0340-z.

Jones, J. *et al.* (2017) 'Dietary intake and physical activity levels of children attending Australian childcare services', *Nutrition and Dietetics*, 74(5), pp. 446–453. doi: 10.1111/1747-0080.12375.

Kelly, B. *et al.* (2010) 'Opening up Australian preschoolers' lunchboxes', *Australian and New Zealand Journal of Public Health*, 2334(3), pp. 288–292. doi: 10.1111/j.1753-6405.2010.00528.x.

Kerr, E. *et al.* (2021) 'Nutrition, physical activity and screen time policies and practices in Family Day Care in Australia', *Public Health Research and Practice*, (October),

pp. 1–5. doi: 10.17061/31342114.

National Health and Medical Research Council (2013) *Australian Dietary Guidelines*. Canberra: National Health and Medical Research Council. Available at: www.nhmrc.gov.au/guidelines-publications/n55%0Ahttps://www.nhmrc.gov.au/_files_nhmrc/file/publications/n55_australian_dietary_guidelines1.pdf.

New South Wales Government (2018) *Education and Care Services National Regulations*. Available at: https://www.legislation.nsw.gov.au/#/view/regulation/2011/653/chap4/part4.2/div1 (Accessed: 6 February 2019).

NSW Government (2020) *How Munch & Move aligns with the National Quality Framework, Munch and Move*. Available at: https://healthykids.nsw.gov.au/downloads/file/campaignsprograms/NQFBrochure.pdf.

NSW Ministry of Health (2014) *Caring for children birth to 5years. North*. North Sydney. doi: 10.1377/hlthaff.2014.1291.

Sabinsky, M. S. *et al.* (2013) 'Validation of a digital photographic method for assessment of dietary quality of school lunch sandwiches brought from home', *Food & Nutrition Research*, 57, pp. 1–10.

Sambell, R., Devine, A. and Lo, J. (2014) 'Does the food group provision in early years' education and care settings in metropolitan Perth, Western Australia, meet national dietary requirements; and how can Home Economics support this?', *Journal of the Home Economics Institute of Australia*, 21(2), p. 20.

Seward, K. *et al.* (2018) 'Improving the implementation of nutrition guidelines in childcare centres improves child dietary intake: Findings of a randomised trial of an implementation intervention', *Public Health Nutrition*, 21(3), pp. 607–617. doi: 10.1017/S1368980017003366.

De Silva-Sanigorski, A. *et al.* (2011) 'Obesity prevention in the family day care setting: Impact of the Romp & Chomp intervention on opportunities for children's physical activity and healthy eating', *Child: Care, Health and Development*, 37(3), pp. 385–393. doi: 10.1111/j.1365-2214.2010.01205.x.

Spence, A. C. *et al.* (2018) 'Early Childhood Vegetable, Fruit, and Discretionary Food Intakes Do Not Meet Dietary Guidelines, but Do Show Socioeconomic Differences

and Tracking over Time', *Journal of the Academy of Nutrition and Dietetics*, 118(9), pp. 1634–1643. doi: 10.1016/j.jand.2017.12.009.

Stacey, F. G. *et al.* (2017) 'Evidence of the Potential Effectiveness of Centre-Based Childcare Policies and Practices on Child Diet and Physical Activity: Consolidating Evidence from Systematic Reviews of Intervention Trials and Observational Studies', *Current Nutrition Reports*, 6(3), pp. 228–246. doi: 10.1007/s13668-017-0212-z.

Tovar, A. *et al.* (2018) 'Nutritional Quality of Meals and Snacks Served and Consumed in Family Child Care', *Journal of the Academy of Nutrition and Dietetics*, 118(12), pp. 2280–2286. doi: 10.1016/j.jand.2018.08.154.

Tovar, A. *et al.* (2020) 'Exploring the Provider-Level Socio-Demographic Determinants of Diet Quality of Preschool-Aged Children Attending Family Childcare Homes', *Nutrients*, 12(5), p. 1368. doi: 10.3390/nu12051368.

Voortman, T. *et al.* (2015) 'The Development of a Diet Quality Score for Preschool Children and Its Validation and Determinants in the Generation R Study', *The Journal of Nutrition*, 145(2), pp. 306–314. doi: 10.3945/jn.114.199349.

Wallace, R. and Mills, B. (2019) 'A study of the food environment at Australian family day care', *Nutrients*, 11(10), p. 2395. doi: 10.3390/nu11102395.

'Xyris Software. FoodWorks 9 professional [software]. Qld: High Gate Hill; 2018.' (no date).

Yoong, S. L. *et al.* (2014) 'Do childcare services provide foods in line with the 2013 Australian Dietary guidelines? A cross-sectional study', *Australian and New Zealand Journal of Public Health*, 38(6), pp. 595–596. doi: 10.1111/1753-6405.12312.

Yoong, S. L. *et al.* (2019) 'The Impact of a Childcare Food Service Intervention on Child Dietary Intake in Care: An Exploratory Cluster Randomized Controlled Trial', *American Journal of Health Promotion*, 33(7), pp. 991–1001. doi: 10.1177/0890117119837461.

Yoong, S. L. *et al.* (2020) 'A systematic review of interventions to improve the dietary intake, physical activity and weight status of children attending family day care services', *Public Health Nutrition*, 23(12), pp. 2211–2220. doi: 10.1017/S1368980019005275.

Chapter 7: Assessment of feeding practices and mealtime environments in Australian family day care services: an observational study

The previous chapter assessed the food and beverages provided to children and found these to be sub-optimal. In this chapter, educators' feeding practices and mealtime environments are examined. As highlighted in the literature, few studies have observed educators' feeding practices and the mealtime environments in FDC.

This chapter addresses Research Question 4:

i. What are educators' feeding practices and the mealtime environment during FDC?

ii. What factors are associated with educators' feeding practices and the mealtime environment in FDC settings?

This chapter has been published as:

Kerr, E., Kelly, B., Norman, J., Furber, S., Hernandez, L., Hammersley, M.L., Ryan, S., Franco, L., Vuong, C., Okely, A.D., 2021. 'Assessment of feeding practices and mealtime environments in Australian family day care services: an observational study'. *Journal of Nutrition Education and Behavior* (accepted for publication, October 2021).

7.1 Introduction

Mealtimes in Early Childhood Education and Care (ECEC) services provide an opportunity for children to learn healthy eating behaviours and to develop social, language and fine motor skills (Harte et al., 2019). The feeding practices of educators in ECEC services and the mealtime environment can influence the amount and types of foods children eat (Shloim et al., 2015), and when they eat, and can result in improvements in child diet quality (Tovar et al., 2016; Ward et al., 2015). The mealtime environment includes the mealtime atmosphere, who is present and eating with the child, and distractions in the room, such as using electronic devices while eating. The Australian ECEC regulatory framework, the National Quality Framework, recommends relaxed and enjoyable mealtimes, sitting with children, modelling healthy eating, responsive and meaningful interactions with children and supporting children's self-regulation (Australian Children's Education and Care Quality Authority, 2020). Further, all ECEC training qualifications in Australia must include learning outcomes relating to the promotion of healthy eating to children (Australian Government, 2020).

Although studies in ECEC services have demonstrated that positive feeding practices improve child dietary intake and diet quality (Dev et al., 2014a; Ward et al., 2015), research in family day care (FDC) services (also referred to as family child care homes and home-based childcare) is underrepresented in the literature compared to center-based ECEC services (Yoong et al., 2020). In Australia, FDC services can care for up to 4 children under 5 years and 2 primary (equivalent to elementary) school-aged children in their own homes (Australian Children's Education and Care Quality Authority, 2018). Typically FDC educators work alone, caring for children of multiple ages and abilities and consequently face unique challenges during mealtimes, such as managing competing demands of child supervision and meal preparation (Tovar et al., 2018).

Baseline findings from the Keys to Healthy Family Child Care Homes study in the USA found that the mealtime environment and educators' feeding practices did not affect children's diet quality (Benjamin-Neelon et al., 2018). However, Tovar et al., (2018) found that autonomy-supportive practices were significantly associated with children's diet quality scores within US family child care homes.

Previous studies exploring educators' feeding practices or mealtime environments in Australian FDC have done so via educator self-report (Daniels et al., 2003; Wallace and Mills, 2019), however, educators are likely to over-report their use of positive feeding practices (Gans et al., 2019) and may also misperceive their use of negative feeding practices as positive (Dev et al., 2016). Australian FDC educators have reported many challenges during mealtimes, such as managing children's behavior, food refusal, not trying new foods and fussy eating (Daniels et al., 2003; Wallace et al., 2017). It is important to gain a deeper understanding of Australian FDC educators' feeding practices and mealtime environments and the factors associated with these aspects of care to inform evidence-based policies and professional development. In light of this, the current study aimed to (1) assess educators' feeding practices and the mealtime environments in FDC services through direct observation, (2) to examine factors associated with FDC educators' feeding practices and mealtime environments.

7.2 Methods

7.2.1 Study Design and Participants

Australian FDC services work under a two-level structure: a service provider operates at the higher organisational level and educators are registered through the service provider at the lower, operational layer. Educators (n= 885) from 28 service providers who

participated in a previous study (Kerr et al., 2021) in the Illawarra Shoalhaven and south west Sydney regions of New South Wales, Australia were invited to participate in a one-day observational study on the nutrition and physical activity environments in their FDC service. Educators were eligible if their service provider was located in the sampling areas and they cared for at least three children aged 0-5 years.

Informed written consent was obtained from educators and parents/caregivers. Educators received an AUD$100 educational resource voucher for participating in the study. The study was approved by the University of Wollongong Human Research Ethics Committee (2019/ETH10743).

7.2.2 Data collection

One-day site visits to FDC services were conducted in April 2019 to February 2020. Observations commenced from the start of the day when at least two children were present and ended when only one child was left. All mealtimes were observed during this period. This varied between two to four meals, and could include breakfast, morning tea, lunch, afternoon tea and/or dinner. The Environment Policy Assessment and Observation instrument (EPAO) was used to objectively assess the FDC's nutrition and physical activity environment (Vaughn et al., 2017; Ward et al., 2008). The instrument is a valid and reliable tool that was developed in the US for center-based ECEC services and has been modified to assess the environment in USA family child care homes (Vaughn et al., 2017). The EPAO captures 16 best practice items for mealtime environments and feeding practices during each mealtime (breakfast, morning tea, lunch, afternoon tea and dinner). Each item is coded 1 if it is observed or 0 if it is not observed for each mealtime. Additionally, an EPAO score on a scale of 0–3 is calculated using the EPAO–FCCH scoring rubric (Vaughn et al., 2017) based on the

proportion of mealtimes an item is observed within each service, where higher scores indicate closer compliance to best practice. The best practice items are also grouped into a mealtime environment or feeding practices environmental sub-scale score using the EPAO–FCCH scoring rubric (Vaughn et al., 2017). The environmental sub-scale score is calculated by averaging the scores of best practice items in the mealtime environments and feeding practices categories.

For each best practice item, educators were categorised as never using the practice during any observed mealtime, using the practice during some mealtimes (used during at least one mealtime but not every mealtime) or using the practice during every mealtime. The item about food service style was modified to capture how children were provided with the food in their lunchbox (i. educator selected food for children without asking; ii. educator offered children a few food options from their lunchbox; or iii. child chose what food to eat from their lunchbox). Due to the variation in food provision, the best practice ‘educator ate healthy food’ was combined with the best practice ‘educator ate the same food with children’. Six additional feeding practices relevant to this study were added to the instrument based on previous research in the USA that modified the EPAO to better capture feeding practices of family childcare home providers (Tovar et al., 2018), to give a total of 22 EPAO best practice items used in the current study. The additional feeding practices were scored in the same way as similar practices in the original EPAO instrument. A content map of food parenting practices guided the categorisation of feeding practices into three constructs: coercive control, structure, or autonomy support (Table 7.1) (Vaughn et al., 2016). Data collectors recorded notes about the mealtime environment and educators' interactions with children.

The lead author trained an additional two data collectors and all three data collectors completed the online EPAO training. The lead author conducted two trial observations in a different sample area to determine that the USA tool was suitable for use in the Australian FDC setting. Each data collector completed the first observation with the lead author to ensure that they were completing the assessments correctly. To assess reliability of the assessments, intraclass correlations (ICC) were calculated for the 22 best practice items. The ICCs (95% confidence interval) were 0.91 (0.78-0.96) and 0.95 (0.87-0.98), therefore a single data collector undertook the remaining observations at FDC services. The educator was notified the day before the visit.

Educators completed a short online survey when they provided consent that captured information on their postcode of residence (equivalent to zip code), language spoken at home, ECEC experience, and nutrition-related professional development undertaken in the past two years. Postcode of residence was used as a proxy for socioeconomic status (SES), based on the Australian Bureau of Statistics' Index of Relative Socioeconomic Disadvantage, and categorised into low and middle/high SES (Australian Bureau of Statistics, 2018). Main language spoken at home was used to categorise educators into English-speaking or non-English-speaking backgrounds (Australian Bureau of Statistics, 2016).

7.2.3 Data analysis

Statistical analyses were conducted using SPSS (Version 26.0, IMB Corp, Armonk, NY, 2019). Descriptive statistics were calculated for the median and interquartile range of the EPAO score and the frequency of educators' feeding practices observed (never, some mealtimes or all mealtimes). Independent *t*-tests were performed to determine if educators' SES, main language spoken at home, ECEC experience or professional

development in the last 2 years was associated with educators' feeding practices and mealtime environment. Significance levels were set at $p<0.05$.

At the completion of data collection, the additional notes recorded by data collectors were added to NVivo 12 and qualitatively analysed to identify any themes that were not captured in the EPAO tool (QSR International Pty Ltd., 2020). New themes were coded using the content map of food parenting practices (Vaughn et al., 2016). The lead author also checked the notes throughout the data collection period to cross-check the reported practices on the EPAO with the notes.

7.3 Results

Due to COVID-19 restrictions, data collection was suspended prematurely in March 2020. Thirty-three female educators and 104 children (mean age 3.2 years) participated in the study. Nineteen educators spoke a language other than English as their main language and 15 lived in a low SES area. Sixteen educators had more than 10 years' experience working in ECEC and 10 educators reported partaking in nutrition-related professional development in the past two years. One-hundred mealtimes were observed. On average, three mealtimes were observed and children spent 72 minutes per day consuming meals and snacks at FDC. Nine FDC services had food provided only by educators, 14 services had food provided by parents/caregivers and 10 had food provided by the educator and the parents/caregivers.

Educators used a combination of positive and negative practices, often during the same meal occasion. Table 7.1 shows the median EPAO score, and the number of educators observed using positive and negative practices during no mealtimes, some mealtimes or at every mealtime. Educators were observed to do better at avoiding negative practices

than at displaying positive practices. While 23 educators were observed displaying the positive practice of sitting with children during every mealtime, less than one-third of educators were observed using any positive practices during every mealtime. Over two-thirds of educators never used negative practices, with the exception of 18 educators who spoon-fed a child to get them to eat.

Table 7. 1 Family day care educators' positive and negative feeding practices and mealtime environment (N=33)

Positive best practice items	Number of educators			
	Never used	Some mealtimes (at least one but not every mealtime)	Every mealtime	Median (IQR) EPAO score[a]
Autonomy support				
Educator positively encouraged children to try the foods on their plates[c]	12	14	7	1 (0-3)
Educator used an authoritative feeding style[c]	13	11	9	1 (0-3)
Educator positively talked about the foods children were eating[d]	14	18	1	1 (0-1)
Educators allowed children to serve themselves/choose what food they want[d]	19	12	2	0 (0-1)
Verbal praise for trying a new, less preferred or healthy food[d]	26	7	0	0 (0-0)
Educator talked about feelings of hunger and fullness[b]	29	4	0	0 (0-0)
Structure				
Educator sat with children during meal[d]	3	7	23	3 (2-3)
Educator led or encouraged non-food conversation during meals[b]	11	15	7	1 (0-2)
Educator ate healthy food OR ate same food with children during meal[d]	18	15	0	0 (0-1)
Educator role modelled eating healthy foods[d]	20	13	0	0 (0-1)
Children involved in meal preparation, planning or clean-up[b]	22	11	0	0 (0-1)

Negative best practice items	Number of educators			
	Never used	Some mealtimes (at least one but not every mealtime)	Every mealtime	Median (IQR) EPAO score[a]
Coercive control				
Educator spoon-fed a child (that can feed themselves) to get them to eat [b]	15	16	2	1 (1-3)
Educator pressured a child to eat more than they seemed to want[c]	22	10	1	3 (1-3)
Food bribe/reward for eating less preferred food[c]	25	8	0	3 (3-3)
Non-food reward/bribe for eating a specific food[c]	27	5	1	3 (3-3)
Second helpings were served to a child even when the child did not ask for more[c]	29	4	0	3 (3-3)
Food bribe/reward for a particular behaviour [c]	31	2	0	3 (3-3)
Educator required child to sit at the table until they finished the meal[c]	29	4	0	3 (3-3)
Educator used food to control a child's emotions[b]	32	1	0	3 (3-3)
Structure				
Educator talked on the phone, texted or worked on the computer during meals[b]	24	9	0	3 (2-3)
Screen device could be seen or heard from the eating area[d]	24	9	0	3 (3-3)
When a child ate less than half of a meal or snack, the educator removed the plate without asking the child if they were full[c]	29	3	1	3 (3-3)

IQR- interquartile range; EPAO- Environment Policy Assessment and Observation
[a]EPAO scores (0-3): higher scores indicates closer to compliance to best practice
[b]New practice based on the article by Tovar et al[10]
[c] Best practice items averaged to create the feeding practices environmental subscale
[d] Best practice items averaged to create the feeding environment environmental subscale

Table 7.2 shows the factors associated with educators' feeding practices and mealtime environment. There were no significant associations between educators' SES, main language spoken at home, ECEC experience or professional development in the last two years and educators' feeding practices or mealtime environment.

The following additional practices were observed by educators and captured in the mealtime notes: educator ignored or showed indifference to children during the meal (n=4 educators), enforced table manners (n=4), rushed a child/children to eat (n=3), praised a child for finishing his/her plate (n=3) and the presence of distractions (other than TV or screen device) (n=3). Thirteen educators provided children with food or beverages outside of a structured mealtime, including seven educators who gave children a bottle of milk to drink while laying down during nap time.

Table 7. 2 Factors associated with educators' feeding practices and mealtime environment (N= 33)

Environment and Policy Assessment and Observation subscale scores[a]	Main language spoken at home		*P*	Socio-economic status		*P*	Nutrition professional development (past 2 years)		*P*	Early Childhood Education and Care experience		*P*
	English (n=14)	NESB (n=19)		Low (n=15)	Middle/ high (n=18)		Yes (n=10)	No (n=23)		<10 years (n=17)	≥10 years (n=16)	
Feeding practice scores Mean (SD)	1.9 (0.4)	1.8 (0.4)	.30	1.9 (0.4)	1.9 (0.4)	.96	1.9 (0.3)	1.9 (0.4)	.77	1.8 (0.4)	1.9 (0.4)	.64
Mealtime environment scores Mean (SD)	1.7 (0.3)	1.5 (0.3)	.13	1.6 (0.3)	1.6 (0.3)	.80	1.5 (0.3)	1.6 (0.3)	.46	1.6 (0.3)	1.6 (0.3)	.55

SD indicates standard deviation, NESB indicates non-English speaking background.

[a]Subscale scores range from 0 and 3, with higher scores indicating closer to best practice.

Note: Independent *t*-test was used in all analyses

7.4 Discussion

This study assessed educators' feeding practices and mealtime environments in Australian family day care services and examined the factors associated with educators' feeding practices and mealtime environments. Most educators avoided the use of negative feeding practices, apart from spoon-feeding a child to get them to eat. Despite this, fewer educators were observed to use positive feeding practices during every mealtime, such as role modelling healthy eating and talking positively about food. This research highlights the need to target mealtimes as an opportunity for developing healthy eating behaviors and life skills through positive feeding practices and supportive mealtimes.

The study found that most educators did not use autonomy-supportive practices during every mealtime. This is concerning as educators' use of autonomy-supportive practices has been associated with higher diet quality scores (Tovar et al., 2018) and increased willingness to try healthy foods in children attending family child care homes in the USA (Tovar et al., 2016). The most common autonomy-supportive feeding practices observed in the present study were educators using an authoritative feeding style and educators encouraging a child to try the foods on their plates. Authoritative feeding style, where the caregiver encourages the children to eat healthy foods, but the child determines which foods they eat, has been associated with improved vegetable and dairy intake (Patrick et al., 2005) and a healthy body mass index (Shloim et al., 2015). The least common autonomy-supportive feeding practices observed were educators allowing children to serve themselves, verbal praise for trying new or less preferred food and talking about feelings of hunger and fullness. Family-style meals, where children can self-select the foods they eat and the quantity; encourages children to self-regulate their appetite (Benjamin Neelon and Briley, 2011), develop social skills

(Benjamin Neelon and Briley, 2011) and can increase vegetable intake(Cooke et al., 2004). Consistent with previous studies, this study found that most educators did not provide children with an opportunity to serve themselves or choose what they wanted from their lunchbox during every mealtime (Gans et al., 2019; Martyniuk et al., 2015; Tovar et al., 2018). The least common autonomy support practice was educators talking about feelings of hunger and fullness; which can support children to self-regulate their food intake (Ramsay et al., 2010). Tovar et al., (2018) also found that less than one-third of educators (n=133) talked about feelings of hunger or fullness with children. This could be due to educators' lack of awareness about children's ability to respond to their hunger and satiety cues and self-regulate their appetite (Dev et al., 2017, 2014b). Increased awareness and skills to communicate with children about their hunger and satiety could be a simple yet effective practice for educators to implement in mealtime conversations. The low autonomy-supportive practices observed in this study are contrary to self-reported practices from 140 Australian FDC educators in South Australia, over three-quarters of educators reported that they often or always encourage children to try new foods, and let children decide when they have had enough food to eat (Daniels et al., 2003).

Educators were more likely to structure mealtimes positively by sitting with children, encouraging conversation and role modelling eating healthy foods opposed to negative practices, such as allowing children to watch screen devices during mealtimes or using a screen device themselves. Sitting with children during a mealtime was the most common positive feeding practice observed however, less than half of the educators ate the same or healthy foods with children, or role modelled healthy eating. The National Quality Framework recommends modelling healthy eating during mealtimes (Australian Children's Education and Care Quality Authority, 2018). Educators sitting with children

during meals and snacks and eating the same foods with children have been associated with increased vegetable intake in ECEC centre-based services (Kharofa et al., 2016). Sitting with children and encouraging conversation is also important to develop social and language skills (Kultti, 2014). Previous studies have highlighted challenges that FDC educators have reported in regard to role-modelling positive food behaviors, such as lack of time and competing priorities such as feeding children and managing behavior (Vandeweghe et al., 2016; Wallace and Mills, 2019).

Despite there being only limited use of positive practices, in most cases, educators in this study were not observed consistently using excessive coercive practices. Coercive practices can inhibit children's ability to self-regulate their appetite and can also reduce children's preferences for nutritious foods such as vegetables (Stoeckel et al., 2017). Similar to this study, Tovar et al found that over half (64.1%) of the FDC educators spoon-fed a child to get them to eat whereas just over one-third (38%) pressured a child to eat more than they seemed to want to eat. (Tovar et al., 2018) Educators may use coercive feeding practices for a variety of reasons, including perceived benefits of the effectiveness of the practices in getting children to eat, pressure from parents, not trusting children's ability to self-regulate and children's responses to eating, for example, children refusing to eat foods, or asking for seconds (Dev et al., 2016; Tovar et al., 2016). Many educators inadvertently use negative practices and are also unaware of the consequences relating to appetite dysregulation and developing an unhealthy relationship with foods (Dev et al., 2016). Interviews with FDC educators in the USA have identified several facilitators that support educators' avoidance of coercive feeding practices. These include using positive feeding practices as alternative feeding practices; nutrition professional development; and, policies that do not allow the use of coercive practices, such as not using food as a reward (Dev et al., 2016).

The present study found that educators' feeding practices and mealtime environment scores were not associated with main language spoken at home, SES, nutrition professional development or ECEC experience. Previous studies have reported associations with educators' feeding practices and mealtime environment, however, the Keys to Healthy Family Child Care Homes randomised control trial found no significant improvements in feeding practices and feeding environment scores after the intervention (Ward et al., 2020). Research in family child care homes in the USA have found no differences between Hispanic and non-Hispanic educators modelling healthy eating (Gans et al., 2019). However, Hispanic educators were more likely to use coercive controlling feeding practices such as rewarding children for eating certain foods, pressuring children and encouraging children to eat all the foods on their plate (Gans et al., 2019; Tovar et al., 2015). A study in the USA found that family child care home educators' participation in the Child and Adult Care Food Program (CACFP), a proxy for lower SES, were more likely to use positive feeding practices, including teaching children about the healthy foods they were eating (Erinosho et al., 2018). However, this could be due to the training and resources provided by CACFP.

This study has a number of limitations. First, the small sample size means the population may not have been representative of FDC educators in the area. The observation study was also conducted on one day which may not have captured usual behaviour. It is also possible that some educators altered their behaviors due to the presence of observers. Despite these limitations, this research contributes to the scant studies conducted in FDC services.

7.5 Implications for research and practice

This research provides insights into the mealtime environment and educator feeding practices in Australian FDC services and highlights the need for specific training on positive feeding practices. These findings provide support for future interventions to target mealtimes as a pedagogical opportunity for developing healthy eating behaviours and learning life skills through positive feeding practices and supportive mealtimes. This could be done by providing Australian educators with the skills to integrate mealtimes into program planning and learning outcomes to meet the National Quality Framework, for example, using responsive interactions and supporting children's self-regulation. Further research with Australian FDC educators is warranted to determine whether the standards in the National Quality Framework are feasible at each mealtime and also to understand the enablers and barriers to using autonomy-supportive practices and avoiding coercive practices.

7.6 References

Australian Bureau of Statistics (2016) *Australian Standard Classification of Languages (ASCL), 2016, Canberra, Australia*. Available at: https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1267.0Main+Features12016?OpenDocument.

Australian Bureau of Statistics (2018) *Socio-Economic Indexes for Areas Australia*. Commonwealth of Australia. Available at: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by Subject/2033.0.55.001~2016~Main Features~SOCIO-ECONOMIC INDEXES FOR AREAS (SEIFA) 2016~1 (Accessed: 16 April 2021).

Australian Children's Education and Care Quality Authority (2018) *Guide to the National Quality Framework*. Available at: https://www.acecqa.gov.au/sites/default/files/2020-09/Guide-to-the-NQF-September-2020.pdf.

Australian Children's Education and Care Quality Authority (2020) 'Guide to the National Quality Framework', (January), pp. 1–634. Available at: https://www.acecqa.gov.au/sites/default/files/2020-09/Guide-to-the-NQF-September-2020.pdf.

Australian Government (2020) *Unit of competency details*. Available at: https://training.gov.au/Training/Details/CHCECE004.

Benjamin-Neelon, S. E. *et al.* (2018) 'The family child care home environment and children's diet quality', *Appetite,* 126, pp. 108–113. doi: 10.1016/j.appet.2018.03.024.

Benjamin Neelon, S. E. and Briley, M. E. (2011) 'Position of the American Dietetic Association: Benchmarks for Nutrition in Child Care', *Journal of the American Dietetic Association,* 111(4), pp. 607–615. doi: 10.1016/j.jada.2011.02.016.

Cooke, L. J. *et al.* (2004) 'Demographic, familial and trait predictors of fruit and vegetable consumption by pre-school children', *Public Health Nutrition,* 7(2), pp. 295–302. doi: 10.1079/phn2003527.

Daniels, L. A., Franco, B. and McWhinnie, J. A. (2003) 'An assessment of the potential of Family Day Care as a nutrition promotion setting in South Australia', *Nutrition & Dietetics,* 60(1), pp. 30–37.

Dev, D. A., Speirs, K. E., *et al.* (2014) 'Head Start and child care providers' motivators,

barriers and facilitators to practicing family-style meal service', *Early Childhood Research Quarterly*, 29(4), pp. 649–659. doi: 10.1016/j.ecresq.2014.07.004.

Dev, D. A., McBride, B. A., *et al.* (2014) 'Predictors of head start and child-care providers' healthful and controlling feeding practices with children aged 2 to 5 years', *Journal of the Academy of Nutrition and Dietetics*, 114(9), pp. 1396–1403. doi: 10.1016/j.jand.2014.01.006.

Dev, D. A. *et al.* (2016) '"Great Job Cleaning Your Plate Today!" Determinants of Child-Care Providers' Use of Controlling Feeding Practices: An Exploratory Examination', *Journal of the Academy of Nutrition and Dietetics*, 116(11), pp. 1803–1809. doi: 10.1016/j.jand.2016.07.016.

Dev, D. A. *et al.* (2017) 'Providers perspectives on self-regulation impact their use of responsive feeding practices in child care', *Appetite*, 118, pp. 66–74. doi: 10.1016/j.appet.2017.07.022.

Erinosho, T. *et al.* (2018) 'Participation in the Child and Adult Care Food Program Is Associated with Healthier Nutrition Environments at Family Child Care Homes in Mississippi', *Journal of Nutrition Education and Behavior*, 50(5), pp. 441–450. doi: 10.1016/j.jneb.2017.11.004.

Gans, K. M. *et al.* (2019) 'Nutrition-related practices of family child care providers and differences by ethnicity', *Childhood Obesity*, 15(3), pp. 167–184. doi: 10.1089/chi.2018.0083.

Harte, S., Theobald, M. and Trost, S. G. (2019) 'Culture and community: Observation of mealtime enactment in early childhood education and care settings', *International Journal of Behavioral Nutrition and Physical Activity*, 16(1), pp. 1–11. doi: 10.1186/s12966-019-0838-x.

Kerr, E. *et al.* (2021) 'Nutrition, physical activity and screen time policies and practices in Family Day Care in Australia', *Public Health Research and Practice*, (October), pp. 1–5. doi: 10.17061/31342114.

Kharofa, R. Y. *et al.* (2016) 'Are Mealtime Best Practice Guidelines for Child Care Centers Associated with Energy, Vegetable, and Fruit Intake?', *Childhood Obesity*, 12(1), pp. 52–58. doi: 10.1089/chi.2015.0109.

Kultti, A. (2014) 'Mealtimes in Swedish preschools: pedagogical opportunities for toddlers learning a new language', *Early Years*, 34(1), pp. 18–31. doi: 10.1080/09575146.2013.831399.

Martyniuk, O. J. M. *et al.* (2016) 'Comparing the nutrition environment and practices of home- and centre-based child-care facilities', *Public Health Nutrition*, 19(4), pp. 575–584. doi: 10.1017/S1368980015003535.

Patrick, H. *et al.* (2005) 'The benefits of authoritative feeding style: Caregiver feeding styles and children's food consumption patterns', *Appetite*, 44(2), pp. 243–249. doi: 10.1016/j.appet.2002.07.001.

QSR International Pty Ltd. (2020) 'NVivo'. Available at: https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home/.

Ramsay, S. A. *et al.* (2010) '"Are you done?" Child care providers' verbal communication at mealtimes that reinforce or hinder children's internal cues of hunger and satiation', *Journal of Nutrition Education and Behavior*, 42(4), pp. 265–270. doi: 10.1016/j.jneb.2009.07.002.

Shloim, N. *et al.* (2015) 'Parenting styles, feeding styles, feeding practices, and weight status in 4-12 year-old children: A systematic review of the literature', *Frontiers in Psychology*, 6(DEC). doi: 10.3389/fpsyg.2015.01849.

Stoeckel, L. E. *et al.* (2017) 'Psychological and neural contributions to appetite self-regulation', *Obesity*, 25(MARCH), pp. S17–S25. doi: 10.1002/oby.21789.

Tovar, A. *et al.* (2015) 'An Assessment of Nutrition Practices and Attitudes in Family Child-Care Homes: Implications for Policy Implementation', *Preventing Chronic Disease*, 12, p. E88. doi: 10.5888/pcd12.140587.

Tovar, A. *et al.* (2016) 'Providers' response to child eating behaviors: A direct observation study', *Appetite*, 105, pp. 534–541. doi: 10.1016/j.appet.2016.06.020.

Tovar, A. *et al.* (2018) 'Modifying the Environment and Policy Assessment and Observation (EPAO) to better capture feeding practices of family childcare home providers', *Public Health Nutrition*, 22(2), pp. 223–234. doi: 10.1017/s1368980018002665.

Vandeweghe, L. *et al.* (2016) 'Perceived effective and feasible strategies to promote healthy eating in young children: Focus groups with parents, family child care providers and daycare assistants', *BMC Public Health*, 16(1), p. 1045. doi: 10.1186/s12889-016-3710-9.

Vaughn, A. E. *et al.* (2016) 'Fundamental constructs in food parenting practices: A content map to guide future research', *Nutrition Reviews*, 74(2), pp. 98–117. doi: 10.1093/nutrit/nuv061.

Vaughn, A. E. *et al.* (2017) 'Assessment of nutrition and physical activity environments in family child care homes: Modification and psychometric testing of the Environment and Policy Assessment and Observation', *BMC Public Health*, 17(1), p. 680. doi: 10.1186/s12889-017-4686-9.

Wallace, R., Devine, A. and Costello, L. (2017) 'Determining educators' needs to support healthy eating environments in early childhood settings', *Australasian Journal of Early Childhood*, 42(2), pp. 20–28. doi: 10.23965/AJEC.42.2.03.

Wallace, R. and Mills, B. (2019) 'A study of the food environment at Australian family day care', *Nutrients*, 11(10), p. 2395. doi: 10.3390/nu11102395.

Ward, D. *et al.* (2008) 'An Instrument to Assess the Obesogenic Environment of Child Care Centers', *American Journal of Health Behavior*, 32(4), pp. 380–386. Available at: https://www.lib.uwo.ca/cgi-bin/ezpauthn.cgi?url=http://search.proquest.com/docview/211893057?accountid=15115%5Cnhttp://vr2pk9sx9w.search.serialssolutions.com/?ctx_ver=Z39.88-2004&ctx_enc=info:ofi/enc:UTF-8&rfr_id=info:sid/ProQ%3Apsychologyshell&rft_val_fm.

Ward, D. S. *et al.* (2020) 'Keys to healthy family child care homes: Results from a cluster randomized trial', *Preventive Medicine*, 132(October 2019), p. 105974. doi: 10.1016/j.ypmed.2019.105974.

Ward, S. *et al.* (2015) 'Systematic review of the relationship between childcare educators' practices and preschoolers' physical activity and eating behaviours', *Obesity Reviews*, 16(12), pp. 1055–1070. doi: 10.1111/obr.12315.

Yoong, S. L. *et al.* (2020) 'A systematic review of interventions to improve the dietary intake, physical activity and weight status of children attending family day care services', *Public Health Nutrition*, 23(12), pp. 2211–2220. doi: 10.1017/S1368980019005275.

Chapter 8: Environmental influences on physical activity and sedentary behaviour of children in family day care

The previous two chapters examined the foods and beverages provided to children in FDC and the mealtime environments and educator feeding practices. This chapter assessed the physical activity and sedentary behaviour environment. Further, the chapter examined the relationship between the environment and children's physical activity and sedentary behaviour.

This chapter addresses Research Question 5:

i. How much time do children spend in physical activity and sedentary behaviour during FDC?

ii. Are the policies, practices and environments at a service provider and educator level associated with children's physical activity and sedentary behaviour?

This chapter has been submitted to a peer-reviewed journal and is currently under review:

Kerr, E., Hammersley, M.L., Norman, J., Furber, S., Hernandez, L., Ryan, S., Franco, L., Vuong, C., Okely, A.D. 'Environmental influences on physical activity and sedentary behaviour of children in family day care'. *Child: Care, Health and Development* (under review).

8.1 Introduction

Physical activity is important for optimal gross motor, musculoskeletal, cardio-metabolic, and cognitive development (Carson et al., 2017; Timmons et al., 2012). Conversely, excess sedentary screen time is associated with cardiovascular disease, obesity, motor development problems, sleep issues, concentration and socialisation problems (Li et al., 2020). The Australian 24-Hour Movement Guidelines for the Early Years (birth to 5 years) recommend children aged 2-5 years should spend 180 minutes of their day in a variety of physical activities and 60 minutes in energetic play (ie, moderate- to vigorous-intensity physical activity) (Australian Government: Department of Health, 2017). Further, children aged 2-5 years should spend less than one hour of their day in sedentary screen time, and children aged 0-2 years should have no sedentary screen time (Australian Government: Department of Health, 2017). Less than two-thirds (61%) and one-quarter (25%) of Australian children aged 2-5 years are meeting physical activity and screen time guidelines, respectively (Australian Institute of Health and Welfare., 2018).

Early Childhood Education and Care (ECEC) services are recognised as a key setting to promote children's physical activity (WHO, 2017). In Australia, family day care (FDC) is a type of ECEC service where educators provide education and care for up to four children below school age (0-5 years) and an additional three school-aged children (5-12 years) in a home environment (Australian Children's Education and Care Quality Authority, 2020). Over 125,000 Australian children aged between zero and 12 years attended FDC in 2019 (Australian Government, 2018). Australian FDC educators must be registered through an approved service provider to receive government subsidies (Australian Children's Education and Care Quality Authority, 2020). The service provider monitors and supports educators compliance to the Australian ECEC National Quality Framework (NQF) and the service providers' policies (Australian Children's

Education and Care Quality Authority, 2020). The NQF includes the National Law and National Regulations, National Quality Standards and an approved Learning Framework (Australian Children's Education and Care Quality Authority, 2020). Physical activity is promoted in the NQF; however, policies containing guidelines on physical activity, sedentary behaviour and screen time are not mandatory in Australian ECEC services (Australian Children's Education and Care Quality Authority, 2020). Furthermore, no specific ECEC guidelines outline recommended levels of physical activity, sedentary behaviour, or screen time.

The Institute of Medicine (IOM) recommends children are provided with at least 15 minutes of physical activity per hour spent in ECEC services (Birch et al., 2011). Studies involving direct observation in family child care homes in the USA and home-based childcare in Canada (equivalent to FDC) have found many children are not meeting these guidelines (Chai et al., 2020; Mazzucca et al., 2018; Vanderloo et al., 2015a). Improvements in children's physical activity (Gunter et al., 2012; Neshteruk et al., 2018) and sedentary behaviour (Chai et al., 2020) in family child care homes has been positively associated with the provision of daily outdoor active play (Chai et al., 2020; Gunter et al., 2012); fixed and portable play equipment (Chai et al., 2020; Gunter et al., 2012); availability of indoor play space (Chai et al., 2020; Gunter et al., 2012; Neshteruk et al., 2018); educators' engagement in active free play time (Chai et al., 2020; Gunter et al., 2012); and physical activity professional development (Gunter et al., 2012).

Australian studies exploring the physical activity environments in FDC have identified there are insufficient opportunities for active play (De Silva-Sanigorski et al., 2011; Temple and O'Connor, 2003), screen time is not solely provided for educational purposes or to facilitate physical activity, and children under 2 years are provided with screen time

(Lum et al., 2020). However, no Australian studies have objectively measured children's physical activity behaviours in FDC. It is unknown whether studies in the USA and Canada are comparable to the Australian FDC context. Therefore, this study aimed to objectively measure the physical activity and sedentary levels of children attending FDC and assess what aspects of the FDC environment were associated with children's physical activity in FDC.

8.2 Methods

Cross-sectional physical activity data were collected from FDCs in New South Wales (NSW), Australia, from April 2019 to February 2020. The study was approved by the University of Wollongong Human Research Ethics Committee (2019/ETH10743).

8.2.1 Study participants and recruitment

FDC educators were recruited from a sample of 28 service providers who participated in the study outline in Chapter 5 (Kerr et al., 2021). Once the service provider agreed to participate, they were asked to provide a list of all their eligible FDC educators' contact details to be invited to the study, as this information was not publicly available. If the service providers did not want to provide their educators' contact details, they emailed their educators an invitation to participate. FDC educators were invited to participate in a one-day observational study to assess their FDC's nutrition and physical activity environments. Educators were eligible if they cared for at least three children aged 0-5 years, and their service provider was located in the Illawarra Shoalhaven or south western Sydney regions of NSW. Educators and parents or caregivers provided informed written consent. Participating educators received an AUD$100 educational resource voucher.

A power calculation was conducted based on children's physical activity levels, which was a primary outcome of the study. A target sample size of 220 children was calculated based on a sample of 28 service providers with 700 eligible educators and approximately 2200 children that participated in a previous study (Kerr et al., 2021). The power calculation used baseline data of children's physical activity levels in family child care homes (Mazzucca et al., 2018) , with an intraclass correlation of 0.33, a mean of 8.1 (3.1) minutes per hour in physical activity, design effect 1.99, and cluster size of three children per service.

8.2.2 Data collection

One-day observations were conducted in FDCs to assess children's physical activity levels, the physical activity environment and collect child and educator demographic data.

Physical Activity

Children's sedentary, light- and moderate- to vigorous-intensity physical activity was measured using Actigraph GT3X+ accelerometers, worn on an elastic belt over the right hip during the day. Data collectors fitted children with an accelerometer on arrival to the FDC and removed it when the child left for the day. Accelerometers were initialised to record data in 15-second epochs. Data collectors recorded times the belt was fitted, and individual nap times and non-wear periods (consecutive 0 counts for ≥60 minutes) were excluded from the data. Children's accelerometry data were considered valid if they had a minimum wear time of 3 hours (excluding nap time) (Okely et al., 2020). Child cut-points were ≤ 25 counts/15 seconds for sedentary behaviour (Janssen et al., 2013) , ≥200 counts/15 seconds for total physical activity (light-, moderate-, and vigorous-intensity physical activity) (Pate et al., 2015) and ≥420 counts/15 seconds for moderate- to

vigorous-intensity physical activity (MVPA) (Janssen et al., 2013). Time spent in sedentary, MVPA, and total physical activity in minutes/hour was calculated by dividing each category by the child's daily wear time.

Physical Activity Environment

The physical activity practices, environment, and policies in FDCs were assessed using the Environment Policy Assessment and Observation instrument for family child care homes (EPAO-FCCH) (Vaughn et al., 2017). The EPAO-FCCH is a reliable and valid tool designed to objectively assess the nutrition and physical activity environment in family child care homes in the USA (Vaughn et al., 2017; Ward et al., 2008). Data were collected from the start of the day when at least two children were present and ended when only one child was left. The lead author completed the online EPAO training and conducted two trial observations in a different geographic sample area. The lead author then trained two additional data collectors using the online EPAO training and additional contextual information relevant to the Australian FDC sector. Interrater reliability was calculated between data collectors for the first assessment (over 90% agreement); consequently, a single data collector undertook the remaining observations at a service. The educator was notified the day before the visit.

The EPAO captured 27 best practice physical activity items that were scored on a scale from 0 to 3 using the EPAO-FCCH scoring rubric. The best practice items were assigned to 10 environmental categories and averaged to produce a subscore ranging from 0 to 3 (Table 8.1). An overall physical activity score out of 30 was calculated by summing the subscores. Higher subscores and overall physical activity scores indicate closer proximity to meeting best practice and a better physical activity promoting environment. The

General Sedentary Time section in the EPAO was adapted to include all types of screen devices (i.e. computers, tablets, video games) in addition to television. In Australian FDC, policies are held at the service provider level, and educators do not have individual policies. Therefore, policies were collected at the service provider level and reviewed by the lead author using the EPAO document review criteria.

Table 8. 1 Description of Environment and Policy Assessment and Observation Physical Activity Subscore Categories

EPAO subscore category	Description of EPAO subscore categories
Physical activity time provided	Total amount of indoor and outdoor physical activity time per day; teacher-led physical activity time; and length of seated time at one time
Indoor play environment	Availability and types of portable play equipment; and posters and books to promote physical activity
Physical activity practices	Not withholding physical activity (>5 minutes) as punishment; Teacher role during play time; and physical activity in routines or transitions
Physical activity education and professional development	Planned gross motor lessons; informal physical activity education; professional development for physical activity; and family education about physical activity
Physical activity policy	Comprehensive, written policy including content around physical activity amount, equipment, and teacher practices
Outdoor playtime	Outdoor play sessions; and outdoor time
Outdoor play environment	Shaded play spaces; open area; garden; offering portable play equipment; and portable play equipment accessibility
Screen time	Location of televisions; total TV time; educational and commercial-free programming; and alternate activity during screen time
Screen time practices	Not using screen time as a reward; and teachers engaging with children during screen time
Screen time policy	Comprehensive, written policy including content around screen time type, use, and teacher practices

Abbreviations: EPAO, Environment and Policy Assessment and Observation (Vaughn et al., 2017)

Demographic Surveys

Educators completed a survey to capture information on their main language spoken at home, postcode of residence, ECEC experience and qualifications, and physical activity-related professional development undertaken in the past two years. Educator's main language spoken at home was used to categorise educators into English-speaking or non-English-speaking backgrounds (Australian Bureau of Statistics, 2016). Postcode of residence was used as a proxy for socioeconomic status (SES), based on the Australian Bureau of Statistics' Index of Relative Socioeconomic Disadvantage, and categorised into low and middle/high SES (Australian Bureau of Statistics, 2018).

8.2.3 Data analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 27 (IBM Corp., 2020). Descriptive statistics were used to calculate the means and SDs of children's activity levels and the EPAO-FCCH subscores. Each EPAO subscore was dichotomised into a high or low EPAO physical activity environment score using a median split. Linear mixed models were used to assess the association between different child activity levels (sedentary, MVPA and total physical activity) and the 10 EPAO subscores. The FDCs were added as a random effect to account for FDC clustering. Confounding variables were children's age, sex, SES and language and educator's SES, language, ECEC experience and qualification. Effect sizes were calculated using Cohen's d and judged as large (≥0.80), moderate (≥0.50), and small (≥0.20) (Cohen, 1992).

8.3 Results

Due to COVID-19 restrictions, data collection was suspended in March 2020 before the sample size was reached. Thirty-three female educators and 104 children (mean age 3.2

years, SD 1.2 years) from nine service providers participated in the study. Valid accelerometery data for 85 children (82%) aged 1-5 years was available (mean age 3.2, SD 1.3 years, wear time 5.3 (1.3) hours). Child and educator demographics are presented in Table 8.2. Nineteen educators (58%) spoke a language other than English as their main language, and 15 (46%) lived in a low SES area.

The mean number of minutes (and SD) per hour that children participated in different physical activity intensity levels were: sedentary 27.5 (5.4), light 8.4 (2.0), moderate- to vigorous-intensity physical activity 7.8 (3.8) and total physical activity 16.3 (4.7). Forty-eight (56%) children met the IOM recommendation for participating in ≥15mins/hour of physical activity. On average, children were provided with 86 (65) minutes of outdoor playtime each day and 14 (16) minutes of teacher-led physical activity. Twenty-nine educators provided children with outdoor playtime for an average of 98 minutes, and 24 educators provided children with teacher-led physical activity for an average of 20 minutes. Eleven educators offered screen time to children, ranging from 10 to 100 minutes. Five educators intentionally used screen time for educational purposes or to promote physical activity (ranging from 2 to 17 minutes). Five educators used screen time for recreational purposes, (i.e. not for education or physical activity) and did not engage or discuss the content with the children (ranging from 10 to 95 minutes). Six educators offered screen time to children younger than two years.

The highest EPAO subscores (mean [SD]) were screen time (2.4 (0.8)), screen time practices (2.7 (0.6)) and outdoor play environment (2.0 (0.8)) (Table 8.3). The lowest EPAO subscores were physical activity policy (0.5 (0.2)), screen time policy (0.73 (1.1)) and physical activity education and professional development (0.9 (0.6)). The overall physical activity environment ranged from 11 to 20, with an average score of 15.2 (2.3).

Table 8. 2 Sociodemographic characteristics of family day care educators and children

Educator characteristics (n=33)	**N (%)**
Main language spoken at home	
English	14 (42)
Language other than English	19 (58)
Socioeconomic status	
Low (Quintiles 1-2)	15 (46)
Medium/High (Quintiles 3-5)	18 (54)
Sex, female	33 (100)
Years worked in Early Childhood Education and Care	
< 10 years	17 (52)
≥10 years	16 (48)
Years working in family day care	
< 10 years	24 (73)
≥10 years	9 (27)
Early Childhood Education and Care Qualification	
Certificate III	7 (21)
Diploma	23 (70)
University	3 (9)
Physical activity professional development (past 2 years)	9 (27)
Physical activity policy (service provider level)	8 (25)
Screen time policy (service provider level)	14 (42)
Child characteristics (n=85)	
Age	
Toddlers (12-35 months)	34 (40)
Preschoolers (36-60 months)	51 (60)
Sex, female	36 (42)
Main language spoken at home	
English	47 (55)
Language other than English	38 (45)
Socioeconomic status	
Low (Quintiles 1-2)	32 (38)
Medium/High (Quintiles 3-5)	53 (62)

Table 8. 3 Mean EPAO physical activity subscore categories

EPAO subscore category[1]	Mean subscore (SD)
Physical activity time provided	1.8 (0.5)
Indoor play environment	0.8 (0.4)
Physical activity practices	1.4 (0.2)
Physical activity education and professional development	0.9 (0.6)
Physical activity policy	0.5 (0.2)
Outdoor playtime	1.8 (1.0)
Outdoor play environment	2.0 (0.8)
Screen time	2.4 (0.8)
Screen time practices	2.7 (0.6)
Screen time policy	0.73 (1.1)
Overall physical activity environment[2]	15.2 (2.3)

Abbreviations: EPAO, Environment and Policy Assessment and Observation
[1]Subscores range from 0-3, with higher numbers indicating closer proximity to meeting best practice standards
[2]Out of 30

Table 8.4 reports the relationship between the EPAO environmental subscores and minutes per hour of children's sedentary behaviour, MVPA and total physical activity. Associations between the EPAO environmental subscores and minutes per hour of children's sedentary behaviour, MVPA or total physical activity were small and not statistically significant. Physical activity time provided was negatively associated with sedentary behaviour with a medium effect size (Cohen $d = 0.50$).

Table 8. 4 Association between family day care EPAO subscores and children's physical activity and sedentary behaviour

EPAO subscore	Sedentary behaviour (min/hr)		Moderate- to vigorous-intensity physical activity (min/hr)		Total physical activity (min/hr)	
	Estimate (95% CI)[a]	ES	Estimate (95% CI) [a]	ES	Estimate (95% CI)[a]	ES
Intercept	28.05 (21.93 to 34.17)		8.27 (4.68 to 11.86)		16.82 (11.38 to 22.26)	
Physical activity time provided	-3.35 (-7.28 to 0.79)	0.50	2.10 (-1.02 to 5.22)	-0.47	3.57 (-1.16 to 8.30)	0.54
Indoor play equipment	0.38 (-4. 31 to 5.07)	-0.18	-1.05 (-3.80 to 1.70)	0.12	-2.29 (-6.45 to 1.87)	0.23
Physical activity practices	-2.03 (-6.91 to 2.86)	0.09	1.78 (-1.09 to 4.64)	-0.29	2.16 (-2.18 to 6.50)	-0.23
Physical activity education and professional development	-2.68 (-7.87 to 2.52)	0.32	-0.60 (-2.45 to 3.65)	0.01	0.67 (-3.94 to 5.29)	-0.08
Physical activity policy	0.95 (-6.01 to 7.92)	-0.08	-1.18 (-5.26 to 2.90)	0.23	-2.06 (-8.23 to 4.12)	0.25
Outdoor playtime	1.46 (-4.53 to 7.45	-0.05	-0.75 (-4.27 to 2.76)	0.01	-1.22 (-6.54 to 4.11)	-0.05
Outdoor play environment	2.98 (-3.18 to 9.15)	-0.08	-1.59 (-5.20 to 2.03)	-0.01	-1.66 (-7.13 to 3.82)	-0.05
Screen time	2.50 (-4.31 to 9.31)	-0.12	2.04 (-1.25 to 5.33)	-0.02	2.70 (-2.28 to7.67)	0.02
Screen time practices	0.24 (-4.47 to 4.96)	-0.01	-2.29 (-6.27 to 1.69)	0.20	-2.80 (-8.82 to 3.22)	0.12
Screen time policy	-4.96 (-12.00 to 2.08)	0.26	-0.43 (-3.18 to 2.32)	0.00	-0.52 (-4.69 to 3.65)	-0.01

CI, confidence interval; EPAO, Environment and Policy Assessment and Observation; ES, effect size

[a]No associations reached statistical significance at a $p<0.05$

8.4 Discussion

This is the first known Australian study to objectively assess children's physical activity levels and the physical activity environment in FDC. We found that nearly half of the children in this study did not participate in adequate amounts of physical activity in FDC and that the environment was not conducive to physical activity. This study supports the need for more resources for professional development and policies to support children's physical activity in FDC.

Almost half the children did not meet the IOM recommendations of 15 minutes of total physical activity per hour in FDC. Previous studies in FDC have reported children spend between 10.4 to 33.8 min/hr in total physical activity in FDC (Neshteruk et al., 2018; Vanderloo et al., 2015a). This large variance may be due to different physical activity cut-points (Evenson et al., 2008; Pate et al., 2006; Pfeiffer et al., 2006; Van Cauwenberghe et al., 2011). FDC educators have reported a variety of challenges in promoting children's physical activity, including their own physical health limitations, mixed ages of children (particularly younger children), inclement weather, lack of space, low confidence, skills and knowledge, concerns around safety and competing priorities, such as teaching literacy and numeracy (Fees et al., 2009; O'Connor and Temple, 2005; Riethmuller et al., 2009). Furthermore, there is a common misconception among FDC educators and parents that young children are naturally active (O'Connor and Temple, 2005).

This study found low EPAO-FCCH environmental subscores, particularly physical activity and screen time policies, physical activity education and professional development and indoor play environment. Similar findings have been reported in family child care homes in the USA (Mazzucca et al., 2018). It is not surprising that physical activity and screen time policy scores were low in our study as these are not mandated

under the Australian Education and Care Services National Regulations. Studies in Australia (Kerr et al., 2021; Lum et al., 2020), the USA (Chai et al., 2020; Mazzucca et al., 2018), and Canada (Martyniuk et al., 2015; Tucker et al., 2015) have also found low levels of comprehensive physical activity and screen time policies. Interestingly, despite low screen time policy subscores, the subscores for screen time and screen time practices were high, and only one-third of educators used screen time. This finding is contrary to results from an Australian survey with 174 FDC educators that revealed almost two-thirds (64%) of FDC educators did not ensure the appropriate use of screen time for children (Lum et al., 2020). Appropriate use of screen time was defined as only using small screen devices (smartphones and tablets) with children for educational or physical activity purposes and not providing screen time for children under two years (Lum et al., 2020). This inconsistency may be due to our study only capturing one day of observational data for each FDC which may not be indicative of regular screen time use in FDC.

The low education and professional development subscore highlights a gap in physical activity and screen time professional development for FDC educators. NSW Health offers a free capacity building program, *Munch & Move*®, to all NSW ECEC services to promote health-promoting practices for childen aged 0-5 years (Lockeridge et al., 2015). *Munch & Move*® provides FDC service providers with access to professional development, resources and support from a Local Health District health promotion officer to implement organisation-wide health promoting practices (Lockeridge et al., 2015). FDC service providers are encouraged to support their FDC educators to implement the program and access program training material. Direct access to the program training was extended towards FDC educators in 2019; however this was not actively promoted to those FDC service providers participating in this study. It is important to note that other physical activity interventions in FDC have been unsuccessful. The *Romp & Chomp* intervention

in Victoria reported significant reductions in organised active play and free inside play and no changes in outdoor free play, which was contrary to the intended effects of the intervention (De Silva-Sanigorski et al., 2011). The Keys to Healthy Family Child Care Home intervention found significant improvements in the time provided for physical activity and physical activity practices (Ward et al., 2020). However, the subscores were still low post-intervention, and there were no improvements in children's total physical activity and MVPA levels (Ward et al., 2020).

Our study found no environmental subscores were associated with children's MVPA or sedentary behaviour. While not significant, the time provided for physical activity was negatively associated with sedentary behaviour and positively associated with total physical activity with a medium effect size. Other studies have found that time provided for outdoor play was negatively associated with sedentary behaviour in FDC (Chai et al., 2020; Mazzucca et al., 2018) and positively associated with physical activity (Gunter et al., 2012; Mazzucca et al., 2018); however, these findings were only significant in two studies (Chai et al., 2020; Gunter et al., 2012). Nevertheless, this suggests that time provided for physical activity should be targeted in future interventions designed to increase physical activity in FDC.

This study has several strengths and limitations. The small sample size limits the generalisability of the findings and the power to detect significant associations. The small sample size is attributed to the recruitment challenges and early cessation of the study due to COVID-19. Another limitation is that observations were only captured on one day, which may not represent usual practice. However, other studies have also only collected one day of observational data using the EPAO (Martyniuk et al., 2015; Vanderloo et al., 2015b). Nevertheless, these are important findings that contribute to the growing

literature in FDC and the study is the first in Australia to objectively measure activity levels and observe the physical activity environment using a validated tool.

8.5 Conclusions

Children attending FDC are not meeting the IOM guidelines and the environments assessed are not conducive to physical activity. These findings highlight the need to provide professional development to FDC educators to improve the physical activity environment and increase children's physical activity levels. Support around the development and implementation of physical activity and screen policies in FDC is warranted. Future studies in this field will benefit from consulting educators and service providers to develop strategies that overcome the unique challenges that FDC educators experience.

8.6 References

Australian Bureau of Statistics (2016) *Australian Standard Classification of Languages (ASCL), 2016, Canberra, Australia*. Available at: https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1267.0Main+Features12016?OpenDocument.

Australian Bureau of Statistics (2018) *Socio-Economic Indexes for Areas Australia*. Commonwealth of Australia. Available at: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by Subject/2033.0.55.001~2016~Main Features~SOCIO-ECONOMIC INDEXES FOR AREAS (SEIFA) 2016~1 (Accessed: 16 April 2021).

Australian Children's Education and Care Quality Authority (2020) 'Guide to the National Quality Framework', (January), pp. 1–634. Available at: https://www.acecqa.gov.au/sites/default/files/2020-09/Guide-to-the-NQF-September-2020.pdf.

Australian Government: Department of Health (2017) *Australian 24-Hour Movement Guidelines for the Early Years (birth to 5 years): An Integration of Physical Activity, Sedentary Behaviour, and Sleep*. Available at: http://www.health.gov.au/internet/main/publishing.nsf/content/FCE78513DAC85E08CA257BF0001BAF95/$File/Birthto5years_24hrGuidelines_Brochure.pdf.

Australian Government (2018) *Child Care in Australia, Department of Education and Training*. Available at: https://www.education.gov.au/child-care-australia (Accessed: 26 April 2019).

Australian Institute of Health and Welfare. (2018) *Physical activity across the life stages*. Cat. no. P. Canberra: AIHW. Available at: https://www.aihw.gov.au/reports/physical-activity/physical-activity-across-the-life-stages/contents/table-of-contents.

Birch, L. L., Parker, L. and Burns, A. (2011) *Early Childhood Obesity Prevention Policies Committee on Obesity Prevention Policies for Young Children*. Available at: http://www.nap.edu. (Accessed: 13 August 2019).

Carson, V. *et al.* (2017) 'Systematic review of the relationships between physical activity and health indicators in the early years (0-4 years)', *BMC Public Health*, 17(Suppl 5). doi: 10.1186/s12889-017-4860-0.

Van Cauwenberghe, E. *et al.* (2011) 'Calibration and comparison of accelerometer cut

points in preschool children', *International Journal of Pediatric Obesity*, 6(2–2), pp. 582–590. doi: 10.3109/17477166.2010.526223.

Chai, L. K., Rice-McNeil, K. and Trost, S. G. (2020) 'Patterns and Correlates of Sedentary Behavior in Children Attending Family Child Care', *International journal of environmental research and public health*, 17(2), pp. 1–10. doi: 10.3390/ijerph17020549.

Cohen, J. (1992) 'A Power Primer', *Quantitative Methods in Psychology*, 112(1), pp. 155–159. doi: 10.1037/0033-2909.112.1.155.

Evenson, K. R. *et al.* (2008) 'Calibration of two objective measures of physical activity for children', *Journal of Sports Sciences*, 26(14), pp. 1557–1565. doi: 10.1080/02640410802334196.

Fees, B. *et al.* (2009) 'Physical Activity Programming in Family Child Care Homes: Providers' Perceptions of Practices and Barriers', *Journal of Nutrition Education and Behavior*, 41(4), pp. 268–273. doi: 10.1016/j.jneb.2008.01.013.

Gunter, K. B. *et al.* (2012) 'Factors associated with physical activity in children attending family child care homes', *Preventive Medicine*, 54(2), pp. 131–133. doi: 10.1016/j.ypmed.2011.12.002.

IBM Corp. (2020) 'IBM SPSS Statistics for Windows'. Armonk, NY: IBM Corp.

Janssen, X. *et al.* (2013) 'Predictive validity and classification accuracy of actigraph energy expenditure equations and cut-points in young children', *PLoS ONE*, 8(11). doi: 10.1371/journal.pone.0079124.

Kerr, E. *et al.* (2021) 'Nutrition, physical activity and screen time policies and practices in Family Day Care in Australia', *Public Health Research and Practice*, (October), pp. 1–5. doi: 10.17061/31342114.

Li, C. *et al.* (2020) 'The relationships between screen use and health indicators among infants, toddlers, and preschoolers: A meta-analysis and systematic review', *International Journal of Environmental Research and Public Health*, 17(19), pp. 1–20. doi: 10.3390/ijerph17197324.

Lockeridge, A. *et al.* (2015) *Munch & Move: Evidence and Evaluation Summary. NSW Ministry of Health*. Available at: https://healthykids.nsw.gov.au/wp-content/uploads/2020/05/FINALMunchMoveSummary.pdf (Accessed: 22 May 2019).

Lum, M. *et al.* (2020) 'Assessing the implementation of healthy eating and physical

activity policies and practices in the family day care setting: A cross sectional study', *Health Promotion Journal of Australia*, (September), pp. 1–10. doi: 10.1002/hpja.420.

Martyniuk, O. J. M. *et al.* (2016) 'Comparing the nutrition environment and practices of home- and centre-based child-care facilities', *Public Health Nutrition*, 19(4), pp. 575–584. doi: 10.1017/S1368980015003535.

Mazzucca, S. *et al.* (2018) 'Physical activity and sedentary behaviors of children in family child care homes: Are there opportunities for improvement?', *Pediatric Exercise Science*, 30(4), pp. 529–536. doi: 10.1123/pes.2018-0040.

Neshteruk, C. D. *et al.* (2018) 'The physical environment in family childcare homes and children's physical activity', *Child: Care, Health and Development*, 44(5), pp. 746–752. doi: 10.1111/cch.12578.

O'Connor, J. P. and Temple, V. A. (2005) 'Constraints and Facilitators for Physical Activity in Family Day Care', *Australasian Journal of Early Childhood*, 30(4), pp. 1–9. doi: 10.1177/183693910503000402.

Okely, A. D. *et al.* (2020) '"Jump start" childcare-based intervention to promote physical activity in pre-schoolers: Six-month findings from a cluster randomised trial', *International Journal of Behavioral Nutrition and Physical Activity*, 17(1), pp. 1–12. doi: 10.1186/s12966-020-0910-6.

Pate, R. R. *et al.* (2006) 'Validation and Calibration of an Accelerometer in Preschool Children', *Obesity*, 14(11), pp. 152–157. doi: 10.1249/01.mss.0000183219.44127.e7.

Pate, R. R. *et al.* (2015) 'Prevalence of compliance with a new physical activity guideline for preschool-age children', *Childhood Obesity*, 11(4), pp. 415–420. doi: 10.1089/chi.2014.0143.

Pfeiffer, K. A. *et al.* (2006) 'Validation and calibration of the actical accelerometer in preschool children', *Medicine and Science in Sports and Exercise*, 38(1), pp. 152–157. doi: 10.1249/01.mss.0000183219.44127.e7.

Riethmuller, A. *et al.* (2009) 'Developing and active play resource for a range of Australian early childhood settings: Formative findings and recommendations', *Australasian Journal of Early Childhood*, 34(1), pp. 43–52.

De Silva-Sanigorski, A. *et al.* (2011) 'Obesity prevention in the family day care setting: Impact of the Romp & Chomp intervention on opportunities for children's physical

activity and healthy eating', *Child: Care, Health and Development*, 37(3), pp. 385–393. doi: 10.1111/j.1365-2214.2010.01205.x.

Temple, V. A. and O'Connor, J. P. (2003) 'Family day care environments and physical activity.', *ACHPER Australia Healthy Lifestyles Journal*, 51(4), pp. 12–17.

Timmons, B. W. *et al.* (2012) 'Systematic review of physical activity and health in the early years (aged 0–4 years)', *Applied Physiology, Nutrition, and Metabolism*, 37(4), pp. 773–792. doi: 10.1139/h2012-070.

Tucker, P. *et al.* (2015) 'Prevalence and influences of preschoolers' sedentary behaviors in early learning centers: A cross-sectional study', *BMC Pediatrics*, 15(1). doi: 10.1186/s12887-015-0441-5.

Vanderloo, L. M. *et al.* (2015) 'Environmental influences on preschoolers' physical activity levels in various early-learning facilities', *Research Quarterly for Exercise and Sport*, 86(4), pp. 360–370. doi: 10.1080/02701367.2015.1053105.

Vanderloo, L. M., Martyniuk, O. J. M. and Tucker, P. (2015) 'Physical and sedentary activity levels among preschoolers in home-based childcare: A systematic review', *Journal of Physical Activity and Health*, 12(6), pp. 879–889. doi: 10.1123/jpah.2013-0483.

Vaughn, A. E. *et al.* (2017) 'Assessment of nutrition and physical activity environments in family child care homes: Modification and psychometric testing of the Environment and Policy Assessment and Observation', *BMC Public Health*, 17(1), p. 680. doi: 10.1186/s12889-017-4686-9.

Ward, D. *et al.* (2008) 'An Instrument to Assess the Obesogenic Environment of Child Care Centers', *American Journal of Health Behavior*, 32(4), pp. 380–386. Available at: https://www.lib.uwo.ca/cgi-bin/ezpauthn.cgi?url=http://search.proquest.com/docview/211893057?accountid=15115%5Cnhttp://vr2pk9sx9w.search.serialssolutions.com/?ctx_ver=Z39.88-2004&ctx_enc=info:ofi/enc:UTF-8&rfr_id=info:sid/ProQ%3Apsychologyshell&rft_val_fm.

Ward, D. S. *et al.* (2020) 'Keys to healthy family child care homes: Results from a cluster randomized trial', *Preventive Medicine*, 132(October 2019), p. 105974. doi: 10.1016/j.ypmed.2019.105974.

WHO (2017) *Report of the Commission on Ending Childhood Obesity., Implementation Plan: Executive summary,*. doi: 10.1016/j.jhep.2013.02.018.

Chapter 9: General discussion and recommendations

Chapter 9 presents an overview of the research findings, followed by an overall discussion of the research. The results are discussed and compared with the most recent body of literature. Next, the strengths and limitations are considered. Finally, implications for practice and policy and recommendations for future research are proposed.

9.1 Overview of findings

This doctoral thesis explored the nutrition and physical activity practices and environments at two levels of the FDC sector; the service provider and the educator level. Overall, this thesis provides evidence for the need to support educators' implementation of best practice guidelines.

Research question 1. What are the correlates of children's dietary intake, physical activity and sedentary behaviours in ECEC settings?

Chapter 3 examined the correlates of children's dietary intake, physical activity and sedentary behaviours in FDC. Most of the significant correlations identified were at the intrapersonal, interpersonal and organisational levels of the socio-ecological model. However, few studies assessed the same correlate, limiting the opportunity to pool findings across studies. Only two unique studies found significant associations with the same correlate. Indoor play space was positively associated with total physical activity (Gunter et al., 2012) and MVPA (Neshteruk et al., 2018). Children's dietary intake was associated with ethnicity (Ramirez et al., 2020; Tovar et al., 2020) and the food provided to children (Benjamin-Neelon et al., 2018; Tovar et al., 2018) in two studies; however, they were from the same study sample. Chapters 2 and 3 also identified that no Australian

studies have objectively assessed the nutrition, physical activity and sedentary environments in FDC services.

Research question 2a. Is Munch & Move training associated with FDC service providers' nutrition, physical activity and screen time policies, resources and professional development?

2b. To what extent do the service provider's policies adhere to national guidelines and relevant guidelines?

Chapter 5 examined the effect of *Munch & Move* training on service providers' policies and practices. Service providers trained in *Munch & Move* were more likely to offer professional development to educators on healthy eating and physical activity and to have more comprehensive nutrition policies. However, the study found no significant differences in the resources supplied to families and educators. The study also highlighted the disparity in service providers' policies and practices across topic areas. Nutrition policies were more likely to be comprehensive and adhere to national guidelines than policies for infant feeding, physical activity, and screen time. Similarly, service providers were also more likely to provide families and educators with resources related to nutrition than for infant feeding, physical activity and screen time.

Research question 3a. What is the nutritional quality of food provided to children during FDC?

3b. Are the policies, practices and environments at a service provider and educator level associated with the type of food provided to children by parents or educators during FDC?

Chapter 6 assessed the food provided to 104 children in FDC by families and educators. Less than one-quarter of children were provided with 50% of their recommended food group servings for vegetables (17%), lean meat and meat alternatives (19%), and dairy (25%), and only 26% of children were provided with wholegrains. However, almost three-quarters of children (71%) were provided with excess discretionary foods (mean 1.5 serves). The study found that children's age, SES and type of main meal were associated with the nutritional quality of food provided. However, service provider policies and educators' professional development were not associated with the food provided.

Research question 4a. What are educators' feeding practices and the mealtime environment during FDC?

4b. What factors are associated with educators' feeding practices and the mealtime environment in FDC settings?

Chapter 7 assessed educators' feeding practices and mealtime environments. Educators often used a combination of positive and negative practices during the same meal occasion. Most educators avoided using negative feeding practices during every meal occasion; however, they did not consistently use positive feeding practices. Out of the 11 positive best practice items assessed at mealtimes, the only practice used by most educators during at least one of the observed mealtimes was sitting with children whilst eating (n=30). The most common negative practice observed was educators' spoon-feeding a child that were able to feed themselves to get them to eat (n=18 educators did this at least once). Educators' main language spoken at home, SES, nutrition professional development, or ECEC experience did not influence educators' feeding practices or mealtime environment scores.

Research question 5a. How much time do children spend in physical activity and sedentary behaviour during FDC?

5b. Are the policies, practices and environments at a service provider and educator level associated with children's physical activity and sedentary behaviour?

Chapter 8 explored the association between the physical activity environment and children's physical activity and sedentary behaviour. Almost half of the children (48 out of 85) in this study did not meet the Institute of Medicine recommendations of 15 minutes of total physical activity per hour in FDC. The lowest EPAO subscore categories were physical activity and screen time policies (that belonged to the associated service providers) and physical activity education and professional development. Further, educators' practices and the environment were not conducive to physical activity, particularly the indoor play environment and educators' physical activity practices (for example, role during play time). The physical activity policies, practices and environments were not associated with children's sedentary behaviour, MVPA or total physical activity in FDC.

9.2 Discussion of findings

These findings provide important insights into Australian FDC services' healthy eating and physical activity environments and identify specific areas to develop and enhance policies and professional development. This thesis was unique as it examined the healthy eating and physical activity practices at the service provider level (Chapter 5) and educator level (Chapters 6-8) of the FDC sector. Only one other Australian study from the Hunter New England region of New South Wales has assessed FDC service providers' and educators' healthy eating and physical activity policies and practices (Lum et al., 2020). Similar to our findings, Lum et al., (2020) found that more service providers had

comprehensive policies for nutrition compared to physical activity, screen time and breastfeeding policies. Lum et al., (2020) reported that only three out of 16 service providers had provided *Munch & Move* training to at least 80% of educators. In contrast, the study reported in this thesis (Chapter 5) found that most service providers trained in *Munch & Move* (18 out of 20) reported providing *Munch & Move* training to their educators. However, despite all the educators that participated in Phase 2 (Chapters 6-8) being registered with *Munch & Move* trained service providers, less than half of the educators had participated in healthy eating (n=16) and physical activity (n=13) professional development. These findings suggest that the *Munch & Move* program is not reaching a large number of FDC educators.

This thesis was the first Australian study to capture detailed practices at the educator level using a validated observational assessment tool. In Chapter 3, the majority of correlations identified were at the intrapersonal, interpersonal and organisational levels of the socio-ecological model. In our study, only three correlates were identified; two at the intrapersonal and one at the organisational level. The nutritional quality of the food provided to children was associated with children's age, socio-economic status, and main meal type. As identified in Chapter 3, another study similarly found that younger children had higher micronutrient densities than older children in FDC services in Rhode Island, USA (Esther et al., 2019). The finding that children from low socio-economic backgrounds in our study had higher food provision index scores was unexpected. Similarly, Tovar et al., (2020) found that children attending low-income FDC services consumed more greens, beans, and proteins foods than those in care with higher-income educators. However, another study found that FDC services with higher food expenditures served more protein, wholegrains, fresh fruit and vegetables than services with lower expenditures (Monsivais & Johnson, 2012). In addition, Lum et al., (2020)

found that educators from lower socio-economic backgrounds were less likely to implement *Munch & Move* best practices than educators from higher socio-economic backgrounds. Our finding that children provided with mixed dishes had significantly higher food provision quality compared to children provided with sandwiches/wraps/rolls was a result of mixed dishes containing more vegetables and protein foods. However, instead of replacing sandwiches with mixed meals, interventions should focus on improving ingredients in sandwiches and the quality of snacks at morning and afternoon tea. The food audit found that most discretionary foods were served as snacks at morning and afternoon tea. This highlights an opportunity to replace discretionary foods with vegetables, wholegrains, dairy and lean meat and meat alternatives during morning and afternoon tea.

Chapter 6-8 found that service providers' policies did not influence the food provided to children, educators' feeding practices or children's physical activity or sedentary behaviour. The systematic literature review in Chapter 3 also found that policies were not associated with children's physical activity (Gunter et al., 2012; Mazzucca et al., 2018; Vanderloo et al., 2015) or sedentary behaviour (Chai et al., 2020; Delaney et al., 2014; Mazzucca et al., 2018; Tucker et al., 2015). Conversely, nutrition policies were significantly associated with children's diet quality (Benjamin-Neelon et al., 2018). Our finding that policies did not affect educators' practices (Chapter 6-8) could be related to the absence of clear policy guidelines. The policy review criteria developed in this thesis (Chapter 4) was based on national guidelines, however the national guidelines do not include specific information regarding the quantity of food to provide children while in FDC or the recommended time children should spend being physically active or sedentary (including screen time) in FDC. Statements such as 'food should be adequate in quantity'

are ambiguous and open to interpretation and result in inconsistent policy implementation.

Chapters 6-8 also found that educators' participation in professional development was not associated with the food provided to children, educators' feeding practices or children's physical activity or sedentary behaviour. Conversely, the systematic literature review (Chapter 3) found that nutrition education (including professional development) was significantly associated with children's diet quality in the only study that assessed this relationship (Benjamin-Neelon et al., 2018). The impact of professional development on educators' nutrition practices has had mixed findings (Loth et al., 2019; Pelletier et al., 2019). As outlined in Chapter 3, only one (Gunter et al., 2012) out of four studies found that professional development was associated with children's physical activity (Delaney et al., 2014; Mazzucca et al., 2018; Vanderloo et al., 2015). However, two studies reported significant associations between physical activity training and educators' reported physical activity practices (Loth et al., 2019; Pelletier et al., 2019).

FDC obesity prevention interventions identified from a recent systematic review found that most studies reported positive improvements in educators' nutrition and physical activity practices (Yoong et al., 2020). One study captured child-level outcomes using the plate-waste method (Woodward-Lopez et al., 2018), and one study observed the physical activity environment and amount of physical activity offered to children (Kao et al., 2018). Although these measurement tools are valid, both used a pre-post intervention design with no control group. The remaining six FDC intervention studies identified in the review all collected data using self-report surveys, none reported child-level outcomes, and only two interventions included a control (Yoong et al., 2020). One of these studies evaluated a capacity-building program (similar to *Munch & Move)* in

Victoria called *Romp & Chomp*. Educators in the intervention group reported providing more positive meal experiences for children, allowing fewer unhealthy food and beverage items, providing more nutrition resources and a higher rating for the food-related physical environment (De Silva-Sanigorski et al., 2011). However, there were significant reductions in organised active play and free inside play and no changes in outdoor free play, contrary to the intervention's intended effects (De Silva-Sanigorski et al., 2011). After the Yoong et al. (2020) systematic review was published, the outcomes the Keys to Healthy Family Child Care Homes cluster randomised-control trial intervention published findings that included child-level outcomes (Ward et al., 2020). The study reported significant improvements in children's diet quality, however, there was a significant reduction in children's vegetable intake. Significant improvements in the time provided for physical activity and physical activity practices were also documented (Ward et al., 2020). However, the subscores were still low post-intervention, and there were no improvements in children's total physical activity and MVPA levels (Ward et al., 2020).

Reasons that professional development did not influence educators' practices in this thesis research could be attributed to the fidelity of the *Munch & Move* training and the challenges associated with implementing policies and professional development. Concerns around the fidelity of the *Munch & Move* training has also been identified in another study that evaluated the *Munch & Move* FDC training model in 2019 (Kantar Public Division, 2019). This involved observing 12 FDC services for three hours and six interviews with service providers (Kantar Public Division, 2019). The study identified varying levels of implementation of the 13 *Munch & Move* 'Program Adoption Indicators' attributed partly to the program's flexibility and the onus on the service provider to train educators (Kantar Public Division, 2019). As a result of this report and the preliminary findings of this thesis research, the *Munch & Move* training model changed at the end of

2019. FDC educators could complete the training via an eLearning package instead of being trained by their service provider. This change in the *Munch & Move* program delivery coincided with the time of FDC observations in the current study. As a result, no FDC educators participating in this research had accessed the eLearning training. A key difference between the Kantar study and the current research study was that the Kantar study focused on educators' implementation of the thirteen *Munch & Move* 'Program Adoption Indicators'. In contrast, this thesis undertook more comprehensive assessments of educators' practices and the environment using a validated tool.

It is important to note that the *Munch & Move* 'Program Adoption Indicators' do not cover all the best practices assessed in the observational study. For example, they do not explicitly mention feeding practices and mealtimes, whereas Chapter 7 provides a detailed description of educators' positive and negative feeding practices and the mealtime environment. Our research also found that FDC educators' feeding practices are nuanced, highlighting the need for specific training to help educators integrate positive feeding practices in every mealtime. The *Munch & Move* program offers the same training for all ECEC services, including FDC and centre-based ECEC services, with only minor modifications for FDC services. Therefore, the training might not adequately address the structural and social challenges experienced by FDC educators, such as limited support and resources and different ages and requirements of children (Stitou et al., 2018). Multiple studies have also identified specific barriers experienced by FDC educators that influence their ability to promote healthy eating and physical activity. Qualitative interviews conducted with FDC educators in Western Australia identified parents' provision of unhealthy foods and children's fussy eating as barriers to healthy eating (Wallace and Mills, 2019). Other Australian studies have also highlighted difficulties with talking to parents about healthy food due to concerns about upsetting relationships with

parents and losing business (Daniels et al., 2003; Kantar Public Division, 2019). FDC educators have also expressed challenges in role-modelling positive food behaviours due to lack of time and prioritising feeding children and managing behaviour (Vandeweghe et al., 2016; Wallace and Mills, 2019). FDC educators experience further barriers promoting physical activity in FDC, including managing differing ages, limited space, physical capabilities of educators, limited time and finances to professional development and educators' confidence and knowledge (Reithmuller 2009; O'Conner and Temple 2005; Fees 2009).

A report from FDC Australia also identified that many FDC educators are overwhelmed with paperwork and compliance with quality standards and regulations (Family Day Care Australia, 2019). This is an important finding because promoting healthy eating and physical activity can be applied to all elements of the National Quality Standard, not just children's health and safety. For example, using responsive interactions with children, supporting children's self-regulation and organising all aspects of the program to maximise opportunities for each child's learning (Australian Children's Education and Care Quality Authority, 2020). The synergy between the National Quality Standards and the promotion of healthy eating and physical activity is already recognised by the *Munch & Move* program (NSW Government, 2020). However, there are opportunities for further development through providing more examples of how it can be applied, for example, through videos and reflections. A recent systematic review found that educators' sensitivity to children (i.e. responsive and respectful relationships) was the strongest predictor of overall quality in FDC services (Eckhardt and Egert, 2020). High-quality teaching practices and interactions have been associated with responsive feeding practices (Malek-Lasater et al., 2021) and increased children's physical activity levels (Tonge et al., 2019; Zhang et al., 2021, 2019) in centre-based ECEC services. However, the

relationship between quality teaching and nutrition and physical activity practices has not been assessed in FDC services.

9.3 Strengths and limitations

This research had a number of strengths. The systematic review was conducted using a registered study protocol in PROSPERO, including a pre-determined search strategy, and followed the PRISMA guidelines (Page et al., 2021). This review was the first to summarise the correlates of children's dietary intake, physical activity and sedentary behaviour in FDC. A strength of the research in Phase 1 (Chapter 5) was that two different researchers reviewed each policy to increase the reliability of the assessments. Phase 2 was the first observational study in Australian FDC services to examine the nutrition and physical activity environment using a validated tool and objectively measure the food provided to children and children's physical activity and sedentary behaviour.

Despite the strengths identified, this thesis also has limitations. Firstly, this research only included cross-sectional studies, meaning that only correlations could be identified, not causal relationships. Another limitation of this research was the small sample size in both phases of the reseach, which limits the representativeness of the sample and power to detect statistical changes. The small sample size achieved can be partly explained by recruitment coinciding with legislative changes and new child care subsidies causing increased administrative pressure on FDC service providers (Family Day Care Australia, 2018). Further, FDC service providers and educators also experienced increased stress at the time the study was undertaken, due to the Government regulator’s stricter assessment and rating processes caused by fraudulent activity and non-compliance to national standards and regulations (Family Day Care Australia, 2018). This was evident when talking to service providers, and 40% of the service providers in the study sampling areas

closed down during recruitment. Educator recruitment was also challenging, mainly because educators were recruited through their service providers. Reasons for educators declining included unsettled babies, not wanting a stranger in their house, parents not providing consent and educators' fear of being judged. Recruitment rates increased after using many strategies to increase participation (detailed in Chapter 4), but unfortunately, data collection stopped in March 2020 due to COVID-19 restrictions. Due to the small sample size of service providers and educators, data analysis in Chapter 5 and Chapter 7 involved independent *t*-tests, chi-square and fishers, and did not account for potential confounding variables. Another limitation of this research was that educators' postcode of residence was used as the proxy for socio-economic status and may not have been as accurate as education or income. This study only assessed food provision, not dietary intake. As a result, the impact of educators' feeding practices or mealtime environment on children's dietary intake was not assessed. Finally, FDC services were only observed for one day, which may not be indicative of usual practice.

9.4 Implications for practice and policies

A key finding that emerged from this thesis was that service providers' policies and professional development did not influence educators' practices or children's physical activity or sedentary behaviours. As part of the PRSP project, these findings are being used by the NSW Ministry of Health (at a state and Local Health District level) to enhance the capacity-building model of the *Munch & Move* program and inform policy and resource allocation. The findings have highlighted specific areas to inform the development of videos, case studies and reflection tools that can complement the *Munch & Move* training. Local Health District health promotion officers can also provide

targeted support through meetings with FDC service providers and workshops for educators. Strategies, professional development and policies should focus on:

- Replacing discretionary foods with vegetables, wholegrains, meat and meat alternatives and dairy foods. Simple strategies could involve providing parents and educators with easy healthy alternatives to discretionary snacks or providing share platters with foods from the five food groups in line with the Australian Dietary Guidelines.
- Promoting positive mealtimes using responsive feeding practices and integrating mealtimes into the educational program. This could involve videos and reflections on different mealtimes practices with children ranging from 0-5 years.
- Providing time for educator and child-led active play. This should include videos, strategies and ideas to encourage active play for children of different ages. For example, modifying games for different ages and safe activities for infants and young children that do not involve putting them in movement restricting devices.

9.5 Recommendations for future research

This thesis has contributed to the limited research in Australian FDC services and provides valuable insights into educators' practices that can be used to develop future research studies and professional development for educators. Due to the lower than anticipated sample size, a survey for educators (adapted from NAP SACC) was sent to all services providers in NSW educators to supplement the observation study. This survey was led by the PhD candidate, including adaption of the questionnaire, obtaining human research ethics approval and study sampling and recruitement. However, the findings are not reported as part of this thesis. Building on the findings from this thesis, the PRSP FDC working group is currently developing an online quality improvement support tool

for FDC educators and service providers which aims to facilitate improvement in educator practices and environments relating to healthy eating and movement behaviours. In addition to the research already being conducted based on the research findings from this thesis, other recommendations for future research include to:

- Assess the quality of interactions between educators and children and how this influences educators' practices.
- Examine the impact of educators' practices on infants' healthy eating and physical activity behaviours in FDC. Our study intended to include children aged 0-5 years; however, only one infant (11 months) was observed. A common reason for educators declining participation in the study was having an unsettled young baby, suggesting this is a challenging area.
- Conduct interviews or focus groups with FDC service providers and educators to explore the barriers and enablers experienced by FDC service providers and educators in relation to promting healthy eating and physical activity.
- Co-design future interventions with FDC educator and service providers.
- Future interventions should assess the impact of professional development on children's dietary intake, fundamental movement skills and tummy time, and educators' quality of interactions, in addition to the practices assessed in this thesis.

9.6 Conclusion

This thesis is the first Australian study to objectively assess the nutrition and physical activity environments in FDC services. The findings suggests that FDC educators require additional or modified resources and training to address the specific challenges experienced by educators to promote healthy eating and physical activity. The findings are being used by NSW Health to inform the enhancement of the *Munch & Move*

program by developing additional resources and professional development tailored to FDC services. Key areas to target include policy implementation, replacing discretionary foods with core food groups, embedding positive feeding practices into mealtimes, and providing sufficient time for educator and child-led active play in physical activity promoting environments. Finally, FDC service providers and educators should be involved in the development of resources and professional development to ensure that they are relevant and address the barriers and challenges specific to the FDC setting.

9.7 References

Australian Children's Education and Care Quality Authority (2020) 'Guide to the National Quality Framework', (January), pp. 1–634. Available at: https://www.acecqa.gov.au/sites/default/files/2020-09/Guide-to-the-NQF-September-2020.pdf.

Benjamin-Neelon, S. E. *et al.* (2018) 'The family child care home environment and children's diet quality', *Appetite*, 126, pp. 108–113. doi: 10.1016/j.appet.2018.03.024.

Chai, L. K., Rice-McNeil, K. and Trost, S. G. (2020) 'Patterns and Correlates of Sedentary Behavior in Children Attending Family Child Care', *International journal of environmental research and public health*, 17(2), pp. 1–10. doi: 10.3390/ijerph17020549.

Cuadrado-Soto, E. *et al.* (2019) 'Micronutrient adequacy in preschool children attending family child care homes', *Nutrients*, 11(9), pp. 1–15. doi: 10.3390/nu11092134.

Daniels, L. A., Franco, B. and McWhinnie, J. A. (2003) 'An assessment of the potential of Family Day Care as a nutrition promotion setting in South Australia', *Nutrition & Dietetics*, 60(1), pp. 30–37.

Delaney, S. L., Monsivais, P. and Johnson, D. B. (2014) 'Physical activity levels in family child care homes', *Journal of Physical Activity and Health*, 11(7), pp. 1362–1366. doi: 10.1123/jpah.2012-0297.

Eckhardt, A. G. and Egert, F. (2020) 'Predictors for the quality of family child care: A meta-analysis', *Children and Youth Services Review*, 116(February), p. 105205. doi: 10.1016/j.childyouth.2020.105205.

Family Day Care Australia (2018) *Family Day Care Australia Submission to the Senate Select Committee on Red Tape Inquiry into the effect of red tape on child care*. Available at: www.familydaycare.com.au/representing-you/submissions (Accessed: 23 May 2019).

Family Day Care Australia (2019) *Attracting the next generation of family day care educators*. Available at: https://uploads.prod01.sydney.platformos.com/instances/97/assets/public-pdf/Supporting-You/FDCA_EducatorResearchReportUpdate_online.pdf?updated=1585270019.

Gunter, K. B. *et al.* (2012) 'Factors associated with physical activity in children

attending family child care homes', *Preventive Medicine*, 54(2), pp. 131–133. doi: 10.1016/j.ypmed.2011.12.002.

Kantar Public Division (2019) *Munch & Move Family Day Care Evaluation*. Available at: https://healthykids.nsw.gov.au/downloads/file/campaignsprograms/FDC Final Report.pdf.

Kao, J. *et al.* (2018) 'Improvements in Physical Activity Opportunities: Results From a Community-Based Family Child Care Intervention', *American Journal of Preventive Medicine*, 54(5), pp. S178–S185. doi: 10.1016/j.amepre.2018.01.005.

Loth, K. A. *et al.* (2019) 'Does adherence to child care nutrition and physical activity best practices differ by child care provider's participation in support programs and training?', *Children and Youth Services Review*, 105. doi: 10.1016/j.childyouth.2019.104417.

Lum, M. *et al.* (2020) 'Assessing the implementation of healthy eating and physical activity policies and practices in the family day care setting: A cross sectional study', *Health Promotion Journal of Australia*, (September), pp. 1–10. doi: 10.1002/hpja.420.

Malek-Lasater, A. D. *et al.* (2021) 'Supporting Children's Healthy Development During Mealtime in Early Childhood Settings', *Early Childhood Education Journal*, (0123456789). doi: 10.1007/s10643-020-01137-2.

Mazzucca, S. *et al.* (2018) 'Physical activity and sedentary behaviors of children in family child care homes: Are there opportunities for improvement?', *Pediatric Exercise Science*, 30(4), pp. 529–536. doi: 10.1123/pes.2018-0040.

Monsivais, P. and Johnson, D. B. (2012) 'Improving nutrition in home child care: Are food costs a barrier?', *Public Health Nutrition*, 15(2), pp. 370–376. doi: 10.1017/S1368980011002382.

Neshteruk, C. D. *et al.* (2018) 'The physical environment in family childcare homes and children's physical activity', *Child: Care, Health and Development*, 44(5), pp. 746–752. doi: 10.1111/cch.12578.

NSW Government (2020) *How Munch & Move aligns with the National Quality Framework, Munch and Move*. Available at: https://healthykids.nsw.gov.au/downloads/file/campaignsprograms/NQFBrochure.pdf.

Page, M. J. *et al.* (2021) 'The PRISMA 2020 statement: An updated guideline for

reporting systematic reviews', *The BMJ*, 372. doi: 10.1136/bmj.n71.

Pelletier, J. E. *et al.* (2019) 'Public Health Support for Weight-Related Practices in Child Care Settings in Minnesota', *Health Promotion Practice*, 20(3), pp. 419–428. doi: 10.1177/1524839918781523.

Ramirez, A. *et al.* (2020) 'Dietary Contributors to Food Group Intake in Preschool Children Attending Family Childcare Homes: Differences between Latino and Non-Latino Providers', *Nutrients*, 12, pp. 1–15.

De Silva-Sanigorski, A. *et al.* (2011) 'Obesity prevention in the family day care setting: Impact of the Romp & Chomp intervention on opportunities for children's physical activity and healthy eating', *Child: Care, Health and Development*, 37(3), pp. 385–393. doi: 10.1111/j.1365-2214.2010.01205.x.

Stitou, M., Bourgeault, I.-L. and Kohen, D. (2018) 'The job content, context, and requirements of regulated home-based childcare workers', *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*, 27(4), pp. 607–628. doi: 10.1177/1048291117739417.

Tonge, K. L., Jones, R. A. and Okely, A. D. (2019) 'Quality Interactions in Early Childhood Education and Care Center Outdoor Environments', *Early Childhood Education Journal*, 47(1), pp. 31–41. doi: 10.1007/s10643-018-0913-y.

Tovar, A. *et al.* (2018) 'Nutritional Quality of Meals and Snacks Served and Consumed in Family Child Care', *Journal of the Academy of Nutrition and Dietetics*, 118(12), pp. 2280–2286. doi: 10.1016/j.jand.2018.08.154.

Tovar, A. *et al.* (2020) 'Exploring the Provider-Level Socio-Demographic Determinants of Diet Quality of Preschool-Aged Children Attending Family Childcare Homes', *Nutrients*, 12(5), p. 1368. doi: 10.3390/nu12051368.

Tucker, P. *et al.* (2015) 'Prevalence and influences of preschoolers' sedentary behaviors in early learning centers: A cross-sectional study', *BMC Pediatrics*, 15(1). doi: 10.1186/s12887-015-0441-5.

Vanderloo, L. M. *et al.* (2015) 'Environmental influences on preschoolers' physical activity levels in various early-learning facilities', *Research Quarterly for Exercise and Sport*, 86(4), pp. 360–370. doi: 10.1080/02701367.2015.1053105.

Vandeweghe, L. *et al.* (2016) 'Perceived effective and feasible strategies to promote healthy eating in young children: Focus groups with parents, family child care providers and daycare assistants', *BMC Public Health*, 16(1), p. 1045. doi:

10.1186/s12889-016-3710-9.

Wallace, R. and Mills, B. (2019) ‘A study of the food environment at Australian family day care’, *Nutrients*, 11(10), p. 2395. doi: 10.3390/nu11102395.

Ward, D. S. *et al.* (2020) ‘Keys to healthy family child care homes: Results from a cluster randomized trial’, *Preventive Medicine*, 132(October 2019), p. 105974. doi: 10.1016/j.ypmed.2019.105974.

Woodward-Lopez, G. *et al.* (2018) ‘Changes in Nutrition Policies and Dietary Intake in Child Care Homes Participating in Healthy Eating and Active Living Initiative’, *American Journal of Preventive Medicine*, 54(5), pp. S170–S177. doi: 10.1016/j.amepre.2018.01.007.

Yoong, S. L. *et al.* (2020) ‘A systematic review of interventions to improve the dietary intake, physical activity and weight status of children attending family day care services’, *Public Health Nutrition*, 23(12), pp. 2211–2220. doi: 10.1017/S1368980019005275.

Zhang, Z. *et al.* (2019) ‘The associations between environmental characteristics of early childhood education and care centers and 1-year change in toddlers’ physical activity and sedentary behavior’, *Journal of Physical Activity and Health*, 16(11), pp. 1000–1006. doi: 10.1123/jpah.2019-0066.

Zhang, Z. *et al.* (2021) ‘Associations Between the Child Care Environment and Children’s In-Care Physical Activity and Sedentary Time’, *Health Education and Behavior*, 48(1), pp. 42–53. doi: 10.1177/1090198120972689.

Appendices

Appendix A: Published article: Nutrition, physical activity and screen time policies and practices in family day care in NSW

public health research&practice
A JOURNAL OF THE SAX INSTITUTE

October 2021; Online early
https://doi.org/10.17061/phrp31342114
www.phrp.com.au

Brief report

Nutrition, physical activity and screen time policies and practices in family day care in NSW, Australia

Erin M Kerr[a,g], Bridget Kelly[a], Jennifer Norman[a,b,c], Susan Furber[b,c,d], Lara Hernandez[e], Megan L Hammersley[a,c], Sarah Ryan[a], Lisa Franco[b], Cecilia Vuong[f] and Anthony D Okely[a,c]

[a] Early Start, Faculty of the Arts, Social Sciences and Humanities, University of Wollongong, NSW, Australia
[b] Health Promotion Service, Illawarra Shoalhaven Local Health District, Wollongong, NSW, Australia
[c] Illawarra Health Medical Research Institute, Wollongong, NSW, Australia
[d] School of Health and Society, Faculty of the Arts, Social Sciences and Humanities, University of Wollongong, Australia
[e] NSW Ministry of Health, Sydney, Australia
[f] Health Promotion Service, South Western Sydney Local Health District, NSW, Australia
[g] Corresponding author: emk833@uowmail.edu.au

Article history

Publication date: October 2021
Citation: Kerr EM, Kelly B, Norman J, Furber S, Hernandez L, Hammersley ML, Ryan S, Franco L, Vuong C, Okely AD. Nutrition, physical activity and screen time policies and practices in family day care in NSW, Australia. Public Health Res Pract. 2021; Online early publication. https://doi.org/10.17061/phrp31342114

Key points

- We developed a policy review tool to assess the extent to which family day care service providers' policies adhere to national standards and relevant guidelines
- Service provider policies and practices were more likely to promote healthy eating compared with infant feeding, physical activity and screen time
- Service providers trained in the *Munch & Move* program were more likely to offer healthy eating and physical activity professional development to educators and have more comprehensive nutrition policies

Introduction

In Australia, family day care (FDC) is an approved Early Childhood Education and Care (ECEC) service where educators provide education and care for up to seven children aged 0–12 years, but only four children younger than school age (0–5 years), in a home environment.[1] More than 130 000 Australian children aged 0–12 years attended FDC in 2018[2]; comprising 12% of the ECEC sector (excluding outside school hours care services). Australian FDC services operate under a two-tiered structure: the service provider operates at the first tier at the organisational level and educators are registered through the service provider at the second tier providing education and care directly to the children. The service providers act as coordination units, monitoring and supporting educators to ensure they comply with service providers' policies as well as national standards and regulations.[3]

Munch & Move is a program designed to promote healthy eating, physical activity and reduced screen time in the ECEC sector.[4] The program began in 2008 and was enhanced in 2016 with health promotion officers providing additional support to service providers[5], to help disseminate training, resources and information to educators and/or families. Development work for *Munch & Move* was conducted with centre-based services, with adaptations appropriate to FDC, however, the impact of the program has only been evaluated in preschools.[6] The aim of this study was to examine the effect of *Munch & Move* training on existing policies, resources and professional development used by FDC service providers that were designed to promote healthy eating and physical activity, and reduce screen time for children aged 0–5 years.

Methods

Study design and setting

A cross-sectional study was conducted with FDC service providers from South Western Sydney and Illawarra Shoalhaven Local Health Districts in NSW, Australia, from February to September 2018. All FDC service providers in these districts (n = 85) were invited to participate in a telephone or face-to-face survey and policy review. The list of service providers was obtained from the Australian Children's Education & Care Quality Authority (ACECQA).[7]

Data collection measures: policy review and survey

Service providers' practices and policies were assessed in two ways: policy review and survey. We defined a service provider policy as a formal written policy owned by the service provider. To undertake the policy review, four separate policy review tools were developed to assess policies containing guidelines about nutrition, infant feeding and breastfeeding, physical activity and screen time. The policy review criteria were based on seven National and NSW nutrition and physical activity guidelines detailed on the 'Children's health and safety' resource page of the ACECQA website.[8] Supplementary tables 1–4 outline the criteria in each policy review tool and the source of each criterion (available from: doi.org/10.6084/m9.figshare.16676296).

Researchers independently reviewed each policy twice and each individual criterion was categorised as either 'no information provided'; 'topic is partially covered;' or 'topic is fully covered'; and given scores of 0, 0.5, or 1.0, respectively. Policy scores were compared and inconsistent scores were determined by consensus. The total number of criteria covered were summed to give an overall score for each individual policy. Policies were classed as comprehensive if more than two-thirds of the criteria were covered.

A 25-item survey was developed by the authors focusing on policies, resources provided to families and educators, and the type of professional development accessed about infant feeding, nutrition, physical activity and screen time for children aged 0–5 years.

The survey was reviewed by 12 experts experienced in health promotion and research in ECEC settings from the University of Wollongong and NSW Health. The survey was tested with two FDC service providers from another local health district. The lead author and a research assistant conducted the 30-minute survey with first-tier FDC employees on the phone or in person. Service providers' postcodes were used to determine socioeconomic status and remoteness using standardised indices.[9,10] Ethics approval was obtained from the University of Wollongong Human Research Ethics Committee (HREC/17/WGONG/139).

Data analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows (Armonk, NY: IBM Corp; version 23). Descriptive statistics were calculated for all variables. Fisher's exact test was used to test for associations between service providers trained or not trained in *Munch & Move*, their provision of resources and professional development to educators and families, and their possession of policies. Independent t-tests (parametric data) and Mann–Whitney U test (nonparametric data) were used to test for differences between policy scores and service providers trained or not trained in *Munch & Move*. Average policy scores were calculated from service providers with a policy in the category. Significance levels were set at $p < 0.05$.

Results

Thirty-four (40%) service providers from the ACECQA list ceased operating during the study period. Of the remaining 51 service providers, 28 participated (55%). These 28 service providers had 885 registered educators in total, ranging from 5 to 91 each. All service providers enrolled children aged 0–12 years. Most service providers (22 of 28) were located in the most disadvantaged areas (SEIFA quintiles 1 and 2)[9] and most providers (25 of 28) were in major cities.[10] Table 1 shows nutrition, physical activity and screen time information, and resources and professional development, offered by service providers that were trained and not trained in *Munch & Move*. Service providers trained in *Munch & Move* were more likely to offer professional development to educators on healthy eating (90% vs. 25%, p = 0.002) and physical activity (90% vs 13%, p = 0.002), and to have more comprehensive nutrition policies (average policy score out of 17: 11.8 vs. 9.0, p = 0.03). Service provider policies and practices were more likely to promote healthy eating compared with healthy infant feeding, physical activity and screen time.

Discussion

Differences were found between FDC service providers trained or not trained in *Munch & Move* regarding professional development and nutrition, physical activity and screen time policies but not in the resources provided. Other studies have generally found that professional development has improved both policies and resources[11–13], however a recent US study, which focused on educator professional development, found no difference in nutrition, physical activity or screen time policies between intervention and control.[14] The strong focus *Munch & Move* places on training educators and implementing policies[4] provides a possible explanation for the finding that service providers trained in the *Munch & Move* program were more likely to provide healthy

Table 1. Service provider practices of resource provision and educator professional development, and policy quality by service providers trained or not trained in *Munch & Move*

Service provider practices	Number *n* (%)	Trained in Munch & Move (*n* = 20) *n* (%)	Not trained in *Munch & Move* (*n* = 8) *n* (%)	*p*-value
Resources supplied to families[a]				
Healthy eating	26 (93)	18 (90)	8 (100)	1.000
Promoting physical activity	19 (68)	15 (75)	4 (50)	0.371
Limiting screen time	18 (64)	14 (70)	4 (50)	0.400
Breastfeeding	16 (57)	13 (65)	3 (38)	0.231
Fussy eating	13 (46)	12 (60)	1 (13)	0.058
Supervised floor-based play	9 (32)	8 (40)	1 (13)	0.214
Introducing solids	8 (29)	7 (35)	1 (13)	0.371
Fundamental movement skills	6 (21)	6 (30)	0 (0)	0.141
Resources supplied to educators[a]				
Healthy eating learning experiences	25 (89)	19 (95)	6 (75)	0.188
Supervised floor-based play	21 (75)	17 (85)	4 (50)	0.142
Fundamental movement skills	21 (75)	17 (85)	4 (50)	0.142
List of physical activity equipment	20 (71)	14 (70)	6 (75)	1.000
'Breastfeeding welcome here' sign	9 (32)	8 (40)	1 (13)	0.214
Professional development offered to educators[a]				
Healthy eating	20 (71)	18 (90)	2 (25)	0.0002
Physical activity	19 (68)	18 (90)	1 (13)	0.0002
Service provider policies[b]	**Total**	**Trained in Munch & Move (*n* = 20)**	**Not trained in *Munch & Move* (*n* = 7)**	***p*-value**
Nutrition policy[a]				
n (%)	27 (100)	20 (100)	7 (100)	NA
Average policy score (out of a total of 17 points)[c]	11.1	11.8	9.0	0.03
Infant feeding policy				
n (%)	24 (89)	19 (95)	5 (71)	0.16
Average policy score (out of a total of 6 points)[c]	3.1	3.2	2.7	0.52
Physical activity policy				
n (%)	11 (41)	7 (35)	4 (57)	0.39
Average policy score (out of a total of 4 points)[d]	2.3	2.5	1.9	0.56
Screen time policy				
n (%)	14 (52)	9 (45)	5 (71)	0.39
Average policy score (out of a total of 6 points)[d]	2.3	2.9	1.2	0.06

NA = not applicable
[a] Fisher's exact tests
[b] 27 service providers provided policies to review. Average policy scores were calculated from service providers with a policy.
[c] Independent t-tests
[d] Mann–Whitney U test

eating and physical activity professional development and have comprehensive nutrition policies.

Our study found most FDC service providers promoted nutrition and healthy eating messages through policies and resources provided to families and educators. However less information was provided about infant feeding, physical activity and screen time. Similar to our findings, studies in the US have demonstrated that family child care homes (equivalent to FDC) were more likely to provide families with information relating to nutrition than physical activity, and also hold more comprehensive nutrition policies than physical activity policies.[15,16] It is unsurprising that fewer service providers in our study had comprehensive policies relating to infant feeding, physical activity and screen time as these are not mandated under national regulations.[3] Of the limited studies conducted in Australian FDC services, Lum et al.[17] found that more than two-thirds of FDC service providers in the NSW Hunter New England region of NSW had comprehensive nutrition policies but less than one-third had comprehensive physical activity and screen time policies and none had comprehensive infant feeding policies. Bravo et al.[18] found that nutrition policies lacked detail and were not comprehensive. McGuire et al.[19] qualitatively analysed infant feeding policies in Australian centre-based and FDC services, and found most policies focused on minimising risk within child care environments.

Limitations of our study include potential bias from self-reported data, and the survey and policy audit instruments not being validated. However, written policies were obtained to cross-check reporting and the policies were reviewed by two different researchers. The sample may not be representative of the FDC sector because of the low sample size and the high proportion of service providers who had previously participated in *Munch & Move* training (71% of participating service providers had completed the *Munch & Move* training compared with 53% of all service providers who were invited to participate). The sample may not be adequately powered because of its small size. It is likely that recruitment was affected by state legislative changes that led to the closure of a high proportion of service providers[20] and fee structure changes that increased administrative pressure.[20]

Conclusion

Our findings suggest that *Munch & Move* training had a positive impact on FDC service providers' policies and educators' professional development but service providers need additional support to adopt policies and to provide resources to educators and families, specifically targeting infant feeding, physical activity and screen time. Further research should investigate whether policies, resources and professional development provided by service providers to educators and families are associated with improvements in educator practices and whether they have a positive impact on children's physical activity and eating behaviours. Future studies are also needed to validate the policy review tool that could be used to assess other Australian ECEC services' policies.

Acknowledgements

This work was supported by the Prevention Research Support Program, funded by the NSW Ministry of Health.

Peer review and provenance

Not commissioned, externally peer reviewed.

Competing interests

None declared.

Author contributions

EK was responsible for acquisition of the data, policy review and drafting the article, and MH and SR contributed to the policy review. All authors contributed to the conception and design of the research, interpretation of data and critically revised the manuscript.

References

1. Australian Children's Education and Care Quality Authority. Guide to the National Quality Framework. Canberra: ACECQA; 2018 [cited 2021 Sep 10]. Available from: www.acecqa.gov.au/sites/default/files/2018-11/Guide-to-the-NQF_0.pdf
2. Department of Education and Training. Child care in Australia. Canberra: Commonwealth of Australia; 2018 [cited 2019 Apr 26]. Available from: www.dese.gov.au/key-official-documents-about-early-childhood/early-childhood-and-child-care-reports/child-care-australia-report-december-quarter-2018
3. NSW Government. Education and Care Services National Regulations (2011 SI 653). Sydney: NSW Government; 2018 [cited 2019 Feb 6]. Available from: www.legislation.nsw.gov.au/#/view/regulation/2011/653/chap4/part4.2/div1
4. Lockeridge A, Innes-Hughes C, O'Hara BJ, Brian M, Rissel C. Munch & Move: evidence and evaluation summary. Sydney: NSW Ministry of Health; 2015 [cited 2019 May 22]. Available from: healthykids.nsw.gov.au/wp-content/uploads/2020/05/FINALMunchMoveSummary.pdf
5. NSW Government. Munch & Move support. Sydney: NSW Government; 2020 [cited 2020 Aug 27]. Available from: healthykids.nsw.gov.au/munch-move-support/

6. Hardy LL, King L, Kelly B, Farrell L, Howlett S. Munch and Move: evaluation of a preschool healthy eating and movement skill program. Int J Behav Nutr Phys Act. 2010;7(1):80.
7. Australian Children's Education and Care Quality Authority. National registers. Canberra: ACECQA; 2019 [cited 2019 Sep 23]. Available from: www.acecqa.gov.au/resources/national-registers
8. Australian Children's Education and Care Quality Authority. Quality area 2 – children's health and safety. Canberra: ACECQA; 2021 [cited 2021 Sep 15]. Available from: www.acecqa.gov.au/nqf/national-quality-standard/quality-area-2-childrens-health-and-safety
9. Australian Bureau of Statistics. Socio-economic indexes for areas, Australia. Canberra: ABS; 2018 [cited 2019 Aug 12]. Available from: www.abs.gov.au/ausstats/abs@.nsf/Lookup/by Subject/2033.0.55.001~2016~Main Features~SOCIO-ECONOMIC INDEXES FOR AREAS (SEIFA) 2016~1
10. Australian Bureau of Statistics. The Australian statistical geography standard (ASGS) remoteness structure. Canberra: ABS; 2018 [cited 2019 Aug 12]. Available from: www.abs.gov.au/websitedbs/d3310114.nsf/home/remoteness+structure
11. Woodward-Lopez G, Kao J, Kuo ES, James P, Lenhart K, Becker C, et al. Changes in nutrition policies and dietary intake in child care homes participating in Healthy Eating and Active Living initiative. Am J Prev Med. 2018;54(5):S170–7.
12. Kao J, Woodward-Lopez G, Kuo ES, James P, Becker CM, Lenhart K, et al. Improvements in physical activity opportunities: results from a community-based family child care intervention. Am J Prev Med. 2018;54(5):S178–85.
13. Trost SG, Messner L, Fitzgerald K, Roths B. A nutrition and physical activity intervention for family child care homes. Am J Prev Med. 2011;41(4):392–8.
14. Ward DS, Vaughn AE, Burney RV., Hales D, Benjamin-Neelon SE, Tovar A, Ostbye T. Keys to healthy family child care homes: results from a cluster randomized trial. Prev Med (Baltim). 2020;132:105974.
15. Trost SG, Messner L, Fitzgerald K, Roths B. Nutrition and physical activity policies and practices in family child care homes. Am J Prev Med. 2009;37(6):537–40.
16. Gunter KB, Rice KR, Trost S. Nutrition and physical activity policies and practices in family child care homes in Oregon: baseline findings from the health home child care project. Ext J. 2012;50(3):3FEA3.
17. Lum M, Grady A, Falkiner M, Jones J, Finch M, Green S, et al. Assessing the implementation of healthy eating and physical activity policies and practices in the family day care setting: a cross sectional study. Heal Promot J Aust. 2020;1–10.
18. Bravo A, Cass Y, Tranter D. Good food in family day care: improving nutrition and food safety in family day care. Nutr Diet. 2008;65(1):47–55.
19. McGuire J, Gallegos D, Irvine S. Infant feeding nutrition policies in Australian early childhood education and care services: a content and qualitative analysis. Int J Child Care Educ Policy. 2018;12(1):14.
20. Family Day Care Australia. Family Day Care Australia submission to the Senate Select Committee on Red Tape inquiry into the effect of red tape on child care. NSW: Family Day Care Australia; 2018 [cited 2019 May 23]. Available from: www.familydaycare.com.au/representing-you/submissions

Appendix B: Published article: Foods provided to children in family day care: an observational study

Public Health Nutrition: page 1 of 9 doi:10.1017/S1368980021001506

Foods provided to children in family day care: an observational study

Erin M Kerr[1,*], Bridget Kelly[1], Megan L Hammersley[1,2], Lara Hernandez[3], Jennifer Norman[1,2,4], Susan Furber[2,4], Cecilia Vuong[5], Sarah Ryan[1], Karen Wardle[5] and AD Okely[1,2]

[1]Early Start, Building 21, Faculty of the Arts, Social Sciences and Humanities, University of Wollongong, Wollongong, New South Wales 2522, Australia: [2]Illawarra Health and Medical Research Institute, Wollongong, New South Wales, Australia: [3]Centre for Population Health, NSW Ministry of Health, St Leonards, New South Wales, Australia: [4]Health Promotion Service, Illawarra Shoalhaven Local Health District, Warrawong, New South Wales, Australia: [5]Health Promotion Service, South Western Sydney Local Health District, Liverpool, New South Wales, Australia

Submitted 24 November 2020: Final revision received 19 March 2021: Accepted 31 March 2021

Abstract

Objective: To assess the quality and quantity of foods and beverages provided to children aged 0–5 years in family day care and identify structural and socio-demographic factors associated with the nutritional quality of food provided.

Design: A cross-sectional study measured the food and beverages provided to children using weighed food records. The number of serves from different food groups was calculated according to the Australian Guide to Healthy Eating, and a healthy food provision index score was created. Associations between structural and socio-demographic factors and healthy food provision index scores were analysed using linear mixed models.

Setting: Family day care services in two large geographic areas in New South Wales, Australia.

Participants: One hundred and four children in thirty-three family day care services.

Results: During attendance at childcare, most children met recommended servings of fruit but not dairy, vegetables, lean meat and meat alternatives and wholegrains. Discretionary foods exceeded recommendations. Children's age, socio-economic status and the type of main meal provided were significantly associated with the healthy food provision index score.

Conclusions: Foods provided to children in family day care are aligned with dietary recommendations for fruit but not vegetables, dairy, lean meat and meat alternatives, wholegrains or discretionary foods. Interventions to promote healthy eating are needed to support families and educators to improve the nutritional quality of food provided to children.

Keywords
Family day care
Nutrition
Food provision
Children

In the early years, nutrition is vital for optimal health and cognitive, emotional and physical development and can reduce the risk of developing chronic diseases in later life[1]. Australian children's diets are far from ideal with only 20 % of children aged 2–3 years and 3 % of children aged 4-8 years meeting the recommended intake of vegetables[2]. Further, discretionary food and beverages contribute to 30 % and 38 % of energy intake in children aged 2-3 and 4-8 years, respectively, contributing to excess intakes of total and saturated fat, added sugars and Na[3].

Systematic reviews have found that Early Childhood Education and Care (ECEC) services can improve children's dietary intake[4,5]. They can also communicate health messages to support families to make positive changes at home[6]. Nutrition guidelines in New South Wales recommend that children in ECEC services be provided with at least 50 % of the Australian Dietary Guidelines' recommended daily intake of all nutrients when attending an ECEC services for more than 8 h or when they receive morning tea, lunch and afternoon tea while in attendance[7].

*Corresponding author: Email emk833@uowmail.edu.au

In Australia, family day care (FDC) is a form of ECEC service where educators provide education and care for up to four children below school age (0–5 years) and an additional three school-aged children (5–12 years) in a home environment[8]. FDC educators must be registered through an approved service provider to work as a FDC educator in Australia and receive government subsidies[8]. The service provider monitors and supports educators to ensure they comply with the service providers' policies and the National Quality Framework (Australia's ECEC regulatory system composed of the National Quality Standard, the Education and Care Services National Regulations and the Early Years Learning Framework)[8]. Over 125 000 Australian children aged between 0 and 12 years attended FDC in 2019[9].

Most research exploring the nutrition environment in ECEC services has been conducted with centre-based services, with little on FDC[10,11]. Studies involving direct observation in Family Child Care Homes (equivalent to FDC) in the USA have found children's diet quality has been associated with the food provided[12,13], nutrition education[12], nutrition policy[12], educator income[14], ethnicity[14] and main language spoken at home[14]. Additionally, children were not being provided with, or consuming, adequate amounts of vegetables, total protein foods, seafood and plant-based proteins and wholegrains[13]. Unlike the USA where all food is provided by educators, in Australia, food can be provided by parents/caregivers, educators or a combination of both, depending on the preference of the individual educator[15]. To our knowledge, only four studies have been published in Australia that explore healthy eating in FDC; however, all have involved self-reported data and no studies captured information on the quantity of food provided[15–18]. Therefore, the present study aimed to: (1) assess the quality and quantity of food and beverages provided to children aged 0-5 years in FDC services in two large geographic areas in New South Wales, Australia, and (2) identify structural and sociodemographic factors associated with the nutritional quality of foods provided to children.

Methods

Setting and design

A cross-sectional study involving direct observation within thirty-three FDC services was conducted between April 2019 and February 2020 in the south west Sydney and Illawarra Shoalhaven regions of New South Wales.

Study sample and recruitment

Educators were recruited through their FDC service provider who had previously participated in a survey and policy review (unpublished results)[19]. Based on the sample of twenty-eight service providers from the previous study, 700 educators were eligible to participate with approximately 2200 children. A sample size of approximately 220 children was calculated to be sufficient to estimate children's physical activity levels, which was an outcome of interest in the larger study. The calculation used baseline data of children's physical activity levels in Family Child Care Homes, with an intraclass correlation of 0·33, a mean of 8·1 (SD 3·1) min/h in physical activity and a design effect of 1·99 (using a cluster size of three children per service). Once the service provider agreed to participate, they were asked to provide a list of all their eligible educators' contact details (email and/or telephone number) to be invited to participate in the study as this information is not publicly available. Where service providers did not want to provide their educators' contact details without their permission, the service providers emailed their educators an invitation to participate, including the participant information sheet and consent forms. Educators were eligible if they cared for at least three children aged 0-5 years, and their service provider was situated in the sampling areas. If an educator consented to participate, a data collector contacted them to confirm their eligibility, introduce themselves and explain what the observation would entail.

Multiple recruitment strategies were utilised, including face-to-face recruitment at FDC meetings and the development of a brief video to explain the study (which was sent to service providers and educators via email). Educators were informed of the date of the observation 24 h in advance and asked not to inform parents about the scheduled observation so parents would not alter the types of food provided to their child (if applicable). Children were included in the current study if food data were collected for lunch and at least one snack (morning or afternoon tea). As a thank you for participating in the study, an AUD$100 educational resource voucher was provided to educators who completed the observation.

Measurements

Parent/caregivers completed a short survey that was attached to the consent form to capture information on their child's sex, date of birth, postcode of residence and the main language spoken at home. Educators also completed an online survey when they provided consent that included information on their postcode of residence, language spoken at home, ECEC experience (including FDC) and qualifications and nutrition-related professional development undertaken in past 2 years. Data collection was scheduled between 1 week and 1 month after the educator provided consent and competed the survey.

Postcode of residence was used as a proxy for socioeconomic status (SES), based on the Australian Bureau of Statistics' Index of Relative Socioeconomic Disadvantage, categorised into tertiles[20]. Educators and children were categorised into English-speaking or non-English-speaking

backgrounds based on their main language spoken at home (using the Australian Bureau of Statistics' Australian Standard Classification of Languages)[21].

Food audit

A food audit tool was developed in Research Electronic Data Capture (REDCap) to record the amount and type of foods provided to children at FDC by families and educators based on a tool used by Kelly *et al.* (2010)[22]. REDCap is a secure online web application used to build and manage surveys and databases for research studies[23]. The tool classified foods into one of nine food and beverage categories (fruit, vegetables, dairy, grain (cereal) foods, meat and meat alternatives, sweet discretionary foods, savoury discretionary foods, discretionary beverages and main meal). Main meals were classified into mixed dishes; sandwich/wrap/roll; take away. A mixed dish was defined as a main meal that was provided by the educators or parent/caregiver that included more than one food group and was not a sandwich, wrap or roll or take away. The tool also recorded the ingredients in the mixed dishes and sandwich/wrap/rolls. Data collectors recorded details of packaged foods including brand name and product description. Food was weighed using Salter scales (model number 1035 SSBKDR) and photographed on an A3 grid at a 45° angle (centimetre increments)[24]. To minimise handling of food, it was weighed in the serving container or plate, when appropriate. In these cases, the audit tool captured information on total weight and container weight, which was subtracted from the relevant food items. Food and beverages provided by the family were weighed and photographed in the morning before the first meal, and food and beverages provided by the educator were weighed and photographed before each meal.

A dietitian (E.K.) calculated the number of serves of each of the foods provided comparing the assessed weight of the foods with the Australian Guide to Healthy Eating standard serving sizes[26]. The serves of each food group from mixed meals were calculated using Australian food composition data on Foodworks[26,27]. The food photographs were used to assist in the calculation of food serves for mixed foods, whereby the photographs were used to estimate the proportion of the total weight attributed to individual items. Shared food platters were divided by the number of children who were provided with the food as an estimation of individual serving sizes.

Discretionary foods and beverages were determined based on the Australian Guide to Healthy Eating[25] and the Australian Bureau of Statistics Discretionary Food List[28]. Kilojoule content of the foods was calculated using the nutrition information panel of packaged food or Australian food composition data, if the nutrition information panel was not available. The number of serves of discretionary food was calculated by dividing the kilojoules of the food by 600 kJ (1 serve of discretionary food = 600 kJ)[25].

Healthy food provision index score

A healthy food provision index score of provided foods was created to measure the alignment of the food provided in FDC services to the Australian Guide to Healthy Eating. The score was adapted from other scores[29,30]; however, it was simplified as it was based on the food provided on 1 d in FDC and therefore could not capture overall diet quality, such as variety of vegetables or inclusion of fish or legumes in the diet that are not typically consumed daily. For each food group, a score out of 1 was assigned to indicate the degree that the child was provided with at least 50 % of the recommended serves of the food group for their age while in FDC (Table 1), with a maximum of five points allocated in total for all food groups. A score of 0 indicated the food was not provided at the recommended guidelines, and a score of 1 indicated the food was provided at or above recommendations. For example, a 3-year-old child provided with 0·75 serves of vegetables would receive a score of 0·6 (0·75 divided by 1·25 serves) for this food group. Scores exceeding minimum recommendations were truncated at 1. The Australian Guide to Healthy Eating recommends mostly wholegrain and/or high cereal fibre varieties. Therefore, up to 0·5 points were given if they were provided with 50 % of the recommended number of serves of grains and up to another 0·5 if at least 1 of these serves was wholegrain. For discretionary foods and beverages, this scoring system was reversed, with higher scores reflecting lower amounts provided. If more than half a serve of discretionary food was provided, then the category received a negative score up to the value of −1, and if no serves were provided, then the category was scored at 1. Children that had between 0·1 and 0·5 serves of discretionary foods received a score of 0. For example, 0·3 serves of discretionary foods resulted in a score of 0 and 1·5 serves of discretionary foods resulted in a score of −1 (0·5–1·5 serves). Scores of the individual food categories were summed, resulting in a healthy food provision index score ranging from −1 to 6 on a continuous scale, with a higher score indicating better food provision quality.

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 25 (IBM Corp.). Descriptive statistics were calculated using means and standard deviations for continuous variables, and frequencies and percentages for categorical variables. Linear mixed models were used to examine the difference between healthy food provision index scores by child, educator and service provider and family covariates (SES, main language spoken at home, educator experience, food provider (i.e. FDC or parent), educator qualification, nutrition professional development, ECEC experience, presence of a comprehensive nutrition policy (at the service provider level), type of main meal (e.g. sandwich or mixed dish) or number of meals provided). To account for the clustered nature of the data, the models included the FDC educator as a random effect. Fixed effects such as age of child, sex of child, SES and cultural background were included as covariates in the mixed models. Significance levels were set at $P < 0·05$.

Table 1 Healthy food provision index score components and standards for scoring

Food category	Number of serves for maximum score (1–2-year-olds)	Number of serves for maximum score (2–3-year-olds)	Number of serves for maximum score (4–8-year-olds)	Maximum points awarded	Minimum points awarded
Vegetables	1*	1·25	2·25	1	0
Fruit	0·25	0·5	0·75	1	0
Dairy	0·5*	0·75	0·75*	1	0
Total grains/cereals	2·0	2·0	2·0	0·5	0
Whole grains	1·0	1·0	1·0	0·5	0
Lean meat and meat alternatives	0·5	0·50	0·75	1	0
Discretionary food and beverages	0	0	0	1	−1

*Where the Australian Guide to Healthy Eating recommendations were reported as a range, the lower range was used.

Results

The study was intended to finish once the sample size was reached; however, data collection ended in March 2020 due to COVID-19 restrictions coming into force. During the possible data collection period, ten service providers agreed to participate, four had closed down and fourteen declined. Thirty-three observation visits were conducted, and data were collected on 104 children. Thirty-two children had all their food provided from home, thirty-one children had all their food provided by educators and forty-two children had food provided by both educators and from home. Twenty-eight children had lunch and one snack, and seventy-six children had lunch and two snacks. Educator and child characteristics are described in Table 2. More than half of educators (n 19) spoke a language other than English as their main language, while half of children came from homes that spoke a language other than English as their main language. Children were aged from 11 months to 5·3 years, and the mean age of children was 3·2 (SD 1·2) years. Twenty-five educators were registered with a service provider who had a comprehensive nutrition policy.

Most children were provided with fruit (n 103) and grains (n 101) followed by dairy (n 77), vegetables (n 74), discretionary foods (n 74), lean meats and meat alternatives (n 64) and wholegrains (n 27) (Table 3). Fifty-nine children were provided with a mixed dish (n 59), and forty-two children were provided with a sandwich, wrap or roll (n 42). Sweet discretionary foods were more common than savoury discretionary foods and discretionary beverages. Sweet biscuits were the most common sweet discretionary food (n 30), followed by cakes, muffins, scones, cake-type desserts (n 12) and muesli, cereal, nut and seed style bars (n 30). Savoury biscuits were the most common savoury discretionary food (n 18), followed by processed meats (n 16) and chips and extruded snacks (n 11).

Children's age, SES and the type of main meal provided were significantly associated with the healthy food provision index score (Table 4). Children aged 11–23 months had the highest nutritional quality of food provided compared with children aged 2–3 years and 4–5 years (3·5 *v.* 3·0 *v.* 2·4, $P = 0·006$). Despite the fact that their dietary requirements were lower, on average children aged 11–23 months were provided with more serves of dairy and wholegrains and fewer serves of discretionary foods compared with the other age groups. The primary food groups associated with differences in food quality were dairy and wholegrains. Children living in low SES suburbs were significantly more likely to have a higher healthy food provision index score compared with children living in medium/high SES areas (3·1 *v.* 2·8, $P = 0·03$). More vegetable serves contributed to the higher healthy food provision index score in children from lower SES areas. Children provided with mixed dishes had a higher healthy food provision index score compared with children provided with a sandwich, wrap or bread roll (3·5 *v.* 2·7, $P = 0·008$). The higher score in mixed dishes was influenced by increased provision of vegetables and lean meat and meat alternatives and less discretionary foods.

Discussion

This is the first known Australian study to assess the nutritional quality and quantity of food provided to children in FDC using weighed food records and observations. Most children were not provided with recommended amounts of vegetables, wholegrains, dairy, and lean meat or meat alternatives but were provided with excess discretionary foods. Additionally, children's age, SES and type of main meal were associated with the healthy food provision index score.

Our findings are consistent with other research in FDC conducted in Australia[16,17] and internationally[13], and from Australian ECEC centre-based services[22,31–34]. For example, using diet recalls with FDC educators in South Australia for 367 children aged 1-5 years, researchers found that most children in FDC between 5 and 8 h were provided with bread/cereals (94 %), fruit (89 %) and discretionary foods (87 %) but only 15 % of children were provided with vegetables[16]. Similar to our study, a combination of food

Table 2 Sociodemographic characteristics of family day care educator and children

Educator characteristics	*n*	%
Main language spoken at home		
English	14	42
Language other than English	19	58
Socio-economic status		
Low (Quintiles 1–2)	15	46
Medium/High (Quintiles 3–5)	18	54
Sex, female	33	100
Years worked in Early Childhood Education and Care		
<10 years	17	52
≥10 years	16	48
Years working in family day care		
<10 years	24	73
≥10 years	9	27
Education		
Certificate III	7	21
Diploma	23	70
University	3	9
Nutrition-related professional development in past 2 years		
Yes	10	30
No	23	70
Child characteristics		
Age		
11–23 months	22	21
2–3 years	49	47
4–5 years	33	32
Sex, female	59	57
Main language spoken at home		
English	53	51
Language other than English	51	49
Socio-economic status		
Low (Quintiles 1–2)	44	42
Medium/High (Quintiles 3–5)	60	58

Table 3 Frequency of children provided with food groups and discretionary food and beverage items in family day care and average serve size of food groups if the foods were provided

	Number (%) of children provided		Number (%) of children meeting 50 % of the recommended serves of the food group for their age		Serves per child (if food provided)	
Food category	*n*	%	*n*	%	Mean	SD
Fruit	103	99	92	89	1·3	0·8
Total grains/cereals	101	97	56	36	2·1	1·1
Wholegrains	27	26	N/A		1·5	0·9
Dairy	77	74	41	25	0·8	0·5
Vegetables	74	71	18	17	1·1	0·6
Lean meat and meat alternatives	64	61	20	19	0·5	0·3
Discretionary (total)	74	71	N/A		1·5	1·1
Sweet discretionary foods	49	47	N/A		1·4	0·8
Savoury discretionary foods	45	43	N/A		0·8	0·7
Discretionary beverages	3	3	N/A		0·7	1·9

providers was observed, including parents or educators or both[16]. One Australian intervention, Good Food in Family Day Care (1998-2000), also reported that over 90 % of children were provided with fruit and grains/cereals (pre- and post-nutrition intervention); however, less than two-fifths of children aged 1–5 years old were provided with vegetables after the intervention[17]. The intervention was conducted with educators from seven service providers and parents supplied most of the food[17]. Dietary observations in family child care homes (equivalent to FDC) in the USA also reported that children were not provided with enough vegetables and wholegrains but were close to meeting the American guidelines for

Table 4 Factors associated with healthy food provision index scores of food provided to children

Independent variables		Healthy food provision index score		
		Mean	SD	*P*-value
Age	11–23 months	3·5	1·3	0·006*
	2–3 years	3·0	1·2	
	4–5 years	2·4	1·2	
Sex	Female	2·7	1·3	0·690
	Male	3·2	1·2	
Child SES†	Low	3·1	1·4	0·033*
	Medium/High	2·8	1·2	
Child language	English speaking	2·8	1·2	0·585
	Non-English speaking background	3·0	1·4	
Educator SES†	Low	3·1	1·4	0·337
	Medium/High	2·8	1·2	
Educator language	English speaking	2·9	1·2	0·686
	Non-English speaking background	2·9	1·4	
Food provider	Family	2·3	0·9	0·166
	Educator	3·7	1·1	
	Family and educator	2·8	1·4	
Nutrition policy	Comprehensive	3·0	1·3	0·691
	Not comprehensive	2·7	1·3	
Nutrition-related professional development (last 2 years)	Yes	3·4	1·3	0·502
	No	2·7	1·2	
ECEC‡ experience	<10 years	2·6	1·2	0·782
	≥10 years	3·3	1·3	
ECEC qualification	Certificate III	3·6	1·1	0·354
	Diploma	2·9	1·4	
	University	3·3	1·1	
Type of main meal	Mixed dish	3·4	1·2	0·008*
	Sandwich/wrap/roll	2·2	1·1	
Number of meals	Lunch and 1 snack	3·5	1·1	0·081
	Lunch and 2 snacks	2·7	1·3	

*Socio-economic status.
†Early childhood education and care.

fruit[15]. However, unlike our study, children were close to meeting the American dairy recommendations and all food was provided by the educators[13]. Studies from Australian ECEC centres were parents[33] and centres[31,32] provided food also found that children are not being provided[31,32] or consuming foods[33] in line with dietary recommendations, particularly for vegetables[31,33], lean meat and meat alternatives[31,33] and dairy[31,33]. Furthermore, compared with our study, a lunchbox audit assessing the food provided by parents to Australian preschool children in 2010 found that fewer children were provided with fruit (75 %), vegetables (3 %) and dairy (3 %) but when they were provided with these foods, the mean number of serves were similar[22]. Similar proportions of children were provided with discretionary foods (69 %), but our study found that children were provided with slightly fewer serves (1·8 serves)[22].

Our study found that children aged 4–5 years had lower healthy food provision index scores compared with younger children. This was primarily driven by children in the older age category receiving more discretionary foods and less dairy, as well as their increased dietary requirements. The increase in discretionary foods in older children is comparable with other studies[3,35] and could be attributed to older children being able to clearly vocalise and communicate their food desires compared with younger children[36]. Furthermore, despite vegetable provision remaining similar for each age group, vegetable recommendations almost double between the 2-3 and 4-8 year age groups (from 2 ½ serves/d to 4 ½ serves/d)[25]. These findings are supported by a longitudinal study of Victorian children's daily intake that found vegetable intake did not change considerably from 9 months to 5 years[55]. Many parents may be unaware of the increase in requirements at this age or may find the recommendations overwhelming[37].

Contrary to previous research that has indicated that children from low SES backgrounds consume more discretionary foods and less vegetables than children from high SES backgrounds[56], our study found that children living in a lower SES area were more likely to have higher healthy food provision index scores. Tovar *et al.* (2020) also found that US children attending FDC where educators had lower incomes had higher diet quality scores[34]. Conversely, Australian centre-based studies have reported no associations between SES (using postcode as a proxy) and food provided by parents[22] or centres[31]. It is important to note that postcode was the proxy for SES in our study and other factors such as parental education and income were not assessed which may have a greater impact on food provision.

We found that mixed dishes were also associated with higher healthy food provision index scores compared with a sandwich, wrap or roll. Mixed dishes included dhal, spaghetti Bolognese and mixed food platters and generally contained more vegetables and meat/meat alternatives. On the other hand, children provided with sandwiches generally had more wholegrains. While sandwiches/wraps/rolls generally contained less vegetables and lean meat and meat alternatives in this study, they can be a healthy, easy and convenient lunch option, particularly when served with healthy snack options.

Nutrition interventions in ECEC services appear to be more effective in improving the food when centres provide food compared with centres where families provide food. Australian ECEC nutrition interventions targeting the food provided by centres have found significant improvements in the provision of all food groups[34,38] and the consumption of fruit[34,38], vegetables[34,38], grains/cereals[38,39], lean meat/meat alternatives[34,38], dairy[34] and overall diet quality scores[39]. However, healthy eating and physical activity interventions involving ECEC centres where families provide food demonstrated no significant improvements in the provision[65] or consumption[40] of food groups and discretionary foods. This could be because policy and practice changes at the ECEC level may be more likely to influence educators, cooks and directors compared with parents. Furthermore, FDC educators have expressed challenges in communicating with families about food[15,16]. One study reported that almost half (46 %) of educators did not feel confident telling parents that the quality of the food supplied was unsatisfactory[16]. Educators have also reported many barriers to communicating with parents including fear of losing business or damaging trust and relationships with families, low confidence, knowledge or skills to have challenging conversations and that parents are too busy to listen[16]. There are many factors that may contribute to educators providing more nutritious foods in comparison with families, including that ECEC qualifications involve nutrition training, educator opportunities for nutrition-related professional development, and that Education and Care Services National Regulations state that food provided by educators must be nutritious and adequate in quantity[41]. Despite these positive influences, Wallace (2019) found that educators' nutrition knowledge and attitudes can be barriers to providing healthy eating environments[15].

Parents/caregivers experience a range of barriers to providing children with healthy food. There are many strong interpersonal and environmental factors that affect what food children are provided, including time, children's food preferences and fussy eating, parental-guilt for sending them to ECEC services (which include FDC), wanting their children to feel loved, fear of children not eating enough or being hungry, not wanting to waste food and misleading food marketing[15,42,43]. Intervention strategies should target the complex barriers parents and educators experience. Future interventions should focus on supporting families and educators to provide children with healthy and easy to prepare lunch and snack options by replacing discretionary foods with vegetables, meat/meat alternatives and wholegrains. FDC educators should also be provided with professional development, support from their service provider and resources on communicating with families about food provision and nutrition. It should be noted that FDC educators have a number of responsibilities and many educators experience difficulties with compliance to the national regulations and quality standards[44]. Educators should be upskilled to embed healthy eating into their pedagogical practices and utilise the service provider's nutrition policy and national policies to promote healthy eating. For example, in Australia, the promotion of healthy eating can be used to demonstrate how regulatory requirements and outcomes of the National Quality Framework are being met[8,45].

Several limitations are present in this study. The small sample size (due to recruitment challenges and COVID-19 restrictions) means that caution must be applied as the findings might not be representative of the wider population. However, this remains the first Australian study to collect food data in FDC using weighed food records and observations. Second, the study only assessed the food provided to children on 1 d. The present study also only measured food provision, not intake. Baseline findings from the Keys to a Healthy Home randomised controlled trial found that food provided was significantly associated with the diet quality of food consumed[12]; however, studies have also found that children generally consume less food than provided[13,34,38]. Furthermore, we only captured food data for part of a day and do not know what children were provided for the remainder of the day. Nonetheless, these findings are still concerning and are consistent with Australian national dietary data for children's intake, which also highlight that vegetables, lean meat and meat alternatives and dairy are not being consumed in adequate amounts in children's overall diet[46]. We did not capture any anthropometric measurements for children or educator/parent health indicators for non-communicable diseases that could have possibly contributed to the types of food provided. Postcode was used as an indicator of SES for educators and children/families; however, information on parental education and income was not assessed which may have a greater impact on food provision. Finally, the healthy food provision index score we developed is not validated.

The findings of our study suggest there is opportunity to improve the nutritional quality and quantities of food provided to children attending FDC, particularly replacing discretionary foods with vegetables, meat and meat alternatives, and dairy and choosing wholegrain alternatives over refined grains. Due to the complex and multifaceted factors contributing to the high provision of discretionary foods and suboptimal provision of food groups, many strategies are required to improve the food provided to children in FDC targeting the service provider,

educators and parents. Further research to investigate the barriers and potential solutions to providing nutritious foods to young children attending FDC is warranted.

Acknowledgements

Acknowledgements: The authors wish to thank participating educators and children, and service providers for their assistance with recruitment. We gratefully acknowledge the contribution of research assistants Emma Nicholls and Kaitlyn Neto for their assistance with data collection. *Financial support*: This work was supported by the Prevention Research Support Program, funded by the New South Wales Ministry of Health. This research has been conducted with the support of the Australian Government Research Training Program Scholarship. *Authorship*: All authors contributed to the conception and design, interpretation of the data, critically revised the article and approved the final version to be published. E.K. was responsible for acquisition of data, analysis of data and drafting the article. *Conflict of interest*: None. *Ethics of human subject participation*: This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving research participants were approved by the University of Wollongong Human Research Ethics Committee (2019/ETH10743). Written informed consent was obtained from all educators and parent or caregivers of participating children.

References

1. Engle P, Huffman SL (2010) Growing children's bodies and minds: maximizing child nutrition and development. *Food Nutr Bull* **31**, 186–198.
2. Australian Bureau of Statistics (2018) National Health Survey: First Results, 2017-18. In: 4364.0.55.001. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/bySubject/4364.0.55.001~2017-18~MainFeatures~Children'sriskfactors~120 (accessed July 2020).
3. Australian Bureau of Statistics (2014) Australian Health Survey: Nutrition First Results – Food and Nutrients, 2011–12. 4364055007 1–78. https://www.abs.gov.au/statistics/health/health-conditions-and-risks/australian-health-survey-nutrition-first-results-foods-and-nutrients/latest-release (accessed July 2020).
4. Golley R & Bell L (2015) Interventions for improving young children's dietary intake through early childhood settings: a systematic review. *Int J Child Heal Nutr* **4**, 14–32.
5. Mikkelsen M V, Husby S, Skov LR, *et al.* (2014) A systematic review of types of healthy eating interventions in preschools. *Nutr J* **13**, 1–19.
6. Hardy LL, King L, Kelly B, *et al.* (2010) Munch and Move: evaluation of a preschool healthy eating and movement skill program. *Int J Behav Nutr Phys Act* **7**, 80.
7. NSW Ministry of Health (2014) Caring for children birth to 5years. North Sydney, Australia. https://www.health.nsw.gov.au/heal/Pages/caring-for-children-manual.aspx (accessed April 2020).
8. Australian Children's Education and Care Quality Authority (2018) Guide to the National Quality Framework. https://www.acecqa.gov.au/sites/default/files/2018-11/Guide-to-the-NQF_0.pdf (accessed April 2020).
9. Australian Government (2018) Child Care in Australia. In: Dep. Educ. Train. https://www.education.gov.au/child-care-australia (accessed April 2019).
10. Yoong SL, Lum M, Jones J, *et al.* (2020) A systematic review of interventions to improve the dietary intake, physical activity and weight status of children attending family day care services. *Public Health Nutr* **23**, 2211–2220.
11. Francis L, Shodeinde L, Black MM, *et al.* (2018) Examining the obesogenic attributes of the family child care home environment: a literature review. *J Obes* **2018**, 1–18.
12. Benjamin-Neelon SE, Vaughn AE, Tovar A, *et al.* (2018) The family child care home environment and children's diet quality. *Appetite* **126**, 108–113.
13. Tovar A, Benjamin-Neelon SE, Vaughn AE, *et al.* (2018) Nutritional quality of meals and snacks served and consumed in family child care. *J Acad Nutr Diet* **118**, 2280–2286.
14. Tovar A, Risica PM, Ramirez A, *et al.* (2020) Exploring the provider-level socio-demographic determinants of diet quality of preschool-aged children attending family childcare homes. *Nutrients* **12**, 1–14.
15. Wallace R, Mills B (2019) A study of the food environment at Australian family day care. *Nutrients* **11**, 2395.
16. Daniels LA, Franco B & McWhinnie JA (2003) An assessment of the potential of Family Day Care as a nutrition promotion setting in South Australia. *Nutr Diet* **60**, 30–37.
17. Bravo A, Cass Y & Tranter D (2008) Good food in family day care: improving nutrition and food safety in family day care. *Nutr Diet* **65**, 47–55.
18. De Silva-Sanigorski A, Elea D, Bell C, *et al.* (2011) Obesity prevention in the family day care setting: impact of the Romp & Chomp intervention on opportunities for children's physical activity and healthy eating. *Child Care Health Dev* **37**, 385–393.
19. Kerr G, Kelly B, Norman J *et al.* Nutrition, physical activity and screen time policies and practices in family day care in Australia. Under Rev.
20. Australian Bureau of Statistics (2018) Socio-Economic Indexes for Areas Australia. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/bySubject/2033.0.55.001~2016~MainFeatures~SOCIO-ECONOMICINDEXESFORAREAS(SEIFA)2016~1 (accessed August 2019).
21. Australian Bureau of Statistics (2016) Australian Standard Classification of Languages (ASCL), 2016. In: Canberra, Aust. https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1267.0Main+Features12016?OpenDocument (accessed July 2020).
22. Kelly B, Hardy LL, Howlett S, *et al* (2010) Opening up Australian preschoolers' lunchboxes. *Aust N Z J Public Health* **2334**, 288–292.
23. Harris PA, Taylor R, Minor BL, *et al.* (2019) The REDCap consortium: building an international community of software platform partners. *J Biomed Inform* **95**, 103208.
24. Sabinsky MS, Toft U, Andersen KK, *et al.* (2013) Validation of a digital photographic method for assessment of dietary quality of school lunch sandwiches brought from home. *Food Nutr Res* **57**, 1–10.
25. National Health and Medical Research Council (2013) *Australian Dietary Guidelines*. Canberra: National Health and Medical Research Council.
26. Food Standards Australia and New Zealand AUSNUT 2011–2013 (2016) Australian Food, Supplement and Nutrient Database. https://www.foodstandards.gov.au/science/monitoringnutrients/ausnut/pages/default.aspx (accessed April 2020).
27. Xyris Software (2018) *FoodWorks 9 Professional [Software]*. QLD: High Gate Hill.

28. Australian Bureau of Statistics (2014) Australian Health Survey: Users' Guide, 2011–13 — Discretionary Food List. In: Aust. Heal. Surv. Users' Guid. 2011–13 — Discret. Food List. https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4363.0.55.0012011-13?OpenDocument (accessed April 2020).
29. Voortman T, Kiefte-de Jong JC, Geelen A, *et al.* (2015) The development of a diet quality score for preschool children and its validation and determinants in the generation R study. *J Nutr* **145**, 306–314.
30. Guenther PM, Kirkpatrick SI, Reedy J, *et al.* (2014) The healthy eating index-2010 is a valid and reliable measure of diet quality according to the 2010 dietary guidelines for Americans. *J Nutr* **144**, 399–407.
31. Yoong SL, Skelton E, Jones J, *et al.* (2014) Do childcare services provide foods in line with the 2013 Australian Dietary guidelines? A cross-sectional study. *Aust N Z J Public Health* **38**, 595–596.
32. Sambell R, Devine A, Lo J (2014) Does the food group provision in early years' education and care settings in metropolitan Perth, Western Australia, meet national dietary requirements; and how can Home Economics support this? *J Home Econ Inst Aust* **21**, 20.
33. Jones J, Wyse R, Wiggers J, *et al.* (2017) Dietary intake and physical activity levels of children attending Australian childcare services. *Nutr Diet* **74**,446–453.
34. Bell LK, Hendrie GA, Hartley J, *et al.* (2015) Impact of a nutrition award scheme on the food and nutrient intakes of 2- to 4-year-olds attending long day care. *Public Health Nutr* **18**, 2634–2642.
35. Spence AC, Campbell KJ, Lioret S, *et al.* (2018) Early childhood vegetable, fruit, and discretionary food intakes do not meet dietary guidelines, but do show socioeconomic differences and tracking over time. *J Acad Nutr Diet* **118**,1634–1643.
36. Coxon C, Devenish G, Ha D, *et al.* (2020) Sources and determinants of discretionary food intake in a cohort of Australian children aged 12–14 months. *Int J Environ Res Public Health* **17**, 1–17.
37. Glasson C, Chapman K, James E (2011) Fruit and vegetables should be targeted separately in health promotion programmes: differences in consumption levels, barriers, knowledge and stages of readiness for change. *Public Health Nutr* **14**, 694–701.
38. Seward K, Wolfenden L, Finch M, *et al.* (2018) Improving the implementation of nutrition guidelines in childcare centres improves child dietary intake: findings of a randomised trial of an implementation intervention. *Public Health Nutr* **21**,607–617.
39. Yoong SL, Grady A, Seward K, *et al.* (2019) The impact of a childcare food service intervention on child dietary intake in care: an exploratory cluster randomized controlled trial. *Am J Heal Promot* **33**, 991–1001.
40. Jones J, Wyse R, Finch M, *et al.* (2015) Effectiveness of an intervention to facilitate the implementation of healthy eating and physical activity policies and practices in childcare services: a randomised controlled trial. *Implement Sci* **10**, 1–15.
41. New South Wales Government (2018) Education and Care Services National Regulations. https://www.legislation.nsw.gov.au/#/view/regulation/2011/653/chap4/part4.2/div1 (accessed February 2019)
42. Boyd W (2015) The tensions between food choices and sustainable practices in early childhood centres. *Australas J Early Child* **40**, 58–65.
43. Goldsborough N, Homer C, Atchinson R, *et al.* (2016) Healthy eating in the early years: a qualitative exploration of food provision in the childminder setting. *Br Food J* **118**, 992–1002.
44. Family Day Care Australia (2019) Attracting the next generation of family day care educators. https://uploads.prod01.sydney.platformos.com/instances/97/assets/public-pdf/Supporting-You/FDCA_EducatorResearchReportUpdate_online.pdf?updated=1585270019 (accessed February 2020).
45. NSW Government (2020) How Munch & Move aligns with the National Quality Framework. Munch Move 1–2. https://healthykids.nsw.gov.au/downloads/file/campaignsprograms/NQFBrochure.pdf (accessed July 2020).
46. Australian Bureau of Statistics (2016) Australian Health Survey: Consumption of food groups from the Australian dietary guidelines, 2011-12. 4364055012 1–65. http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.012main+features12011-12 (accessed July 2020).

Appendix C: Published article: Assessment of feeding practices and mealtime environments in Australian family day care services: an observational study

Research Brief

Assessment of Feeding Practices and Mealtime Environments in Australian Family Day Care Services: An Observational Study

Erin M. Kerr, BND (Hons)[1]; Bridget Kelly, PhD[1]; Megan L. Hammersley, PhD[1,2]; Jennifer Norman, PhD[1,2,3]; Lara Hernandez, BHlthSc (Hons)[4]; Susan Furber, PhD[2,3]; Cecilia Vuong, MPH[5]; Karen Wardle, GDipPH[5]; Sarah Ryan, BSc (Hons) Nutrition[1]; Anthony D. Okely, PhD[1,3]

ABSTRACT

Objective: Assess educators' feeding practices and mealtime environments in family daycare services and examine the factors associated with educators' feeding practices and mealtime environments.

Methods: Cross-sectional observational study of family daycare services (n = 33) in Australia. Best practices for mealtime environments and educator feeding practices were assessed during each mealtime using the Environment Policy Assessment and Observation instrument. Correlates assessed via survey included: socioeconomic status, main language spoken at home, early childhood career experience, and nutrition professional development. Descriptive statistics and independent t tests were calculated.

Results: Educators typically had higher scores, indicating better practices, for (the absence of) negative practices compared with positive practices. The only positive practice meeting best-practice standards was educators sitting with children during the meal. There were no significant correlations for educators' feeding practices or mealtime environment.

Conclusions and Implications: Educators may benefit from professional development targeting positive feeding practices and supportive mealtime environments.

Key Words: family daycare, healthy eating, mealtime, feeding practices (*J Nutr Educ Behav*. 2021;■■:■■−■■.)

Accepted October 21, 2021.

INTRODUCTION

Mealtimes in early childhood education and care (ECEC) services provide an opportunity for children to learn healthy eating behaviors and develop social, language, and fine motor skills.[1] The feeding practices of educators in ECEC services and the mealtime environment can influence the amount and types of foods children eat,[2] when they eat and can result in improvements in child diet quality.[3,4] The mealtime environment includes the mealtime atmosphere, who is present and eating with the child, and distractions in the room, such as using electronic devices while eating. The Australian ECEC regulatory framework, the National Quality Framework, recommends relaxed and enjoyable mealtimes, sitting with children, modeling healthy eating, responsive and meaningful interactions with children, and supporting children's self-regulation.[5] Furthermore, all ECEC training qualifications in Australia must include learning outcomes relating to promoting healthy eating to children.[6]

Although studies in ECEC services have demonstrated that positive feeding practices improve child dietary intake and diet quality,[4,7] research in family daycare (FDC) services (also referred to as family child care homes [FCCHs] and home-based child care) is underrepresented in the literature compared with

[1]Early Start, Faculty of the Arts, Social Sciences and Humanities, University of Wollongong, Wollongong, New South Wales, Australia
[2]Illawarra Health Medical Research Institute, Wollongong, New South Wales, Australia
[3]Health Promotion Service, Illawarra Shoalhaven Local Health District, Warrawong, New South Wales, Australia
[4]Centre for Population Health, NSW Ministry of Health, St Leonards, New South Wales, Australia
[5]Health Promotion Service, South Western Sydney Local Health District, Liverpool, New South Wales, Australia

Conflict of Interest Disclosure: The authors have not stated any conflicts of interest.

Address for correspondence: Erin Kerr, BND (Hons), Early Start, Faculty of the Arts, Social Sciences and Humanities, University of Wollongong, Northfields Ave Wollongong, Early Start Bldg 21, Wollongong, New South Wales 2522, Australia.; E-mail: emk833@uowmail.edu.au

J Nutr Educ Behav. 2021;■■:■■-■■

https://doi.org/10.1016/j.jneb.2021.10.006

Appendix D: Magazine article: Every Child Magazine, Early Childhood Australia 2021, 'Screen time use in the family day care environment'

Screen time use in the family day care environment

*University of Wollongong researchers **Erin Kerr,** Senior Professor **Anthony Okely** and **Dr Megan Hammersley** and the Munch & Move® State Program Manager Lara Hernandez report on their research into the risks and benefits of screen time in early learning.*

Screen time is a common sedentary activity among young children, with most children exceeding the recommended guidelines (Baker, Morawska, & Mitchell, 2020). Screen time involves digital technologies, including television, DVDs, tablets, computers, smartphones and video games. There is a growing concern over the potential adverse health effects of screen time for children, including obesity, motor development problems, sleep issues, concentration and socialisation (Li, Cheng, Sha, Cheng, & Yan, 2020). On the other hand, appropriate use of digital technology and screen time can offer many benefits, including supporting vocabulary, literacy, social behaviour, knowledge, learning and development (Kornfeld & Wild, 2020).

The *Australian 24-Hour Movement Guidelines for the Early Years (Birth to 5 Years)* recommend no more than one hour of sedentary screen time for children aged two–five years and no screen time for children younger than two years (Australian Government, 2017). Early Childhood Australia's *Statement on Young children and Digital Technologies* (2018) aims to guide the appropriate use of digital technology in early childhood education and care (ECEC) settings. The statement recognises the valuable role screens can play in ECEC settings and acknowledges that not all screen time is equal. The statement supports the educator's autonomy and skills to appropriately use screen time to promote positive learning outcomes, such as co-viewing and discussing content with children.

The need to know

Research on screen time use in ECEC is limited, particularly in family day care (FDC) settings. Many families choose FDC for its small, intimate and home-like environment. While exposure to screens may be unavoidable in some FDC due to common place items like TVs in homes, this can also be an opportunity to model healthy screen time practices. Given the diverse role that screen time can play in ECEC settings and the limited research in Australian FDC services, we aimed to examine the screen-time environment in FDC services.

Our research involved full-day observations with 33 FDC educators from south-west Sydney and the Illawarra and Shoalhaven regions of NSW. We captured information about the healthy eating and physical activity environment using a validated instrument, the Environment Policy Assessment and Observation tool. When children used screen time, we recorded the duration, type of device, content (educational; physical activity-promoting; or entertainment) and whether the educator engaged with children and discussed what they were watching. We made notes on the content and interactions between the educator and children. We also recorded educators using screen time during structured mealtimes.

Observations

Outside of mealtimes, we observed that nearly one third of the educators (*n*=10) used screen time, with the amount ranging from five to 100 minutes, and averaging 29 minutes. Educators were observed using screen time on a total of 16 separate occasions, on one to three occasions each. Only one FDC educator provided over 60 minutes of screen time—this involved the children passively watching a television show for 95 minutes instead of resting and watching a short 5 minute YouTube video in the afternoon. All other educators used fewer than 40 minutes of screen time. Six FDCs offered screen time to children younger than two years of age.

We observed occasions where screen time supported children's learning or development. In one example, two educators used it to facilitate music and movement sessions in which they actively participated. In another, three educators intentionally used screen time for educational purposes and engaged with the children while using the screen device. In a third example, five educators played nursery rhymes and songs (involving education elements such as counting and signing the alphabet) on a screen device for children to watch, but did not co-view or engage with the children.

In addition, we also observed instances of screen use that was not contributing to the learning or development outcomes of children. In one case, five educators used screen time for non-educational purposes and did not engage or discuss the content with the children. We also observed children from nine FDC services watching television during at least one mealtime. And, when television was used during a mealtime, socialisation was limited and learning opportunities were missed.

Towards a new approach

We found a need for clear guidelines on the appropriate use of screen time and digital technologies, in alignment with ECA's *Statement on Young Children and Digital Technologies*. Screen time can facilitate learning or physical activity experiences in FDC; however, it can also displace physical activity and gross motor development opportunities. Using screen devices to promote physical activity can help overcome some challenges that FDC educators face. These include physical health limitations; mixed ages of children (particularly younger children); inclement weather; lack of space; lack of ideas; and low confidence and skills (Fees, Trost, Bopp, & Dzewaltowski, 2009; O'Connor & Temple, 2005; Riethmuller, 2009).

Opportunities for beneficial screen time may involve:

- promoting healthy screen behaviours with parents
- modelling appropriate use for children
- managing different ages and requirements when using screen time.

Educators should avoid using screens:

- during mealtimes
- when educators cannot engage in the content with children
- at rest time.

Reflective questions for educators when selecting screen time activities:

- How does a particular instance of screen time promote movement, learning or development?
- Can the activity be done in real life without a screen?
- Is the screen necessary? For example, can you play music without a screen?
- What benefits does the screen provide—for example, research or learning new skills?
- Am I limiting prolonged periods of sitting?
- Are any children under two years experiencing sedentary screen time?

References

Australian Government Department of Health. (2017). *Australian 24-hour movement guidelines for the early years (birth to 5 years)* [Brochure]. https://www.health.gov.au/sites/default/files/documents/2021/05/24-hour-movement-guidelines-birth-to-5-years-brochure.pdf

Baker, S., Morawska, A., & Mitchell, A. E. (2020). Do Australian children carry out recommended preventive child health behaviours? Insights from an online parent survey. *Journal of Paediatrics and Child Health*, *56*(6), 900–907. https://doi.org/10.1111/jpc.14773

Early Childhood Australia (ECA). (2018). *Statement on young children and digital technologies.* http://www.earlychildhoodaustralia.org.au/wp-content/uploads/2018/10/Digital-policy-statement.pdf

Fees, B., Trost, S., Bopp, M., & Dzewaltowski, D. A. (2009). Physical activity programming in family child care homes: Providers' perceptions of practices and barriers. *Journal of Nutrition, Education and Behavior*, *41*(4), 268–273. https://doi.org/10.1016/j.jneb.2008.01.013

Kornfeld B., & Wild, B. M. (2020). Screening for healthy screen time. *Pediatric Annals, 49*(11), e452–e454. https://doi.org/10.3928/19382359-20201011-01

Li, C., Cheng, G., Sha, T., Cheng, W., & Yan, Y. (2020). The relationships between screen use and health indicators among infants, toddlers, and preschoolers: A meta-analysis and systematic review. *International Journal of Environmental Research and Public Health*, *17(*19), 1–20. https://doi.org/10.3390/ijerph17197324

O'Connor, J. P., & Temple, V. A. (2005). Constraints and facilitators for physical activity in family day care. *Australasian Journal of Early Childhood*, *30*(4), 1–9. https://doi.org/10.1177/183693910503000402

Riethmuller, A., McKeen, K., Okely, A. D., Bell, C., & de Silva-Sanigorski, A. (2009). Developing an active play resource for a range of Australian early childhood settings: Formative findings and recommendations. *Australasian Journal of Early Childhood*, *(34)*1, 43–52. https://doi.org/10.1177/183693910903400107

Appendix E: Abstract of paper presented as part of a symposium at International Society of Behavioral Nutrition and Physical Activity Conference 2019

Opportunities for Family Day Care Service Providers to promote healthy eating and physical activity

E.M. Kerr[1], A.D. Okely[1], B Kelly[1]

[1]University of Wollongong, Early Start, Faculty of Social Sciences, Wollongong, Australia

Purpose: Early Childhood Education and Care services are a key setting to promote healthy eating and physical activity behaviours in young children. In Australia, Family Day Care (FDC) is a unique form of childcare where education and care are provided for up to four children below school age and an additional three school-aged children, in a home environment. Over 200,000 children attend FDC in Australia. To operate as a FDC and receive government subsidies, educators must be registered through an approved Service Provider. The Service Provider consists of a coordination unit who monitors and supports educators to ensure they comply with the Australian National Quality Framework. The present study aimed to examine the support that FDC Service Providers provide to educators and families and assess the extent to which Service Provider's policies adhere to national standards and relevant guidelines.

Methods: Family Day Care Service Providers (n=51) from two Local Health Districts in New South Wales, Australia, were invited to participate in a structured interview from February 2018 to September 2018. Polices were collected and Service Providers were asked about resources provided to families and educators and professional development related to nutrition and physical activity for children aged 0-5 years old.

Results: Twenty-eight Service Providers participated in the study (55% participation rate), representing 885 educators. All Service Providers had a nutrition policy and most had a breastfeeding policy (88%); however just over one third (37%) had a physical activity policy and about half (52%) had a screen time policy. Health-related information provided to families varied: healthy eating (86%), breastfeeding (59%), limiting screen time (64%) and promoting physical activity (64%). Service Providers were more likely to provide educators with educational resources on healthy eating (89%) than physical activity (71%) and supervised floor based play (78%). Less than three quarters (71%) of Service Providers had offered training to educators in physical activity or nutrition.

Conclusion: FDC Service Providers have the potential to influence the healthy eating and physical activity behaviours of a large number of educators and families. This study identified key areas where training and resources can be provided Service Providers.

Appendix F: Abstract of paper presented at Australasian Journal of Early Childhood Research Symposium 2020

Educators' positive and negative feeding practices and mealtime environments in the family day care setting

Authors: Erin Kerr**,** Bridget Kelly, Megan Hammersley, Jennifer Norman, Susan Furber, Lara Hernandez, Cecilia Vuong, Maria Nacher Espuig, Sarah Ryan, Lisa Franco, Karen Wardle, Anthony Okely,

Presenter: Erin Kerr

Erin Kerr *is a dietitian and is passionate about building healthy eating behaviours in children's early years. She has extensive knowledge and understanding of infant and children feeding practices and early childhood education from her PhD research and work as a health promotion officer supporting early childhood education and care services. Erin's research is looking at the nutrition and physical activity environments in family day care settings.*

Educators' feeding practices can have a positive or negative impact on children's eating behaviours and dietary intake. Mealtimes also provide opportunities to develop children's social, language and fine motors skills. Family Day Care (FDC) services care for children in small and intimate environments, where mealtimes can be challenging for the sole educator responsible for preparing and feeding up to four young children of different ages and abilities. This research examined the mealtime environments and educators' feeding practices in FDC services.

This presentation will discuss the 26 full-day observations in FDC services that were conducted using the Environment Policy Assessment and Observation (EPAO) tools in South Western Sydney and Illawarra Shoalhaven Local Health Districts. Seventeen best practice items for feeding environments and educator feeding practices were observed during each mealtime. Each individual item was coded yes, if it was observed, or no, if it was not observed, for each mealtime.

Seventy-seven meal occasions were observed (22 morning teas, 26 lunches, 25 afternoon teas and four additional meals). Nineteen FDC services had three meals per day and on average, children spent 71 minutes in mealtimes at FDC. The following positive educator feeding practices were observed at every mealtime: educators sat with children (65.4 per cent), educators encouraged children to eat healthy foods while allowing them to make their own choices (38.5 per cent) and educators led or encouraged pleasant conversation (15 per cent). No educators were observed to enthusiastically role model eating healthy foods or praising children for eating healthy foods at every mealtime.

The following negative educator feeding practices were not observed at any mealtime: pressuring children to eat (92.3 per cent), requiring a child to sit at the table until they finished the meal (96.2 per cent), television on during mealtimes (80 per cent) and educator using a screen device during mealtime (73.1 per cent). Less than half of the educators spoonfed a child (who was able to feed themselves) to get them to eat (46.2 per cent).

Most educators avoided the use of negative feeding practices, apart from spoonfeeding. Conversely, many educators were not observed using positive feeding practices at every mealtime. Future interventions should target mealtimes as a pedagogical opportunity for developing key life skills and healthy eating behaviors through positive feeding practices and enjoyable mealtimes.

Discussion questions:

1. What barriers might educators face when trying to use mealtimes as a pedagogical opportunity for developing key life skills and healthy eating behaviours?

2. How can educators be supported to manage challenging mealtimes and promote enjoyable environments through the use of positive feeding practices?

Appendix G: Abstract of paper presented at World Public Health Nutrition Congress 2020

What's in the lunchbox? Food provision in family day care.

Kerr E, Kelly B, Hernandez L, Nacher Espuig M, Wardle K, Norman J , Furber S, Franco L, Vuong C, Okely A.

Background/aims

Good nutrition in young children is essential for optimal cognitive, emotional and physical development and can reduce the risk of developing chronic diseases. Children attending formal education and care within a Family Day Care (FDC) service receive up to 75% of their daily food intake while in care. This study aimed to capture the food provided to children in FDC by families in children's lunchboxes.

Methods

This cross-sectional observational study included children from FDC homes in the Illawarra and south west Sydney regions of New South Wales in 2019. Lunch content provided to children was measured using weighed food records. Foods and beverages were categorised according to the Australian Guide to Healthy Eating. The proportion of lunchboxes that contained food categories and the average number of serves per group were analysed.

Results

Nutritional preliminary data is available for 36 lunchboxes. All lunchboxes contained fruit (average 1.5 serves), 17 contained vegetables (average 0.3 serves), 30 contained dairy (average 0.5 serves), 31 contained grains and cereals (14 contained wholegrains), 28 contained a sandwich/wrap/roll, 10 contained a cooked meal, 35 contained discretionary foods and 2 contained discretionary beverages.

Conclusions

Data on approximately 150 children will be presented. Preliminary findings are consistent with the literature; children are meeting dietary recommendations for fruit but not vegetables, dairy and wholegrains. FDC is an important health promotion setting to reach young children and their families. Interventions to promote healthy eating should use FDC to encourage families to improve the diet quality in their child's lunchbox. Background/aims

Sustainable Development Goal 3: Good health and well-being

Presentation type: Rapid Fire - Presenters will have 6 minutes' presentation time using up to 3 power point slides, e.g.1. beginning (background) 2. middle (body) 3. end (summary), and allowing to answer one question briefly at the conclusion of the talk. The session will have a nominated chair.

Appendix H: Abstract of paper presented at Early Childhood Australia National Conference 2021

Screen time use in the family day care environment

Authors: Erin Kerr**,** Bridget Kelly, Megan Hammersley, Jennifer Norman, Susan Furber, Lara Hernandez, Cecilia Vuong, Maria Nacher Espuig, Sarah Ryan, Lisa Franco, Karen Wardle, Anthony Okely,

The study aimed to assess screen time use in Family Day Care (FDC).
Full-day observations were conducted with 33 FDC educators using the Environment Policy Assessment and Observation tools in two Local Health Districts of NSW. Duration and type of screen time were recorded, for example, time spent using educational programs.

Five FDC educators allowed the children to watch television during at least one mealtime and eight educators used a screen device themselves while the children were eating during at least one mealtime. When considering screen time outside of mealtimes, nearly one third of educators (n=10) used screen time for an average of 29 minutes. Six FDC educators had children less than 2 years of age who participated in the screen time. Two educators used screen devices to facilitate music and movement sessions and actively participated in the session. Three educators used screen time for educational purposes and engaged with the children while they were using the screen device. Five educators played nursery rhymes and songs for children on a screen device; however, they did not co-view or engage with the children. Five educators used screen time for non-educational purposes and did not engage or discuss the content with the children.

Screen time may be used to facilitate learning or physical activity experiences in FDC; however, it can also displace opportunities for physical activity and gross motor development and not be used in accordance with Australian guidelines. There is a need to work with the FDC sector to educate on the appropriate use of screen time and digital technologies in alignment with the Early Childhood Australia Statement on Young Children and Digital Technologies.

Appendix I: Abstract of paper accepted to present at Early Start Conference

Physical activity and screen time in family day care

Objective: To describe children's physical activity levels, in addition to the physical activity and screen time environment at Family Day Care (FDC).

Methods: Full-day observations were conducted with 33 FDC educators using the Environment Policy Assessment and Observation tools in two Local Health Districts of NSW. Children's sedentary, light and moderate-to-vigorous physical activity was measured using ActiGraph GT3X+ accelerometers.

Results: Accelerometer data were analysed for 85 children aged between 1-5 years old. On average, children wore the accelerometer for 5.3 (1.3) hours per day (excluding nap time). The average daily participation in sedentary, light, moderate-to-vigorous and total physical activity was 28, 8, 8 and 16 minutes/hour, respectively. On average, children spent 86 minutes outside and 19 educators played with children or participated in a game with children when they were outside. Twenty-four educators led a physical activity session (indoors or outdoors) for an average of 20 minutes.

Eleven educators offered screen time to children, ranging from 10 to 100 minutes. Five educators used screen time for recreational purposes, (i.e. not for education or physical activity) and did not engage or discuss the content with the children.

Conclusion: This study highlights opportunities to provide professional development and resources to FDC Service Providers and educator's to improve the physical activity and screen time environment in FDC services. Support around the development and implementation of physical activity and screen policies into practice is warranted.

Appendix J: Supplementary file 3.1: Search strategy for systematic literature review

Additional file 2. Search strategy and terms for each database

Database	Records identified
MEDLINE	438
PsycINFO	515
SCOPUS	1298
ERIC	21
Web of Science	173
Total	**2445**

Scopus search strategy
Published data January 2000 to July 2021
Language: English
Document type: article

S1 All fields	"family day care" OR "family daycare" OR "family child care" OR "family childcare" OR "child minder*" OR "childminder*" OR "child minding*" OR "childminding*"OR "family-based child care" OR "family based child care" OR "family-based childcare" OR "home-based child care" OR "home-based childcare" OR "homebased childcare" OR "home based child care" OR "home-based education" OR "home-based early childhood education" OR "home child care"
S2 All fields	"eat*" OR "nutrition*" OR "nutrient" OR "diet*" OR "feed*" OR "food" OR "meal*" OR "fruit*" OR "vegetable*" OR "physical activit*" OR "physical inactivit*" OR "movement" OR "sedent*" OR "gross motor" OR "exercise*" OR "motor activity" OR "physical education" OR "physical training" OR "sport*"
S3	Combine S1 and S2 with "AND"

MEDLINE with Full Text (EBSCO) search strategy
Published data January 2000 to July 2021
Language: English
Document type: journal article

S1 (No field selected)	"family day care" OR "family daycare" OR "family child care" OR "family childcare" OR "child minder*" OR "childminder*" OR "child minding*" OR "childminding*"OR "family-based child care" OR "family based child care" OR "family-based childcare" OR "home-based child care" OR "home-based childcare" OR "homebased childcare" OR "home based child care" OR "home-based education" OR "home-based early childhood education" OR "home child care"
S2 (No field selected)	"eat*" OR "nutrition*" OR "nutrient" OR "diet*" OR "feed*" OR "food" OR "meal*" OR "fruit*" OR "vegetable*" OR "physical activit*" OR "physical inactivit*" OR "movement" OR "sedent*" OR "gross motor" OR "exercise*" OR "motor activity" OR "physical education" OR "physical training" OR "sport*"

Database: APA PsycINFO (EBSCO)

Published data January 2000 to July 2021	Language: English
Document type: journal article	Peer reviewed
S1 (No field selected)	"family day care" OR "family daycare" OR "family child care" OR "family childcare" OR "child minder*" OR "childminder*" OR "child minding*" OR "childminding*"OR "family-based child care" OR "family based child care" OR "family-based childcare" OR "home-based child care" OR "home-based childcare" OR "homebased childcare" OR "home based child care" OR "home-based education" OR "home-based early childhood education" OR "home child care"
S2 (No field selected)	"eat*" OR "nutrition*" OR "nutrient" OR "diet*" OR "feed*" OR "food" OR "meal*" OR "fruit*" OR "vegetable*" OR "physical activit*" OR "physical inactivit*" OR "movement" OR "sedent*" OR "gross motor" OR "exercise*" OR "motor activity" OR "physical education" OR "physical training" OR "sport*"

ERIC (via ProQuest)

Published data January 2000 to July 2021	Language: English
Document type: scholarly journal article	Peer reviewed
S1 Anywhere	"family day care" OR "family daycare" OR "family child care" OR "family childcare" OR "child minder*" OR "childminder*" OR "child minding*" OR "childminding*"OR "family-based child care" OR "family based child care" OR "family-based childcare" OR "home-based child care" OR "home-based childcare" OR "homebased childcare" OR "home based child care" OR "home-based education" OR "home-based early childhood education" OR "home child care"
S2 Anywhere	"eat*" OR "nutrition*" OR "nutrient" OR "diet*" OR "feed*" OR "food" OR "meal*" OR "fruit*" OR "vegetable*" OR "physical activit*" OR "physical inactivit*" OR "movement" OR "sedent*" OR "gross motor" OR "exercise*" OR "motor activity" OR "physical education" OR "physical training" OR "sport*"

Web of science

Language: English	Document type: articles
S1 All fields	"family day care" OR "family daycare" OR "family child care" OR "family childcare" OR "child minder*" OR "childminder*" OR "child minding*" OR "childminding*"OR "family-based child care" OR "family based child care" OR "family-based childcare" OR "home-based child care" OR "home-based childcare" OR "homebased childcare" OR "home based child care" OR "home-based education" OR "home-based early childhood education" OR "home child care"
S2 All fields	"eat*" OR "nutrition*" OR "nutrient" OR "diet*" OR "feed*" OR "food" OR "meal*" OR "fruit*" OR "vegetable*" OR "physical activit*" OR "physical inactivit*" OR "movement" OR "sedent*" OR "gross motor" OR "exercise*" OR "motor activity" OR "physical education" OR "physical training" OR "sport*"

Appendix K: Supplementary file 3.2: Additional details for risk of bias

Supplementary table 3.2: Additional details for risk of bias

Authors	1. Selection bias	2. Confounding bias	3. Attrition/exclusion bias	4. Detection bias (exposure/correlate)	4. Detection bias (outcome)	5. Selective bias reporting bias	6. Conflict of Interest	Other bias
Diet intake								
Benjamin-Neelon et al. 2018 North Carolina, US	Probably low risk of bias Not random but used a comprehensive recruitment strategy	Definitely low risk of bias Confounding variables: sex, age, race, and BMI z-score, as well as provider race, education, BMI, and number of children in care	Probably low risk of bias Complete data for 492/496 children	Definitely EPAO	Probably low risk of bias DOCC protocol	Definitely low risk of bias Report data from methods and protocol paper	Definitely low risk of bias Declared no conflict of interest	No other bias identified
Cuadrado-Soto et al. 2019 Rhode Island, US	Probably low risk of bias Not random but used a comprehensive recruitment strategy	Probably high risk of bias No confounding variables	Not reported Data on 366/374 children reported. Reason for exclusion not reported.	Definitely low risk of bias Age	Probably low risk of bias DOCC protocol	Definitely low risk of bias Report data from methods and protocol paper	Definitely low risk of bias Declared no conflict of interest	No other bias identified
Ramirez et al 2020 Rhode Island, US	Probably low risk of bias Not random but used a comprehensive recruitment strategy	Definitely low risk of bias Covariates included in adjusted models: CACFP participation, FCCPs age, education and	Probably low risk of bias Reports 120 educts in methods and results	Definitely low risk of bias Ethnicity	Probably low risk of bias DOCC protocol	Definitely low risk of bias Report data from methods and protocol paper	Definitely low risk of bias Declared no conflict of interest	No other bias identified

		income, number of children in the home, the children's age						
Tovar et al. 2018a North Carolina US	Probably low risk of bias Not random but used a comprehensive recruitment strategy	Definitely low risk of bias Child-level covariates- child sex, age, and body mass index FCCH covariates- educator race, education, BMI, child-care quality star rating, and CACFP participation.	Probably low risk of bias Complete data available for 495/496 children	Probably low risk of bias DOCC	Probably low risk of bias DOCC protocol	Definitely low risk of bias Report data from methods and protocol paper	Definitely low risk of bias Declared no conflict of interest	No other bias identified
Tovar et al. 2018b North Carolina US	Probably low risk of bias Not random but used a comprehensive recruitment strategy	Definitely low risk of bias Covariates- educator income, education, age, race, CACFP participation, childcare quality rating and BMI, as well as child age, sex, BMI, hours spent in childcare and study arm	Probably low risk of bias 125/133 FCCH included in analysis after excluding missing values	Probably low risk of bias Feeding practices assessed as valid through expert review	Probably low risk of bias DOCC protocol	Definitely low risk of bias Report data from methods and protocol paper	Definitely low risk of bias Declared no conflict of interest	No other bias identified

		(intervention v. control).						
Tovar et al. 2020	Probably low risk of bias Not random but used a comprehensive recruitment strategy	Probably low risk of bias Adjusted for CACFP, income, ethnicity, and language No child-level covariates	Probably low risk of bias Reports 119 and 120 FCCH in results	Definitely low risk of bias Ethnicity	Probably low risk of bias DOCC	Definitely low risk of bias Report data from methods and protocol paper	Definitely low risk of bias Declared no conflict of interest	No other bias identified
Physical activity and sedentary behaviours	1. Selection bias	2. Confounding bias	3. Attrition/exclusion bias	4. Detection bias (exposure/correlate)	4. Detection bias (outcome)	5. Selective bias reporting bias	6. Conflict of Interest	Other bias
Chai, Rice-McNeil and Trost 2020 Oregan, US	Definitely low risk of bias FCCH randomly selected from child care resource and referral hub	Probably high risk of bias Age was not included as a confounding variable. Mixed model analysis of variance (ANOVA) - Child sex, and accelerometer wear time included as fixed effects, and FDC as a random effect	Probably high risk of bias 41/56 eligible participants completed all study protocol.	Probably high risk of bias NAP SACC is a reliable tool but has self-reporting bias	Definitely low risk of bias Accelerometers used	Probably high risk of bias Only reported 14/19 NAP SACC items that were reported in the methods section	Definitely low risk of bias Declared no conflict of interest	Probably low risk of bias Data collected in 2011 and 2012 but published in 2020
Delaney, Monsivais and Johnson, 2014	Probably high risk of bias	Definitely high risk of bias	Probably high risk of bias	Probably high risk of bias	Definitely low risk of bias	Definitely high risk of bias	Probably low risk of bias	Definitely high risk of bias

	Educators from a previous study or from a CACFP roster invited to participate	Did not account for confounding variables and no statistical tests used	26/62 participants from a previous study responded and met the eligibility criteria; 24 completed the study.	NAP SACC is a reliable tool but has self-reporting bias	Accelerometers used	The study used the physical activity portion of the NAP SACC, however, only reported 6 of the questions.	Not explicitly written but grants stated	Differences between groups were not statistically tested.
Gunter et al. 2012 Oregan, US	Definitely low risk of bias FCCH's randomly selected and all children invited to participate	Definitely low risk of bias Mixed model analysis of variance (ANOVA) FCCH included as a random effect. Age, sex, and BMI z-score included as child-level covariates	Probably low risk of bias 45/56 of initial sample completed NAPSACC and accelerometer protocol. The initial and final samples were comparable with respect to demographics	Probably high risk of bias Self-reported NAP SACC survey that has been validated in centres	Definitely low risk of bias Accelerometers used	Definitely low risk of bias All measured outcomes reported	Definitely low risk of bias Declared no conflict of interest	Probably low risk of bias Epochs not reported
Kang et al. 2021 Rhode Island and Massachusetts, US	Probably low risk of bias Not random but detailed recruitment strategy	Probably high risk of bias Did not account for confounding variables when assessing impact of age and sex Ethnicity accounted for influence of age	Probably high risk of bias Only reported the number of children with valid accelerometry data, not original sample of children	Definitely low risk of bias Age, gender and ethnicity are self-reported but have low risk of bias	Definitely low risk of bias Accelerometers used	Definitely low risk of bias All outcomes reported	Definitely low risk of bias Declared no conflict of interest	Probably high risk of bias Nap time included in analysis Accelerometer results were reported for the full data set (no exclusion of

		and sex if they were significant Not clear if it controls for clustering of FCCH						wear time) and median-half wear time (over 6.3 hours).
Mazzucca, et al. 2018 North Carolina	Probably low risk of bias Not random but used a comprehensive recruitment strategy	Definitely low risk of bias Random effects- FCCH Potential confounders assessed- child age, sex, FCCH Child and Adult Care Food Program participation, provider MVPA.	Probably low risk of bias 'One FCCH had data on only 1 child, which was deemed insufficient to represent the FCCH and was excluded from analyses. This resulted in a total analytic sample of 495 children.'	Definitely low risk of bias EPAO observation tool	Definitely low risk of bias Accelerometers used	Definitely low risk of bias Report data from methods and protocol paper	Definitely low risk of bias Declared no conflict of interest	No other bias identified
Neshteruk al. 2018, central North Carolina	Probably low risk of bias Not random but used a comprehensive recruitment strategy	Probably low risk of bias Outdoor time provided, provider physical activity training, and provider income were included as covariates in the adjusted models. Children's age or gender were not included as confounders	Probably low risk of bias 1 FCCH was excluded from the analysis as they had no valid physical activity data	Definitely low risk of bias EPAO observation tool	Definitely low risk of bias	Definitely low risk of bias Report data from methods and protocol paper	Definitely low risk of bias Declared no conflict of interest	No other bias identified

Rice et al. 2014 Oregon, US	Definitely Low risk of bias Proportional sample of FCCH randomly selected	Probably high risk of bias 3-way factorial ANOVA (gender x age group x weight status). Not clear if it controls for clustering of FCCH	Definitely Low risk of bias 47/56 FCCH's completed the accelerometry protocol. FCCH's that did not complete the protocol had similar demographic characteristics.	Definitely Low risk of bias BMI objectively measured Gender and age reported by parent/carer but low risk of bias	Definitely low risk of bias Accelerometers used	Probably high risk of bias Does not include the minutes per hour of physical activity in each group (e.g. male vs. female)	Probably Low risk of bias Not explicitly written but grants stated	Probably low risk of bias Does not specify the epochs used
Temple et al. 2009 British Columbia, Canada	Probably low risk of bias Mailed invitations to FCCH from 2 health regions	Probably high risk of bias Did not account for confounding variables	Probably low risk of bias 65/78 children in sample participated Detailed recruitment numbers and reasons for exclusion or dropout	Definitely low risk of bias Gender reported by parent/carer but low risk of bias	Definitely low risk of bias Accelerometers used	Probably high risk of bias Assess how the environment supports movement but did not test associations with physical activity	Probably low risk of bias Not explicitly written but grants stated	Probably high risk of bias Does not specify what statistical test was used, only states univariate analyses was used
Tucker et al. 2015 London, Ontario, Canada	Probably high risk of bias Multiple recruitment methods (contacting providers that were on lists from a child	Probably low risk of bias Linear mixed model ANCOVA - Adjusted for sex and early learning environment.	Probably low risk of bias 20/31 children valid physical activity data	Definitely low risk of bias EPAO valid and reliable observation tool but still open to subjectivity	Definitely low risk of bias Accelerometers used	Definitely low risk of bias Report data from methods and protocol paper	Definitely low risk of bias Not explicitly written but grants stated	Probably high risk of bias EPAO - one day Small sample size

	care network, advertisements in newspaper, magazines and social media snowballing). Services not on lists and not directly contacted were probably less likely to participate.	Unstandardized residual scores were calculated by running a regression analysis of age onto sedentary time in order to account for the effect of age.						
Vanderloo et al. 2015 London, Ontario, Canada	Probably high risk of bias Multiple recruitment methods (contacting providers that were on lists from a child care network, advertisements in newspaper, magazines and social media snowballing). Services not on lists and not directly contacted were probably less likely to participate.	Probably low risk of bias linear mixed-model analysis of covariance (ANCOVA) Fixed factors: type of early-learning environment and sex Random effects-classroom clusters "Unstandardized residual scores were created from running a regression analysis of age onto MVPA and	Probably low risk of bias 20/31 children valid physical activity data	Definitely low risk of bias EPAO valid and reliable observation tool but still open to subjectivity	Definitely low risk of bias Accelerometers used	Definitely low risk of bias Report data from methods and protocol paper	Definitely low risk of bias Not explicitly written but grants stated	Probably high risk of bias EPAO - one day Small sample size

	TPA to account for the effect of age on activity levels."	

Appendix L: Ethics approval for service provider survey and policy review

Dear Professor Okely,

I am pleased to advise that the amendment request submitted on 31 May 2018 to the application detailed below has been **approved**.

Ethics Number:	2017/492
Approval Date:	20/12/2017
Expiry Date:	19/12/2018
AuRed Number:	HREC/17/WGONG/139
Project Title:	Healthy Eating and Physical Activity Practices and Policies in the Family Day Care Setting
Researcher/s:	Okely Tony; Ryan Sarah; Franco Lisa; Kelly Gillott Bridget; Kerr Erin; Parkinson Julie; Furber Susan
Documents Approved:	HREA (submission code: AU/1/10311315) Response to review 15/12/2017, 08/12/2017 Appendix - FDC Monitoring Guide Appendix A - Service provider email template V3 - 26/09/2017 Appendix B - Telephone Script V3 - 06/12/2017 Appendix C - Service Provider Participant information sheet v3 - 06/12/2017 Appendix D - Service Provider Consent Form V4 - 06/12/2017 Appendix E - Interview script service provider V4 - 06/12/2017 Appendix F - Coordinator email template V3 - 26/09/2017 Appendix G - Coordinator Participant information sheet V4 - 06/12/2017 Appendix H - Coordinator Consent Form V3 - 06/12/2017 Appendix I - Questionnaire coordinators V4 - 06/12/2017 Appendix J - Researcher Declaration Form - 26/09/2017 Appendix K - Revised budget 2017 Appendix L - Document Review Checklist V1 - 06/12/2017 Appendix M - Telephone Script V1 HPO - 06/12/2017 Appendix N - Service Provider Participant information sheet - 06/12/2017 Appendix O - Service Provider Consent form HPO V1 - 06/12/2017 Appendix P Munch and Move Monitoring Guide V1 - 06/12/2017 Project description V6 - 06/12/2017 Additional Researcher Dr Susan Furber

The HREC has reviewed the research proposal for compliance with the *National Statement on Ethical Conduct in Human Research* and approval of this project is conditional upon your continuing compliance with this document. Compliance is monitored through progress reports; the HREC may also undertake physical monitoring of research.

Please remember that in addition to submitting proposed changes to the project to the HREC prior to implementing them the HREC requires:

- Immediate report of serious or unexpected adverse effects on participants.
- Immediate report of unforeseen events that might affect the continued acceptability of the project.
- The submission of an annual progress report and a final report on completion of your project.

If you have any queries regarding the HREC review process or your ongoing approval please contact the Ethics Unit on 4221 3386 or email rso-ethics@uow.edu.au.

Yours sincerely,

Emma Barkus

Associate Professor Emma Barkus,
Chair, UOW & ISLHD Social Sciences Human Research Ethics Committee

The University of Wollongong and Illawarra and Shoalhaven Local Health District Social Sciences HREC is constituted and functions in accordance with the NHMRC National Statement on Ethical Conduct in Human Research.

Appendix M: Service provider participant information sheet and consent

Healthy Eating and Physical Activity Practices and Policies in the Family Day Care Setting

Participant Information Sheet

Dear [name of approved provider or nominated supervisor],

You are invited to participate in an interview to help us find out what family day care service providers are doing to promote healthy eating and active play. The research is being conducted by the research team from the University of Wollongong (UOW) in partnership with your Local Health District (LHD) and the NSW Office of Preventive Health (OPH).

PURPOSE OF THE RESEARCH

The purpose of the research is to gain an understanding of the healthy eating and physical activity practices and policies in family day care services. The research is part of a larger study and will guide the development of future professional development activities to support coordinators and educators to embed healthy eating and physical activity into their programs. Little research has been conducted into the healthy eating and physical environment in family day care services.

We aim to gain a better understanding of the environment and ensure you as service providers are being supported in the most effective way to ensure you and your educators are receiving adequate training and resources. This research is a part of Erin Kerr's PhD degree at the University of Wollongong supervised by Tony Okely and Bridget Kelly.

INVESTIGATORS

- Professor Tony Okely, University of Wollongong
- Dr Bridget Kelly, University of Wollongong
- Erin Kerr, University of Wollongong
- Sarah Ryan, University of Wollongong
- NSW Office of Preventive Health, NSW Health
- South Western Sydney Local Health District
- Illawarra Shoalhaven Local Health District

If I have any questions about the research, you can contact Erin Kerr emk833@uowmail.edu.au and/or Tony Okely (02) 4221 4641 tokely@uow.edu.au.

METHOD AND DEMANDS ON PARTICIPANTS

If you agree, you will be asked to participate in a 1 hour face-to-face or telephone interview. You will be asked questions to find out what your service is doing to promote healthy eating and active play. You will also be asked to provide any policies and documentation that your FDC service provider holds related to healthy eating, physical activity and screen time. The documentation will be reviewed against best practice standards and feedback will be provided to participating FDC services, highlighting strengths and providing additional resources and information to support their service.

The information you provide will be used for quality improvement purposes and to guide the development of future professional development activities to support FDC services to embed healthy eating and physical activity into their program.

This is part of a larger research project. We would also like to email your coordinators an invitation to participate in an online questionnaire asking them about their healthy eating and physical activity practices. To invite the coordinators we require their names and emails. Providing these contact details is a voluntary and coordinators must consent to their emails being provided. The survey will be anonymous and participation is also voluntary. If you chose not to be involved in the survey your current or future relationship with the LHD, OPH or with the UOW will not be affected.

In the next stage, Family Day Care services in SWSLHD and ISLHD will be randomly selected and invited to participate, which will involve inviting educators to an observational study. This participation is voluntary and agreeing to this current study does not mean you agreeing to the next phase.

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

We can foresee no risks for your involvement in the interview. It is voluntary and you may withdraw from the study at any time. If you choose to withdraw from the study, your current or future relationship with the LHD, OPH or with the UOW will not be affected. All information collected during this study will be kept strictly confidential and be stored in a locked office and a secure database.

FUNDING AND BENEFITS OF THE RESEARCH

This study is funded by a research grant from the Prevention Research Support Program (PRSP). The PRSP provides funding to NSW research organisations conducting prevention and early intervention research that aligns with NSW Health priorities.

Participation in the research is intended to benefit your FDC service. We will also report back the results of the interview to you at a later date and the feedback provided can be used to inform your Quality Improvement Plan. Participating services will also be provided with a children's book to thank them for their time and contribution to the research.

This research is intended for quality improvement purposes and will guide the development of professional development for family day care services. The data collected may also be used in publications, reports and presentations; however these documents will not identify individual services or any personal information. The details of your service and your name will always remain confidential and de-identifiable.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Social Sciences Human Research Ethics Committee of the University of Wollongong. If you have any concerns or complaints regarding the way the research is being conducted, you can contact the Ethics Officer, on (02) 4221 3386 or email rsoethics@uow.edu.au.

Thank you for your interest in this study.

Healthy Eating and Physical Activity Practices and Policies in the Family Day Care Setting

Consent Form

Research conducted by Professor Tony Okely, Dr Bridget Kelly, Erin Kerr, Sarah Ryan, NSW Office of Preventive Health, South Western Sydney Local Health District and Illawarra Shoalhaven Local Health District

I have been given information about the study entitled: **'Healthy Eating and Physical Activity Practices and Policies in the Family Day Care Setting'** and have had the opportunity to discuss the study with the research team.

By signing this form, I confirm that:

- The study has been fully explained to me and all of my questions have been answered
- I understand that this research is a part of Erin Kerr's PhD degree at the University of Wollongong supervised by Tony Okely and Bridget Kelly.
- I understand that the study will involve participating in a 1 hour face-to-face interview and I will be asked questions about how my service promotes healthy eating and active play
- I have approval from the approved provider to provide copies of the service's policies and documents
- I understand that this information will be kept strictly confidential, however I am not obliged to provide these documents
- I will be asked for the names and email addresses of my coordinators (with permission from them) to send them information about how they support educators and that this voluntary
- I understand that this is part of a larger research project and that I may be contacted and invited to participate in the next stage which will involve recruiting educators to the study. I understand that participation in the next phase is also voluntary.
- I understand that I have the right not to take part in the study and the right to stop at any time without penalty
- I understand that if I withdraw from the study, my current or future relationship with the Local Health District, NSW Office of Preventive Health or the University of Wollongong will not be affected now or in the future. I have been informed of the potential risks and benefits of the study
- I understand that no information about who I am will be given to anyone or be published without first asking my permission. I understand that my contribution will be confidential and that there will be no personal identification in the data that I agree to allow to be used in the study. All data collected will be stored securely at UOW.
- I have read and understand each page of this form
- I understand that this research is a part of Erin Kerr's PhD degree at the University of Wollongong supervised by Tony Okely and Bridget Kelly.

- If I have any questions about the research, I can contact Erin Kerr (02) 4298 1188 and/or Tony Okely (02) 4221 4641

If I have any concerns or complaints regarding the way the research is or has been conducted, I can contact the Ethics Officer, Human Research Ethics Committee, University of Wollongong on 4221 3386 or email rso-ethics@uow.edu.au

☐ Please tick this box if you do not want to be contacted and invited to the next phase of the study

Name of Participant (Print)	Signature of Participant	Date

Name of Approved provider (Print)	Signature of Participant	Date

Appendix N: Service provider survey

FDC Service Provider Interview

Date: _____

Family Day Care service provider: _____

Name of interviewee _____

1. What is your position? (more than one answer can be selected)
   - Approved provider
   - Nominated supervisor
   - Coordinator
   - Educational leader
   - Other_____
2. How many coordinators are employed by your service? _____

   Note: Coordinators conduct site visits with the educators. Their role is to monitor and support the family day care educators who are part of the service. They were previously called Child Development Officers (CDO's).

3. How often does a coordinator visit an experienced educator's home? (an experienced educator refers to an educator that does not require additional coordinator visits above the regulations)

   Fortnight | Monthly | Quarterly | other – _____

4. Do you have an educational leader? Y/N
5. What is the age range of children that attend your FDC service?
   - 0-5
   - 0-12
   - 2-5
   - 2-12
   - Other_____

6. How many educators from your service are currently running a FDC service out of their homes for children aged 0-5 years? _____

   Note: This includes educators that also care for children over 5 years of age in addition to children between the ages of 0-5 years.

7. How many children aged 0-5 years are currently enrolled at your service?
8. What is the age range of children that attend your FDC service:
   - 0-5
   - 0-12
   - 2-5
   - 2-12
   - Other_____

INTERVIEW SCRIPT – SERVICE PROVIDER FORM VERSION 4 7TH DECEMBER 2017

9. Who normally provides meals for children who attend family day care?
    - Families
    - Educators
    - Families and educators provide food
    - Other

Notes section:

_____

_____

Policies, procedures and guidelines – Request documents

10. Does the service provider have a policy about breastfeeding or infant feeding (for example formula, introducing solids)? (this may be part of another policy, procedure or guideline)
    - Yes – upload copy
    - Service does not provide care to children aged 0-1 years
    - No
    - Don't know/unsure

11. Does the service provider have a policy, procedure or guideline about healthy eating? (this may be part of another policy, procedure or guideline)
    - Yes – upload copy
    - No
    - Don't know/unsure

12. Does the service provider have a policy, procedure or guideline about physical activity? (this may be part of another policy, procedure or guideline)
    - Yes – upload copy
    - No
    - Don't know/unsure

13. Does the service provider have a policy, procedure and/or guideline about small screen time? (this may be part of another policy, procedure or guideline)
    - Yes – upload copy
    - No
    - Don't know/unsure

Notes section:

_____

_____

Information to families

14. How do you provide information to families? (tick all that apply)
    - Printed resources- e.g. handouts, brochures
    - Email
    - Placed in the child's bag
    - Newsletters
    - Orientation pack
    - Parent handbook
    - Posts made on social media (e.g. Facebook)

- App e.g. Storypark
- Educators verbally provide information
- On display on noticeboards in educators homes/environments
- Text messages
- Closed Facebook
- Open Facebook
- Phone calls

Record any other methods service providers use:

_____

_____

15. Do you provide this information in any other language?

Yes | No

If yes, what languages? _____

16. In the past 12 months, has the service provider provided families with any information on breastfeeding, healthy eating, physical activity and screen time?
    - Yes
    - No
    - Don't know

14a. If yes, *tick all that apply*

- Breastfeeding
- Transitioning textures for Infants/Introducing solids
- Transitioning to a feeding cup/teach your baby to drink from a cup
- Healthy eating
- Healthy lunchboxes
- Healthy recipes
- Planning quick, healthy meals
- Fussy eating tips
- Limiting screen time
- Supervised floor based play for infants
- Physical activity
- Physical activities and games for families
- Fundamental movement skills
- Information from Get Up and Grow or fact sheets
- *Munch & Move factsheets*
- Information from Caring for Children
- Other: _____

Notes section:

_____

_____

17. How often do you send new information to parents on breastfeeding, healthy eating, physical activity and screen time?
    - Weekly
    - Fortnightly
    - Monthly
    - Other: _____

Resources, curriculum material, ideas and activities on healthy eating and physical activity

18. Who develops the educational program for the children?
    - Educators develop their own program and are supported by the service provider (including coordinator and educational leader)
    - Service provider develops a program and educators adapt it to their children's needs
    - Service provider develops the program with little flexibility for educators to adapt to their children's needs
    - Either educator or service provider, depending on confidence and experience of the educator
    - Other_____

19. Does the service provide educators with a breastfeeding welcome here sign?
    - Yes
    - No
    - Service does not provide care to children aged 0-1 years
    - Don't know

The following questions refer to the physical information you provide to educators, for example, educational material, resources (such as books) and activities to support them to promote healthy eating and physical activity.

20. Does the service provide educators with information or resources to provide intentional learning experiences about healthy eating? (e.g. Vegetable gardens, cooking or tasting sessions, stories, songs, puzzles about food.)
    - Yes
    - No
    - Don't know

If yes, what kind of information or resources do you provide? _____

19a. If yes→ what kind of experiences do they provide information on? (tick all that apply)
    - Science experiments and activities about food and water
    - Cooking skills
    - Story time
    - Food growing (e.g. kitchen/vegetable gardens, planting seeds)
    - Tasting sessions
    - Songs, puzzles and books
    - Intentional discussion around healthy eating, including 'everyday' and 'sometimes' foods (e.g. at meal times)
    - Play centre/activities around food shopping, cooking and packing lunchboxes
    - Still life art experiences around healthy eating
    - Composting/worm farms
    - Other_____

21. Does the service provide educators with information or resources on supervised floor based play for babies aged 0-12 months?
    - Yes
    - No
    - Service does not provide care to children aged 0-1 years

- Don't know

If yes, what kind of information or resources do you provide?

22. Does the service provide a list or guidelines for physical activity equipment to encourage active play for 1-5 year olds?
    - Yes - ask to take photos
    - No
    - Don't know

If yes, what kind of information or resources do you provide?

23. Does the service provide educators with information or resources to intentionally teach the fundamental movement skills for children 3-5 years of age? Fundamental movement skills are the basic set of gross motor movements such as running, jumping, catching and kicking.
    - Yes - ask to take photos
    - No
    - Don't know

If yes, what kind of information or resources do you provide?

Notes section:

_____

_____

Professional Development and Training

24. Since 2011, has the nominated supervisor, approved provider or coordinators at your service completed training or professional development in nutrition, healthy eating and/or physical activity?

    Number trained in healthy eating _____
    Number trained in physical activity _____
    Type of training
    - *Munch & Move* face-to-face training
    - *Munch & Move* webinar training
    - Internal training (employee from the FDC service provider conducted training)
    - Other_____

25. Since 2011, have any of your educators completed training or professional development in nutrition, healthy eating and/or physical activity?

    Number trained in healthy eating _____
    Number trained in physical activity _____
    Type of training
    - *Munch & Move* face-to-face training
    - *Munch & Move* webinar training
    - Internal training (employee from the FDC service provider conducted training)
    - Other_____

Notes:

_____

- Quality Improvement Plan (for NQF Assessment and Rating)
- Annual reports (for larger service providers)
- Business/Service plans
- Minutes of management or staff meetings or planning days
- Staff Development Kit Reflective Practice document*
- Other_____

  * Only relevant to M&M trained

Thank interviewee for participating in the study. You will be provided with feedback from the questionnaire that can be used to inform your Quality Improvement Plan.

Appendix O: Supplementary table 5.1: Nutrition policy review criteria sourced from national standards and best practice guidelines and the degree of service providers' policies that have covered each criterion

Supplementary table 5.1: Nutrition policy review criteria sourced from national standards and best practice guidelines and the degree of service providers' policies that have covered each criterion

Criteria	National standards and best practice guidelines					Criteria covered by service providers		
	National Quality Framework	Education and Care Services National Regulations	Get Up and Grow Guidelines	Australian Dietary Guidelines	*Munch & Move*® program adoption indicators	Not covered	Partially covered	Fully covered
Food offered to children is appropriate to the child's age and development	x		x			6	10	11
Food offered includes a wide variety of nutritious foods consistent with the Australian Dietary Guidelines	x	x[a]	x	x	x	-	9	18
Children have access to safe drinking water at all times	x	x	x			1	1	25
Milk offered to children is appropriate to the child's age, i.e. reduced fat milk is acceptable for children over 2 years		x	x	x		22	2	3
Mealtimes are positive, relaxed and social occasions	x		x			5	2	20
Children are encouraged to try different food types and textures in a positive eating environment	x		x			14	1	12

Criteria	National standards and best practice guidelines					Criteria covered by service providers		
	National Quality Framework	Education and Care Services National Regulations	Get Up and Grow Guidelines	Australian Dietary Guidelines	*Munch & Move*® program adoption indicators	Not covered	Partially covered	Fully covered
Children are offered an appropriate amount of food / Children are offered adequate quantities of food	×		×			6	-	21
Children are allowed to decide how much they will actually eat	×	×	×			10	2	15
Meals and snacks are offered at regular and predictable intervals	×		×			10	4	13
Food is safely prepared for children to eat	×	×	×			-	5	22
Educators role model healthy food and drink choices	×	×			×	8	6	13
Food isn't used as a reward or punishment for children	×		×		×	9	3	15
Educators are provided with professional development on nutrition and healthy eating					×	8	2	17
Families are provided with education/information on nutrition	×				×	3	2	22

Criteria	National standards and best practice guidelines					Criteria covered by service providers		
	National Quality Framework	Education and Care Services National Regulations	Get Up and Grow Guidelines	Australian Dietary Guidelines	*Munch & Move*® program adoption indicators	Not covered	Partially covered	Fully covered
Furniture and utensils are age appropriate and encourage children to be positively involved in and enjoy mealtimes	×					16	1	10
Cultural, religious or health requirements are taken into account	×					1	4	23
Educators promote healthy eating in children by including the topic in daily routines, modelling, discussions, songs, stories, games, using different cultural meal settings, and cooking experiences	×	×			×	10	10	7

[a] The Education and Care Services National Regulations state "the food or beverage provided is nutritious" but do not specify that the food should be consistent with the Australian Dietary Guidelines .

Appendix P: Supplementary table 5.2: Infant feeding policy review criteria sourced from national standards and best practice guidelines and the degree of service providers' policies that have covered each criterion

Supplementary table 5.2: Infant feeding policy review criteria sourced from national standards and best practice guidelines and the degree of service providers' policies that have covered each criterion

Criteria	National standards and best practice guidelines				Criteria covered by service providers		
	National Quality Framework	Get Up and Grow Guidelines	Australian Infant Feeding Guidelines	*Munch & Move*® program adoption indicators	Not covered	Partially covered	Fully covered
Information on the safe preparation, storage and handling on infant breastmilk	×		×		2	8	14
Information on the safe preparation, storage and handling on infant formula	×		×		5	13	6
Educators provide a supportive physical environment for mothers who want to breastfeed (e.g. access to a comfortable place for mothers who want to breastfeed or express breastmilk; access to a fridge to store expressed breast milk)	×		×	×	11	-	13
The service provider and educators support breastfeeding		×		×	5	4	15
Suitable solids are introduced at around six months		×	×		16	2	6
Infants under the age of six months who are not exclusively breastfed can be offered cooled boiled water in addition to infant formula		×	×		17	0	7

Appendix Q: Supplementary table 5.3: Physical activity policy review criteria sourced from national standards and best practice guidelines and the degree of service providers' policies that have covered each criterion

Supplementary table 5.3: Physical activity policy review criteria sourced from national standards and best practice guidelines and the degree of service providers' policies that have covered each criterion

Criteria	National standards and best practice guidelines				Criteria covered by service providers		
	National Quality Framework	Get Up and Grow guidelines	Australian 24-Hour Movement Guidelines for the Early Years	*Munch & Move*® program adoption indicators	Not covered	Partially covered	Fully covered
Policy states the Australian 24-Hour Movement Guidelines for the Early Years OR Get Up and Grow Physical Activity Recommendations		x	x	x	5	1	5
Physical activity is embedded in daily programs through spontaneous and intentionally planned active play		x		x	3	-	8
Educators actively role model to children appropriate physical activity behaviours		x		x	4	2	5
Families are provided with education/information on physical activity	x	x		x	6	-	5

Appendix R: Supplementary table 5.4: Screen time policy review criteria sourced from national standards and best practice guidelines and the degree of service providers' policies that have covered each criteria

Supplementary table 5.4: Screen time policy review criteria sourced from national standards and best practice guidelines and the degree of service providers' policies that have covered each criteria

Criteria	National standards and best practice guidelines					Criteria covered by service providers		
	National Quality Framework	Get Up and Grow Guidelines	Australian 24-Hour Movement Guidelines for the Early Years	Early Childhood Australia Statement on young children and digital technologies	*Munch & Move*® program adoption indicators	Not covered	Partially covered	Fully covered
Reference to the Australian 24-Hour Movement Guidelines for the Early Years OR Get Up and Grow Physical Activity Recommendations		×	×		×	4	3	7
Not using screen as a reward or to manage challenging behaviours					×	10	-	4
Screen time is used for educational purposes or to facilitate physical activity				×	×	7	-	7
Educators engage with children and discuss what they are seeing				×		10	1	3

Appendix S: Supplementary Table 5.5 - Examples of policy statements classed as not covered, partially covered and fully covered

Supplementary table 5.5: Examples of policy statements classed as not covered, partially covered and fully covered

Nutrition policy criteria			
Criteria	**Not covered**	**Partially covered**	**Fully covered**
Food offered to children is appropriate to the child's age and development "The food or beverage provided is chosen having regard to the dietary requirements of individual children taking into account each child's growth and development needs"		"Food offered is appropriate for age…" "To provide food that takes into consideration **age appropriateness**, cultural & religious preferences, **nutritional guidelines**, safety issues, **children's individual appetite**, food intolerances, diabetes requirements and allergies" "We will choose foods based on the individual needs of children whether they are based on likes, dislikes, growth and developmental needs, cultural, religious or health requirements." • Given half mark as statement does not specify that all food should be based on child's age and development	"Educators are to ensure that all children are offered appropriate food and drinks on a regular basis throughout the day considering the age, stage of development and individual needs of each child." "Food is appropriate for growth and developmental needs" "food and beverages must be chosen based on individual children's growth and developments needs in addition to any cultural, religious or health requirements."
Cultural, religious or health requirements are taken into account		"Respect the requests of families relating to dietary, religious or cultural beliefs" • Given half mark as statement is not specific to food does not specify health requirements	"Allow for children's specific cultural, religious or health requirements e.g. medical conditions, Halal or Kosher foods."

Food offered includes a wide variety of nutritious foods consistent with the Australian Dietary Guidelines		"Food provided must be nutritious."	"Food provided must be nutritious and include a variety of food groups such as fruit, vegetables, grains, meat and dairy." "Provide healthy food and drinks based on the Australian Dietary Guidelines for Children and adolescents."
Children have access to safe drinking water at all times		"Water is provided" "Provide drinking water"	"Water is available at all times "Water is offered throughout the day"
Milk offered to children is appropriate to the child's age, i.e. reduced fat milk is offered for children over 2 years		"Milk offered to children is appropriate to the child's age." "Low fat food and beverages are not suitable for children under 2 years."	"Reduced fat milk is acceptable for children over 2 years"
Mealtimes are positive, relaxed and social occasions		"Mealtimes should be social."	Create a relaxed atmosphere at mealtimes where children have enough time to eat and enjoy their food as well as enjoying the social interactions with educators and other children. "Educators will: facilitate mealtimes that are relaxed, positive and social" "It is recommended that educators: - Provide relaxed mealtimes - Talk with children and give positive attention while children are eating"
Encourage children to try different food types and textures in a positive eating environment		"Children will be encouraged to eat, but will never be forced to eat" "Children are encouraged to eat healthy foods from their lunchboxes, but they are not required to eat food they do not like or eat more than they want"	"Encourage children to try new/healthy foods but will not force them to eat"

Children are offered an appropriate amount of food / Children are offered adequate quantities of food			"Food provided is adequate in quantity" "Provide children with 50% of the recommended dietary intake for all nutrients" "Adequate quantities of food available for children that are consistent with the Australian Dietary Guidelines, as well as sufficient food for children who may request more" "Educators will follow the guidelines for serving different types of food and the serving sizes in the Guidelines and may use the Australian Government "eat for health" calculator http://www.eatforhealth.gov.au/eat-health-calculators." "Children most be offered healthy, nutritious food of a sufficient quantity throughout the day." "A healthy balance of food and drink in sufficient quantity should be provided on a daily basis." "Plan healthy snacks on the menu to complement what is served at mealtimes and ensure the snacks are substantial to meet the energy and nutrient needs of children."
Children are allowed to decide how much they will actually eat		"Children's right to choose foods and to feed themselves will be respected" "Respect children's right to choose foods and to feed themselves at their own pace" • Given half mark as it does not specify quantity	"Children are not forced to eat" "Respect each child's appetite. If a child is not hungry or is satisfied, educators do not insist he/she eats. "

			"Family day care educators need to respect differences in appetite between children. Force-feeding of children is not acceptable."
Meals and snacks are offered at regular and predictable intervals " are offered food and beverages on a regular basis throughout the day"		"Snack and meal times will be considered within the routine of the daily program but individual needs will be accommodated and catered" "Healthy snacks are available at all times to cater for children who are hungry between meal times. A healthy snack can be breads/ cereals or fruit/ vegetable"	"Daily mealtime routine is established" "Food offered at frequent intervals" "Food offered on a regular basis" "Food and drink should be offered to children at regular intervals as part of the set routine." "Food and beverages will be provided on a regular basis throughout the day."
Food is safely prepared for children to eat		"Food is safely prepared" "All food and drinks are to be stored/refrigerated appropriately, and prepared in a safe and hygienic manner. Each educator will have a suitable area to prepare food and will ensure that this area is kept clean and hygienic at all times."	- All surfaces that will come in contact with the food are to be cleaned before the meal. - Children and staff wash and dry their hands before handling food or eating meals and snacks. - Children are supervised while eating - Ensure gloves are worn or tongs are used by all staff handling 'ready to eat' foods. - Children are discouraged from handling other children's food and utensils. - Food is stored and served at safe temperatures i.e. below 5°C or above 60°C. - Use separate cutting boards for raw meat; utensils and hands are washed before touching other foods.
Educators role model healthy food and drink choices		"Role model appropriate mealtime behaviour" • Given half mark as statement is not specific to eating healthy food"	"Role model consumption of healthy foods and actively engage children in conversations about the food provided"

		"Educators sit and eat with the children, maintaining good personal nutrition."	
Food isn't used as a reward or punishment for children		"Food should not be used a punishment"	"Do not use food as a reward or withhold food for disciplinary purposes"
Families are provided with education/information on nutrition		"Educators encourage and support parents to provide nutritious food"	
Educators are provided with professional development on nutrition and healthy eating		"Encourage and support educators to attend relevant training and workshops"	"All educators will participate in the *Munch & Move* professional training" "The service will provide opportunities for educators to participate in healthy eating and nutrition professional development"
Furniture and utensils are age appropriate and encourage children to be positively involved in and enjoy mealtimes		"Have stable, easy to clean child size table/s and chairs"	
Educators promote healthy eating in children by including the topic in daily routines, modelling, discussions, songs, stories, games, using different cultural meal settings, and cooking experiences		"Establish healthy eating habits in the children by incorporating nutritional information into our program" "Food awareness activities may be included as part of the educational program plan"	"Foster awareness and understanding of healthy food and drink choices through including in the children's program a range of learning experiences encouraging children's healthy eating"
Infant feeding policy			
Element on criteria	**No points**	**Half points**	**Full points**
The Service Provider and educators support breastfeeding		"We discuss breastfeeding support with all potential new families" "Families are asked about breastfeeding at the time of enrolment… and families are	"The Service will provide ongoing support to breastfeeding mothers, including providing the opportunity to breastfeed their baby at any time. "

		provided with current information regarding breast and bottle feeding as well as introducing solids in the form of journal articles, fact sheets, booklets and pamphlets in languages representing the families at the FDC service"	"Staff and educators will support families' choices regarding feeding, including breastfeeding and bottle-feeding." "The purpose of the policy is to inform parents about the breastfeeding supportive services a family child care home provides and to check-in with mothers for feedback and ways to continue providing support." "Ensure parents are aware that the Family Day Care Service is a 'breastfeeding friendly' Service." "[Service provider name] Family Day Care will encourage and support all families to continue breastfeeding their infant until at least 12 months of age."
Suitable solids are introduced at around six months	"It is the parent/s' decision when to introduce solid food to babies' diets"	"Solids will be introduced to babies and toddlers in consultation with the family and in line with recognised nutritional guidelines."	
Information on the safe preparation, storage and handling on infant breastmilk is provided		"The service and educators will ensure the safe handling of breastmilk and infant formula during transportation, storage, thawing, warming, preparation and bottle feeding."	Guidelines according to Australian Government Infant Feeding Guidelines - Label bottles with name and date - Store at back of refrigerator (below 5°C) for maximum 72 hours or freezer for 2 weeks (-15°C) - Wash hands before preparing bottle - Heat in warm water (do not microwave) - Test temperature on wrist - Discard left over milk after feeding
Information on the safe preparation, storage and handling on infant formula is provided	Policies that provided instructions or support for microwaving formula were scored zero, e.g. "For a 120ml size bottle – use high setting and heat for less than 30 seconds."	"The service and educators will ensure the safe handling of breastmilk and infant formula during transportation, storage, thawing, warming, preparation and bottle feeding."	Guidelines according to Australian Government Infant Feeding Guidelines - Wash hands before preparing bottle - Sterilise bottle by boiling for 5 minutes or using an approved sterilising agent

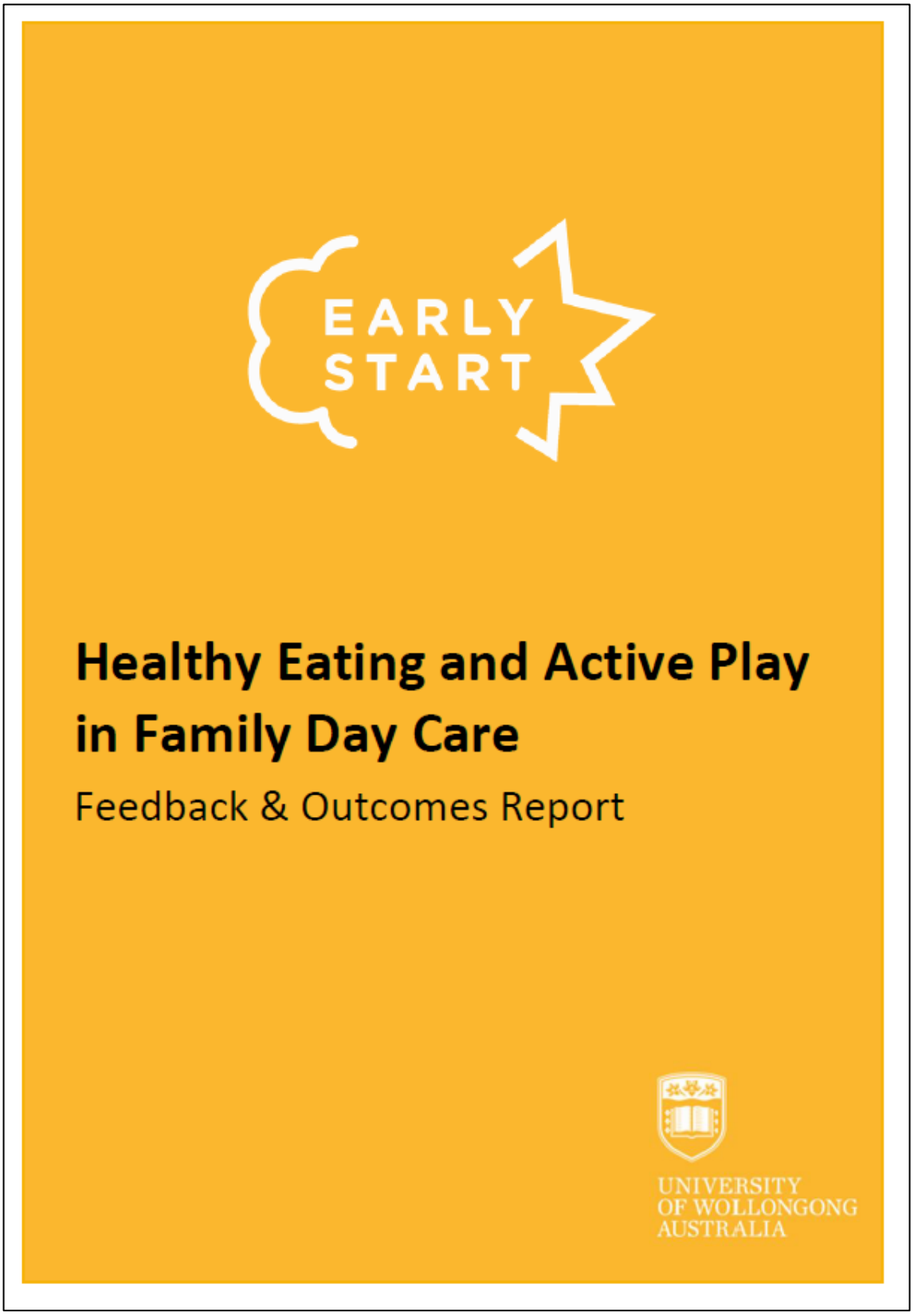
			- Prepare according to formula instructions - Use freshly boiled tap water that has been allowed to cool to lukewarm or room temperature - Test temperature on wrist - Any formula left at the end of the feed or that has been at room temperature for longer than 1 hour should be discarded
Physical activity policy			
Reference to the Australian 24-Hour Movement Guidelines for the Early Years OR Get Up and Grow Physical Activity Recommendations	"Accumulate at least 60 minutes of unstructured movement activities (free play) daily. Accumulate at least 60 minutes of structured activities daily to develop fundamental movement skills. Limit time spent in passive activities to no more than 60 minutes at a time"	"Regulatory requirements and guidelines mandate that children must be provided adequate time to actively engage in physical activities and outdoor play."	**Australian 24-Hour Movement Guidelines for the Early Years:** - For healthy development in infants (birth to 1 year), being physically active several times a day in a variety of ways, particularly through supervised interactive floor-based play, including crawling; more is better. For those not yet mobile, this includes at least 30 minutes of tummy time, which includes reaching and grasping, pushing and pulling, spread throughout the day while awake; - Toddlers (1 to 3 years) and pre-schoolers (3 to 5 years): at least 180 minutes spent in a variety of physical activities, including energetic play, spread throughout the day; more is better; - Pre-schoolers should spend at least 60 minutes in energetic play, spread throughout the day; more is better **Get Up and Grow Physical Activity Recommendations:** Recommendation: For healthy development in infants (birth to 1 year), physical activity

			– particularly supervised floor-based play in safe environments – should be encouraged from birth. Recommendation: Toddlers (1 to 3 years) and pre-schoolers (3 to 5 years) should be physically active every day for at least three hours, spread throughout the day.
Physical activity is embedded in daily programs through spontaneous and intentionally planned active play			"Staff will implement structured physical activity daily e.g. ball games, dancing. Staff will implement an indoor/outdoor programme where children can make decisions about where they would like to play. Children who are more active will have ample opportunity to engage in active experiences."
Educators actively role model to children appropriate physical activity behaviours		"As active role models, educators are encourage to participate in physical activity"	"Educators will: - Participate in physical activity with the children - Show enthusiasm for participation in physical activity and organise play spaces to ensure the safety and wellbeing of all individuals in the environment. - Role model appropriate footwear and clothing for physical activity"
Screen time			
Reference to the Australian 24-Hour Movement Guidelines for the Early Years for Children 0-5 Years (Sedentary Behaviour Recommendations) - For those younger than 2		"Educators will limit the amount of time spent on screens"	**Australian 24-Hour Movement Guidelines for the Early Years:** Babies (infants) under 1 year of age - Screen time is not recommended. Toddlers (1-2 years) - For those younger than 2 years, sedentary screen time is not recommended.

years, sedentary screen time is not recommended - For those aged 2 to 5 years, sedentary screen time should be no more than 1 hour (in a 24-hours period); less is better When sedentary, engaging in pursuits such as reading, singing, puzzles and storytelling with a caregiver is encouraged OR Get Up and Grow Screen time Recommendations			- For those aged 2 years, sedentary screen time should be no more than 1 hour; less is better. <u>Pre-schoolers (3-5 years)</u> - Sedentary screen time should be no more than 1 hour; less is better. **Get Up and Grow Physical Activity Recommendations:** <u>Recommendation:</u> Children younger than two years of age should not spend any time watching television or using other electronic media (DVDs, computer and other electronic games). <u>Recommendation:</u> For children two to five years of age, sitting and watching television and the use of other electronic media (DVDs, computer and other electronic games) should be limited to less than one hour per day.
Screen time is used for educational purposes or to facilitate physical activity	"The use of any electronic media device whether they are electronic and or battery operated used in the provision of education and care are to be used to contribute to the education and care of children. Television, video or DVD can be used for quiet times. The television must be selectively used with the children. It may not be used as a background activity or general diversion for the children."		"Limit experiences involving screen use to those which have an educational component – including movement." "Computers, TV or DVD viewing at FDC will be used only for educational purposes."
Educators engage with children and discuss what they are seeing and learning when viewing screens		"Children need participation with and direction from adults, during television/DVD viewing. The internet should only be used under close supervision of an educator."	"Educators will supervise viewing and encourage interaction and discussion of ideas and issues." "Educators will always view electronic media with the children and:

		- Talk about the programs being watched, discuss the activities and characters being viewed. - Ask children questions and invite them to ask questions about how they feel about what they are watching."

Appendix T: Service provider feedback report



Feedback & Outcomes Report

Dear [redacted]

Thank you for participating in the research 'Healthy Eating and Active Play in Family Day Care.' The purpose of the research is to gain an understanding of the healthy eating and physical activity practices and policies in Family Day Care services. The research is part of a larger study in partnership with NSW Health that will guide the development of future professional development activities to support coordinators and educators to embed healthy eating and physical activity into their programs.

The following report has been created based on the information and documents you have provided. The documentation has been reviewed against best practice standards and in consultation with experts in the field. This report highlights your Service Provider strengths, as well as opportunities for growth. We recommend discussing the feedback with your staff and educators and using it to guide your Quality Improvement Plan. The research directly relates to the National Quality Standard *Quality Area 2.1.3 Healthy eating and physical activity are promoted and appropriated for each child*. The following two pages provide a summary of the results. This is a confidential document and the specific information included about your Service Provider has only been sent to you.

The accompanying USB includes additional resources and information to support your Service Provider to embed healthy eating and physical activity.

Date of Interview: 22.05.2018

Age range of children: 0-12 years

Educators with children aged 0-5 years: 30

Food provider: families

To discuss the report further, please contact Erin Kerr

Email: fdc-project@uow.edu.au

Phone: 02 4298 1188

EARLY START

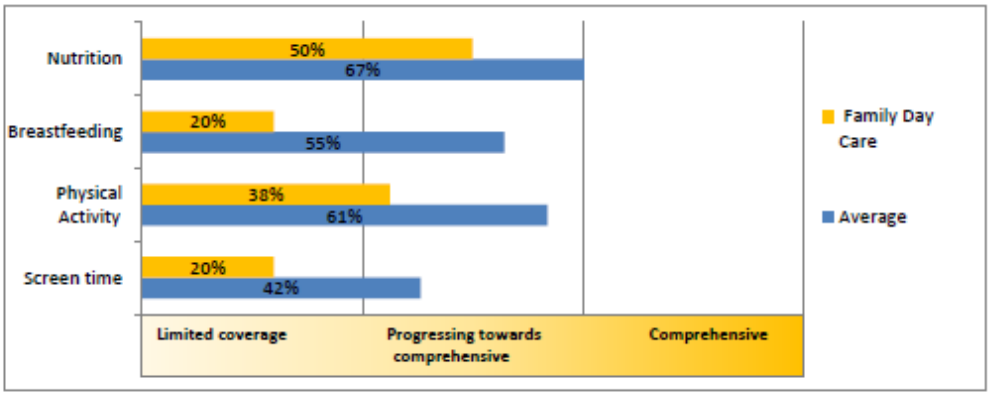
UNIVERSITY OF WOLLONGONG AUSTRALIA

Feedback & Outcomes Report

Results

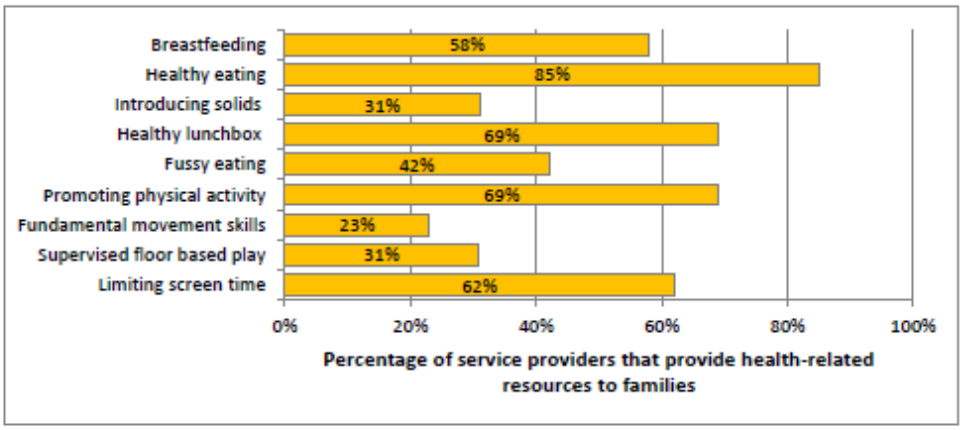
Twenty eight Family Day Care Service Providers from South Western Sydney and Illawarra Shoalhaven Local Health Districts were interviewed. The graphs below summarises the findings.

Table 1: Comparison of policy ratings



The average policy rating was calculated by only from the policies that were assessed. All Service Providers had a nutrition policy and 84% of Service Providers had a breastfeeding policy. However, only 38% of Service Providers had a physical activity policy and 54% of Service Providers had a screen time policy.

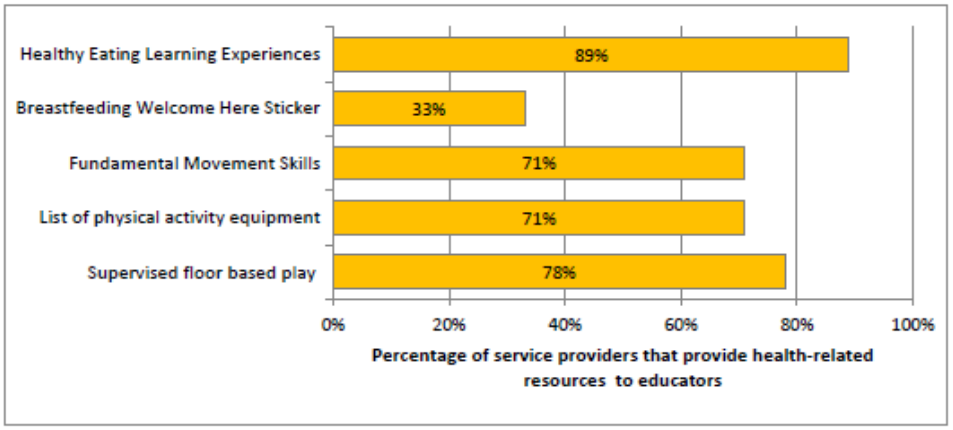
Table 2: Types of information provided to families by their Service Provider



The graph above can be interpreted as 58% of Service Providers provide information on breastfeeding and all Service Providers provide information on healthy eating. Your Service Provider reported providing information only on healthy eating and limiting screen time.

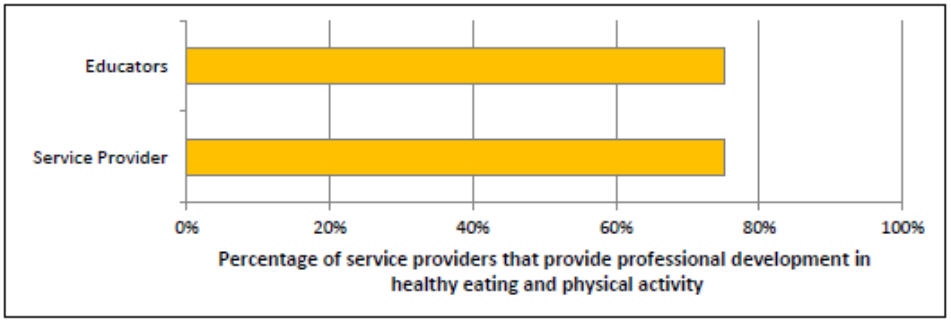
Feedback & Outcomes Report

Table 3: Types of resources provided to educators by their Service Provider



The graph above can be interpreted as 89% of Service Providers provide information on healthy eating learning experiences. Your Service Provider reported providing information on recommended healthy eating learning experiences, breastfeeding welcome here sticker, fundamental movement skills, list of physical activity equipment and supervised floor based play.

Table 4: Professional development in healthy eating and physical activity



The graph above can be interpreted as 75% of Service Providers provide professional development in healthy eating and physical activity to staff at the Service Provider level (ie coordinators) and educators. Your Service Provider reported not providing professional development in healthy eating and physical activity to staff at the Service Provider level and educators.

Feedback & Outcomes Report

Policies

Your nutrition policy includes the following guidelines:

- Families are informed that the service provider and educators support breastfeeding when the families first make contact with the service provider (or during orientation)
- Food offered to children is appropriate to the child's age and development
- Food offered includes a wide variety of nutritious foods consistent with the Australian Dietary Guidelines
- Water is provided
- Food offered is of a suitable serving size
- Food is safely prepared for children to eat

Opportunities for Improvement

Consider adding the following elements to your nutrition policy:

- Information on the safe preparation, storage and handling on infant breast milk and formula is provided
- Families are asked about breastfeeding at the time of enrolment
- Educators develop a documented feeding plan for breastfed infants
- Educators provide a supportive physical environment for mothers who want to breastfeed (e.g. access to a comfortable place for mothers who want to breastfeed or express breastmilk, access to a fridge to store expressed breast milk)
- Suitable solids are introduced at around six months
- Provide age-appropriate milk drinks. Infants under the age of six months who are not exclusively breastfed can be offered cooled boiled water in addition to infant formula
- Mealtimes are positive, relaxed and social occasions
- Cultural, religious or health requirements are taken into account
- Furniture and utensils are age appropriate and encourage children to be positively involved in and enjoy mealtimes
- Encourage children to try different food types and textures in a positive eating environment
- Meals and snacks are offered at regular and predictable intervals
- Educators role model healthy food and drink choices
- Children are allowed to decide how much they will actually eat
- Strategies to ensure food isn't used as a reward or incentive for children
- Educators are provided with professional development on nutrition and healthy eating
- Families are provided with education/information on nutrition
- Educators promote healthy eating in children by including a range of learning experiences that encourage healthy eating

Feedback & Outcomes Report

Your physical activity policy includes the following guidelines:

- Educators actively role model to children appropriate physical activity behaviours
- Staff will implement structured physical activity daily e.g. ball games, dancing.
- Range of equipment is available

Areas to consider adding:

- Reference to the **Australian 24-Hour Movement Guidelines for the Early Years**
  - For healthy development in infants (birth to 1 year), being physically active several times a day in a variety of ways, particularly through supervised interactive floor-based play, including crawling; more is better. For those not yet mobile, this includes at least 30 minutes of tummy time, which includes reaching and grasping, pushing and pulling, spread throughout the day while awake;
  - Toddlers (1 to 3 years) and pre-schoolers (3 to 5 years): at least 180 minutes spent in a variety of physical activities, including energetic play, spread throughout the day; more is better;
  - Pre-schoolers should spend at least 60 minutes in energetic play, spread throughout the day; more is better
- Physical activity is embedded in daily programs through spontaneous and intentionally planned active play that is both child-initiated and educator led
- Families are provided with education/information on physical activity

Your screen time policy includes the following guidelines:

- Screen time is only used for educational purposes or to facilitate physical activity

Areas to consider adding:

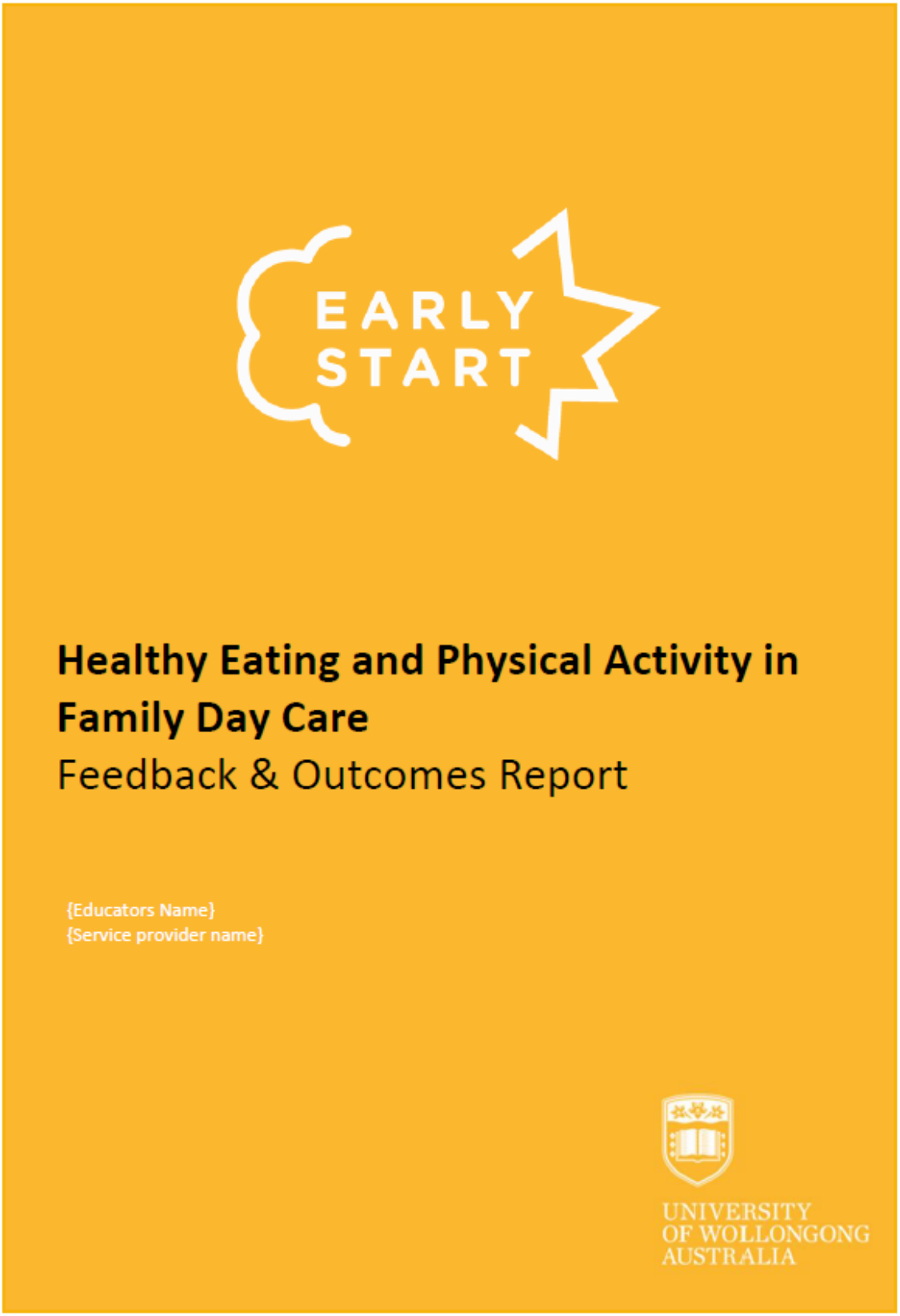
- Reference to the **Australian 24-Hour Movement Guidelines for the Early Years**
  - For those younger than 2 years, sedentary screen time is not recommended
  - For those aged 2 to 5 years, sedentary screen time should be no more than 1 hour (in a 24-hours period); less is better
  - When sedentary, engaging in pursuits such as reading, singing, puzzles and storytelling with a caregiver is encouraged
- When using screen devices with children over the ages of 2 years it is recommended:
  - Not using screen devices as a reward or to manage challenging behaviours
  - Educators engage with children and discuss what they are seeing and learning when viewing screens
  - Families are provided with education/information on screen time

Sample policies can be found on the USB supplied.

Appendix U: Recruitment video

Link: https://www.youtube.com/watch?v=eRB4DTf-Dac&feature=youtu.be

Appendix V: Educator feedback report



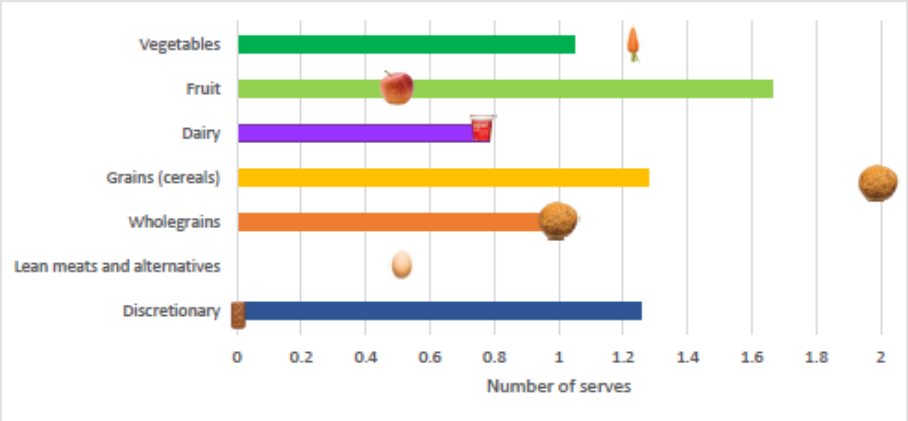
Thank you for participating in the research study "Healthy Eating and Physical Activity in Family Day Care". The research is part of a larger study in partnership with NSW Centre for Population Health, and South Western Sydney and Illawarra Shoalhaven Local Health Districts. The combined results of 33 educators will guide future professional development activities to support family day cares and service providers to embed healthy eating and physical activity into their programs.

The time children spend at family day care provides an important opportunity to encourage and promote healthy eating and active play. This research study observed healthy eating and physical activity behaviours during one day at your family day care. We acknowledge that every day is different and this may not be reflect a typical day for you and the children in your family day care. We hope this report will be a valuable tool to critically reflect on practices and inform future quality improvement plans.

1.1 Healthy Eating

The food provided to children, either from home or from the service, during the one-day observation was assessed using the Australian Dietary Guidelines and the NSW Caring for Children resource. The NSW Caring for Children resource recommends children in care for eight hours or more should receive at least one main meal and two midmeals that provide at least 50% of the recommended serves of each food group. Figure 1 below shows the average number of serves for each of different food group that were provided to children during the one day observation and how this compares to the recommended number of serves. Across all services, the average number of serves of vegetables, grains (cereals) and lean meats and alternatives that were provided were lower than the recommendations. Conversely, the average number of serves of fruit and discretionary foods provided was more than recommended. Discretionary foods include items such as chips, biscuits, processed meat, ice-cream and iceblocks.

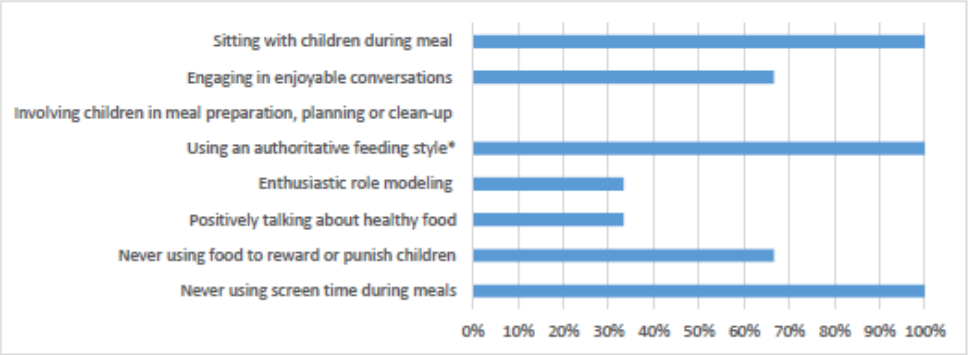
Figure 1: Average number of serves of food groups provided and the recommended serves



▲ Recommended number of serves based on a child aged 2-3 y

The researchers also observed the mealtime environments for children and the practices of educators in supporting children during mealtimes. Mealtime environments and feeding practices of caregivers can influence how much and what type of food children eat, and can influence their ability to self-regulate their food intake based on their appetite in the long term. Figure 2 shows the proportion of mealtimes where positive mealtime environments and feeding practices were observed.

Figure 2: Percentage of mealtimes a behaviour was observed during the observation



*Authoritative feeding style involves encouraging children to eat healthy food without pressuring them to eat food they don't like or to eat more than they feel like eating

EARLY START

UNIVERSITY OF WOLLONGONG AUSTRALIA

Specific to your service, we identified many positive aspects related to the foods provided, mealtime environments and feeding practices. These **strengths** included:

- Children were provided with vegetables, fruit, dairy, wholegrains and lean meats or meat alternatives.
- Discretionary foods were limited.
- Water was available at all times.
- Sitting with children and engaging in enjoyable conversations.
- Children were involved in meal preparation, planning or clean-up.
- Children were encouraged to eat healthy food
- Children were not pressured to eat food they do not like, or to eat more than they feel like eating.
- Enthusiastic role modelling.
- Positively talking about healthy food.
- Children were never rewarded or punished for eating a particular food, and food was never used as a reward or punishment.
- Screen time was never used during mealtimes.

The researchers also identified **ideas to promote healthy eating**, including:

- Replacing discretionary foods with vegetables, wholegrains, dairy and lean meats and meat alternatives with your morning and afternoon snack foods. For examples of recipes refer to page 111 in the Caring for Children resource.
- Sitting and talking to children is a great way to make mealtimes enjoyable. It also provides a great opportunity to role model healthy eating.
- Eating healthy foods with children and talking positively about healthy foods, for example, the taste, texture and colour.
- Eating healthy food with children during mealtimes is great way to promote good eating behaviours, encourage children to eat healthy foods and be a positive role model.
- Serving food on a share platter to encourage food socialization and create a supportive environment for children to try new foods.
- Including children in meal preparation, planning or clean-up. This might involve allowing children to serve food for themselves from the middle of the

table or taking their plate/bowl to the kitchen once they have finished eating.

- Encouraging children to eat healthy food and allowing them to choose what foods on offer they would like to eat, and how much food they want to eat
- Praising children for trying healthy foods instead of using rewards. Offering children a food or non-food reward for eating a particular food does not teach them to enjoy eating healthy foods. It can also make discretionary foods seem more desirable to children.
- Avoiding screen use (such as televisions, tablets and phones) during mealtimes. These distract children from eating, and they are less likely to recognise their hunger and fullness cues.

Below is a list of helpful resources, where you can find further information on healthy eating practices for early education and care services.

Healthy Kids Website - *Munch & Move resources*
https://healthykids.nsw.gov.au/munch-move-resources/
The Healthy eating learning experiences
https://www.healthykids.nsw.gov.au/downloads/file/campaignsprograms/HealthyEatingLearningExperiencesResource.pdf

Caring for Children
https://healthykids.nsw.gov.au/downloads/file/teacherschildcare/CaringForChildrenManual-Complete.pdf

Get Up and Grow Cooking for Children Book
https://www1.health.gov.au/internet/main/publishing.nsf/Content/CE19DBB41BD0C8BACA257BF0001F97DA/$File/HEPA%20-%20B5%20Book%20-%20Cooking%20for%20Children%20Book_LR.pdf

Get Up & Grow: Healthy Eating and Physical Activity for Early Childhood
https://www1.health.gov.au/internet/main/publishing.nsf/Content/EA1E1000D846F0AFCA257BF0001DADB3/$File/HEPA%20-%20A4%20Book%20-%20Directors%20Book%20-%20LR.pdf

https://www1.health.gov.au/internet/main/publishing.nsf/Content/2CDB3A000FE57A4ECA257BF0001916EC/$File/HEPA%20-%20B5%20Book%20-%20Staff%20and%20Carer%20Book_LR.pdf

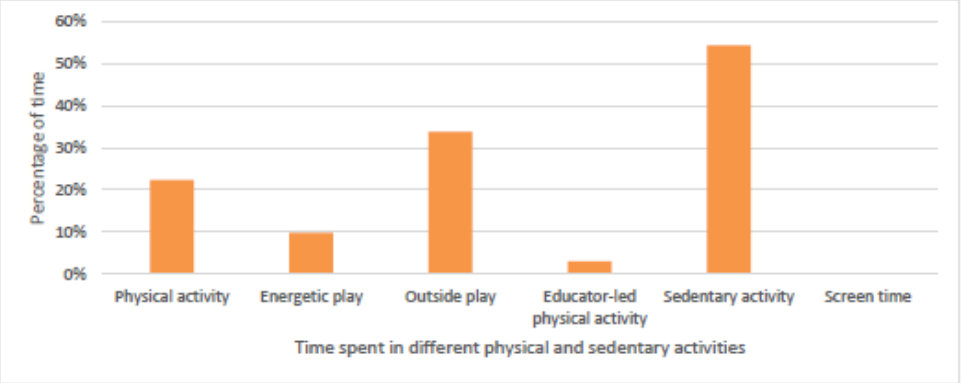
National Quality Standards: Quality Area 2 resources
https://www.acecqa.gov.au/nqf/national-quality-standard/quality-area-2-childrens-health-and-safety

Raising Children Network
https://raisingchildren.net.au/toddlers/nutrition-fitness
https://raisingchildren.net.au/preschoolers/nutrition-fitness

1.2 Physical activity, sedentary behaviour and screen time

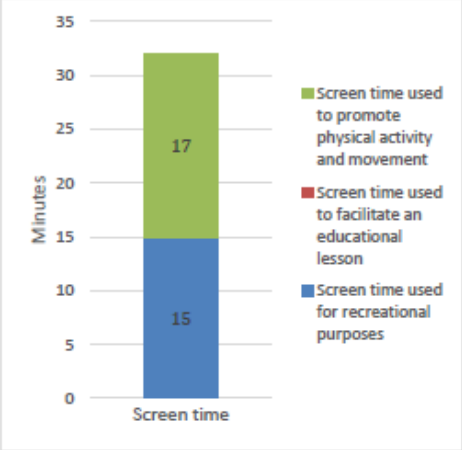
Children's physical activity levels were measured using accelerometer devices worn around their waist. The physical activity criteria that were observed included the environment, educator engagement in physical activity, types of physical activity and screen time. Figure 3 shows the percentage of time children spent in different physical and sedentary activities. Best practice guidelines recommend that children should spend 25% of their time (excluding nap/rest time) in physical activity. In addition, energetic play, such as running and jumping, should be spread throughout the day; more is better.

Figure 3: Percentage of time spent in physical and sedentary activities



*Excluding nap time

Figure 4: Time spent in different types of screen time (if applicable)



Strengths related to physical activity:

- Children were offered multiple opportunities for spontaneous free-play and outside play.
- Children had access to different types of equipment and outdoor areas for active play.
- Children were provided with organised or structured physical activity sessions.
- You were observed to engage in play or physical activity with children.
- You were observed to talk with children about the importance of physical activity.
- Screen time was limited and used for educational purpose or to facilitate physical activity.
- You were observed to interact with children during screen time and engaged in the content.
- Screen time was not used as a reward.
- Screen time was not available to children under 2 years.

Opportunities for promote healthy levels of physical activity and sedentary screen time:

- Scheduling time for unstructured and structured physical activity and outdoor play
- For additional opportunities to actively engage with children in physical activity and for ideas of group games, visit the *Munch & Move* website. Resources include 'Physical activity for Babies and toddlers', 'Active Play Audit tool', 'FMS with Franky and friends' and 'FMS in action'
- https://healthykids.nsw.gov.au/munch-move-resources/
- Limit sedentary screen time to no more than 1 hour per day for children two years of age and over. Most children will be exposed to screen time at home and therefore it is recommended to limit time spent using screen devices in family day care. Screen time is not recommended for children less than two years of age because it may reduce the amount of time they have for active play, socialisation and opportunities for language development.
- If using digital technology with children, it is recommended to use screen devices for educational purposes or to encouragement movement. It is also encouraged to engage with children and discuss the content.

Thank you for participating in this research study! We hope this feedback was helpful.

Additional information about this document:
This report presents the findings from observations conducted in your family day care service. The research relates to the National Quality Standard (NQS):

- QA 2 Element 2.1.3 *Healthy lifestyle*, "Healthy eating and physical activity are promoted and appropriate for each child"
- QA2 Element 2.2.2 "Healthy eating and physical activity are embedded in the program for children" and the supporting documents, including the Australian Guide to Healthy Eating (AGHE), and the Australian 24-Hour Movement Guidelines for the Early Years (birth to 5 years).

Neither this study nor these findings have any impact on the rating system conducted by NSW Department of Education or ACECQA; we are not affiliated with the NSW Department of Education ACECQA and the individual findings from this study will be confidential.

If you would like further information or clarification about this report, please contact us at fdc-project@uow.edu.au

Appendix W: Ethics approval for FDC observation study (HREC/18/WGONG/13)

Dear Professor Okely,

I am pleased to advise that the application detailed below has been **approved**.

Ethics Number:	2018/019
Approval Date:	24/07/2018
Expiry Date:	23/07/2019
AuRed Number:	HREC/18/WGONG/13
Project Title:	Observing Healthy Eating and Physical Activity in Family Day Care Services
Researchers:	Kerr Erin; Parkinson Julie; Ryan Sarah; Okely Tony; Furber Susan; Kelly Gillott Bridget; Franco Lisa; Green Amanda; Hernandez Lara
Documents Approved:	HREA AU/1/0573312 rec. 16/01/2018 Project Description V1 rec. 16/01/2018 Response to Ethics Review 2018/019 Appendix 1 - service provider PIS V1 Appendix 2 - service provider consent form V1 Appendix 3 - Educator participant information sheet V3 Appendix 4 - Educator Consent Form V3 Appendix 4 - Parent Consent Form V1 Appendix 5 - Parent participant information sheet V3 Appendix 6 - Observation tool V1 Investigator Details Forms Cover letter

The HREC has reviewed the research proposal for compliance with the *National Statement on Ethical Conduct in Human Research* and approval of this project is conditional upon your continuing compliance with this document. Compliance is monitored through progress reports; the HREC may also undertake physical monitoring of research.

Approval is granted for a twelve month period; extension of this approval will be considered on receipt of a progress report **prior to the expiry date**. Extension of approval requires:

- The submission of an annual progress report and a final report on completion of your project.
- Approval by the HREC of any proposed changes to the protocol or investigators.
- Immediate report of serious or unexpected adverse effects on participants.
- Immediate report of unforeseen events that might affect the continued acceptability of the project.

If you have any queries regarding the HREC review process or your ongoing approval please contact the Ethics Unit on 4221 3386 or email rso-ethics@uow.edu.au.

Please note that Governance approval is required for research within the NSW Ministry of Health. If you have not already done so, you will need to complete a Site Specific Application for each site and lodge it with the appropriate Research Governance unit for each site.

Yours sincerely,

Susan Thomas

Dr Susan Thomas,
Chair, UOW & ISLHD Health and Medical Human Research Ethics Committee

The University of Wollongong and Illawarra and Shoalhaven Local Health District Health and Medical HREC is constituted and functions in accordance with the NHMRC National Statement on Ethical Conduct in Human Research. The processes used by this HREC to review multi-centre research proposals have been certified by the National Health and Medical Research Council.

Appendix X: Educator participant information sheet and consent form

Healthy Eating and Physical Activity Practices and Environment in Family Day Care Services

Participant Information Sheet

Dear [educator],

You are invited to participate in an observational study to help us understand the healthy eating and physical activity environment in family day care educator's homes. The research is being conducted by the research team from the University of Wollongong (UOW) in partnership with your Local Health District (LHD) and the NSW Office of Preventive Health (OPH).

PURPOSE OF THE RESEARCH

The purpose of the research is to gain an understanding of the healthy eating and physical activity practices and environment in family day care services. The research will guide the development of future professional development activities to support educators to embed healthy eating and physical activity into their programs.

This research is a part of Erin Kerr's PhD degree at the University of Wollongong supervised by Tony Okely and Bridget Kelly.

INVESTIGATORS

- Professor Tony Okely, University of Wollongong
- Dr Bridget Kelly, University of Wollongong
- Erin Kerr, University of Wollongong
- Sarah Ryan, University of Wollongong
- NSW Office of Preventive Health, NSW Health
- South Western Sydney Local Health District
- Illawarra Shoalhaven Local Health District

If I have any questions about the research, you can contact Erin Kerr (02) 4298 1188 emk833@uowmail.edu.au and/or Sarah Ryan (02) 4221 3141 fdc-project@uow.edu.au.

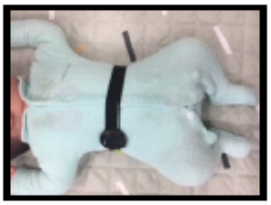
METHOD AND DEMANDS ON PARTICIPANTS

Your family day care service provider has agreed to be involved in this study. If you agree, a trained University researcher will attend your family day care service for one day and observe your daily practices. Observations will be completed by a trained researcher, using the Environmental Policy Assessment Observation tool during normal daily activities with the children. This will not interfere with your normal daily activities.

If you agree to participate in this research we will also ask you to give parents/carers a participant information sheet detailing their children's involvement in the study, which will entail:

- Measuring and recording the contents inside children's lunchboxes at the start of the day out of sight from children
- Asking children to wear a lightweight activity monitor over a period of the day while they are at your family day care service

Children's participation in the study is optional.



The contents inside children's lunchboxes will be photographed, measured, recorded and assessed against the *Australian Guide to Healthy Eating*. Children will also be asked to wear a lightweight activity monitor (belt) over a period of a day while they are at your family day care service. The belt will be worn around their waist (as shown in the pictures). This belt will monitor the level of physical activity they do during the time they are at you family day care. These belts are non-intrusive and will not stop children from being involved in normal program activities (that is, all children will be able to be involved in all activities planned for that day).

Every child's participation in this research is voluntary and if a child expresses or shows signs of any discomfort or irritation from wearing the activity monitor belt they may take it off at any time. You will also be given the opportunity to wear a lightweight activity monitor to measure your activity during the one day observation.

Children's participation in the study is optional and parents will need to return a signed consent form for their child's lunchbox and physical activity levels to be measured.

If you choose to participate, you will be advised of the date of your visit 24 hours in advance, however we will request that you do not tell parents/carers the date of our visit so it does not affect the contents of the child's lunchbox. We will also report back the results of the observation to you at a later date and seek your input in priorities for future professional development activities for educators.

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

We can foresee no risks for your involvement. It is voluntary and you or the children in your care may withdraw from the study at any time. The activity monitor belts are non-intrusive and will not stop children from being involved in normal program activities. You and the children are able to take the belts of at any time during the day if it does cause any discomfort.

Declining to participate or withdrawing participation in the research will not affect your relationship with your employer. If you choose to withdraw from the study, your current or future relationship with the LHD, OPH or with the UOW will not be affected. All information collected during this study will be kept strictly confidential and be stored in a locked office.

The information you provide will be confidential and de-identifiable and will not be shared with your service provider or elsewhere unless required by law. This will be used by the UOW, LHD and OPH to guide the development of future professional development activities to support educators to embed healthy eating and physical activity into their program. The data collected may also be used in publications, reports and presentations; however these documents will not identify individual services or any personal information. The details of your service will always remain confidential and your name will not be recorded in the data.

FUNDING AND BENEFITS OF THE RESEARCH

This study is funded by a research grant from the Prevention Research Support Program (PRSP). The PRSP provides funding to NSW research organisations conducting prevention and early intervention research that aligns with NSW Health priorities.

This is a relatively new and exciting area of research and aims to identify areas to target resources and professional development to family day care services. We will report back the results of the interview to you at a later date and seek your input in priorities for future professional development activities for educators. This research will provide evidence to assist in developing professional development for family day care services and may be used in publications, such as papers, conference presentations and funding applications.

All information collected during this study will be kept strictly confidential and be stored in a locked office and a secure database. Your service and your name will remain anonymous and will not be identifiable. The de-identified data may also be used for future research related to healthy eating and physical activity; however the data will not identify individual services or any personal information.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Health and Medical HERC of the University of Wollongong. If you have any concerns or complaints regarding the way the research is being conducted, you can contact the Ethics Manager, on (02) 4221 4457 or email rso-ethics@uow.edu.au.

Thank you for your interest in this study.

Healthy Eating and Physical Activity Practices and Environment in Family Day Care Services

Consent Form

Research conducted by Professor Tony Okely, Dr Bridget Kelly, Erin Kerr, Sarah Ryan, NSW Office of Preventive Health, South Western Sydney Local Health District and Illawarra Shoalhaven Local Health District

I have been given information about the study entitled: **'Healthy Eating and Physical Activity Practices and Environment in Family Day Care Services'** and have had the opportunity to discuss the study with the research team.

By signing this form, I confirm that:

- The study has been fully explained to me and all of my questions have been answered
- I understand that this research is a part of Erin Kerr's PhD degree at the University of Wollongong supervised by Tony Okely and Bridget Kelly
- I understand the study will involve a trained researcher coming into my family day care service for one day and observing a full day of work using the Environmental Policy Assessment Observation
- I understand that children and I will be asked to wear a lightweight activity monitor over a period of a day and this is an optional part of the study
- I understand that children's lunchboxes will be audited, if parents' consent
- I understand that any food I provide to the children will be measured and photographed and this is an optional part of the study
- I understand that I have the right not to take part in the study and the right to stop at any time without penalty
- I understand that if I withdraw from the study, my relationship with my service provider or the Local Health District, NSW Office of Preventive Health or the University of Wollongong will not be affected now or in the future
- I have been informed of the potential risks and benefits of the study
- I understand that no information about who I am will be given to anyone or be published without first asking my permission. I understand that my contribution will be confidential and that there will be no personal identification in the data that I agree to allow to be used in the study. All data collected will be stored securely at UOW.
- I understand that the de-identified data collected may be used for future research related to healthy eating and physical activity; however the data will not identify individual services or any personal information
- I have read and understand each page of this form

☐ I consent to any food I provide to the children being measured and photographed as part of the lunchbox audit of this study.

Name of Participant (Print)	Signature of Participant	Date

Appendix Y: Parent participant information sheet and consent form

Healthy Eating and Physical Activity Practices and Environment in Family Day Care Services

Participant Information Sheet For Parents/Carers

Dear [parent/carer],

Your child is invited to participate in a research study to help us find out how family day care educators promote healthy eating and active play. The research is being conducted by the research team from the University of Wollongong (UOW) in partnership with your Local Health District (LHD) and the NSW Office of Preventive Health (OPH).

PURPOSE OF THE RESEARCH

The purpose of the research is to explore the healthy eating and physical activity environment and practices in family day care services. The research is part of a larger study and will guide the development of future professional development activities to support coordinators and educators to promote healthy eating and physical activity into their programs.

The research is part of Erin Kerr's PhD degree at the University of Wollongong supervised by Tony Okely and Bridget Kelly.

INVESTIGATORS

- Professor Tony Okely, University of Wollongong
- Dr Bridget Kelly, University of Wollongong
- Erin Kerr, University of Wollongong
- Sarah Ryan, University of Wollongong
- NSW Office of Preventive Health, NSW Health
- South Western Sydney Local Health District
- Illawarra Shoalhaven Local Health District

If I have any questions about the research, you can contact Erin Kerr on (02) 4298 1188 or fdc-project@uow.edu.au and/or Sarah Ryan (02) 4221 3141 rsarah@uow.edu.au.

METHOD AND DEMANDS ON PARTICIPANTS

A trained University researcher will attend your child's family day care service for one day and observe the activities of a typical day in family day care. Researchers will be using a safe observation tool called the Environmental Policy Assessment Observation, which will be completed during normal daily activities. Information from whole group activities not individual children's behaviours will be recorded over one random day of the week (from opening to closing). The EPAO will record the environment, for example, types of indoor or outdoor activities provided, fixed and portable equipment available and the mealtime environment. The aim of this research is to explore the types of environments staff provide children with during their time in FDC services and the opportunities these environments provide for physical activity and healthy eating.

To gain an understanding of how the environment affects children's physical activity, we would also like to ask your child to wear a lightweight activity monitor (belt) over a period of the day while they are at their family day care service. The belt will be worn around their waist (as shown in the pictures). This belt will monitor the level of physical activity they do during the time they are at their family day care service. These belts are non-intrusive and will not stop children from being involved in normal program activities (that is, all children will be able to be involved in all activities planned for that day).

If you agree, the researcher will also collect children's lunch boxes at the beginning of the day and photograph, measure and record the items inside your child's lunchbox. This will be done in a room away from the children. You will not be assessed or judged on what you pack your child and we ask that you continue to pack lunches in the usual way. This information will be kept confidential and will provide valuable information to assist in the development of more culturally appropriate lunchbox recommendations or other useful resources for educators and parents.

This research will not interfere with normal daily activities

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

We can foresee no risks for your child's involvement. It is voluntary and you may withdraw your child from the study at any time. Your child's participation in this research is voluntary and he/she is free to refuse to participate or withdraw from the study at any time. If the child expresses or shows signs of any discomfort or irritation from wearing the activity monitor belt they or their educator may take it off at any time.

All information collected during this study will be kept strictly confidential and be stored in a locked office. You are free to withdraw your child from the research at any time. Declining to participate or withdrawing participation in the research will not affect your relationship with your family day care educator.

FUNDING AND BENEFITS OF THE RESEARCH

This study is funded by a research grant from the Prevention Research Support Program (PRSP). The PRSP provides funding to NSW research organisations conducting prevention and early intervention research that aligns with NSW Health priorities.

This is a relatively new and exciting area of research and aims to identify areas to target resources and professional development to family day care services. This research will provide evidence to assist in developing professional development for family day care coordinators and educators and may be used in publications, such as papers, conference presentations and funding applications.
The data may also be used for future research related to healthy eating and physical activity; however the data will not identify individual services or any personal information.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Health and Medical HERC of the University of Wollongong. If you have any concerns or complaints regarding the way the research is being conducted, you can contact the Ethics Manager, on (02) 4221 4457 or email rso-ethics@uow.edu.au.

Thank you for your interest in this study.

Healthy Eating and Physical Activity Practices and Environment in Family Day Care Services

Consent Form

Research conducted by Professor Tony Okely, Dr Bridget Kelly, Erin Kerr, Sarah Ryan, NSW Office of Preventive Health, South Western Sydney Local Health District and Illawarra Shoalhaven Local Health District

I have been given information about the study entitled: **'Healthy Eating and Physical Activity Practices and Environment in Family Day Care Services'** and have had the opportunity to discuss the study with the research team.

By signing this form, I confirm that:

- The study has been fully explained to me and all of my questions have been answered
- I understand that this research is a part of Erin Kerr's PhD degree at the University of Wollongong supervised by Tony Okely and Bridget Kelly
- I understand the study will involve a trained researcher coming into my child's family day care service for one day and observing a full day of work using the Environmental Policy Assessment Observation
- I understand that my child will be asked to wear a lightweight activity monitor over a period of a day and this is an optional part of the study
- I understand that the items inside my child lunchboxes will be photographed and measured
- I understand that I have the right not to take part in the study and the right to stop at any time without penalty
- I understand that if I withdraw from the study, my relationship with my child's educator or service provider will not be affected now or in the future
- I have been informed of the potential risks and benefits of the study
- I understand that all the information collected will be confidential and that there will be no personal identification in the data that I agree to allow to be used in the study. All data collected will be stored securely at UOW.
- I understand that the de-identified data collected may be used for future research related to healthy eating and physical activity; however the data will not identify individual services or any personal information

Appendix Z: Educator survey

Survey administerd online vis REDCap

FDC Educator Questionnaire

1. Name:
2. Address:
3. What language do you speak most at home?
4. How many years have you worked in the Early Childhood Education and Care sector? This includes time in centre based services, such as long day care or preschool services as well as family day care.
5. How many years have you worked as a Family Day Care educator?
6. How many years have you worked as a Family Day Care educator for your current Service Provider?
7. What is the highest early childhood education qualification that you have completed?
   - No Formal qualification in ECEC
   - TAFE Certificate 3 in ECEC
   - TAFE Diploma in ECEC
   - Undergraduate university
   - Postgraduate university
   - Other
8. In a usual week, how many days do you provide care in your home for children enrolled through Family Day Care?
   - 1
   - 2
   - 3
   - 4
   - 5
   - greater than 5
9. Based on a usual week, how many hours on an average day do you provide care for children enrolled through family day care?
   - 4 or less hours a day
   - Between 5 and 6 hours
   - Between 7 and 8 hours
   - Between 9 and 10 hours
   - 11 or more hours
10. Are you aware of any **children** of Aboriginal or Torres Strait Islander origin enrolled at your service?
    - Yes
    - No
    - Don't know

    a) If yes, how many **children** of Aboriginal or Torres Strait Islander Origin are enrolled at your service?
11. Have you completed training in nutrition/healthy eating?

    o Yes o No

    Training description:

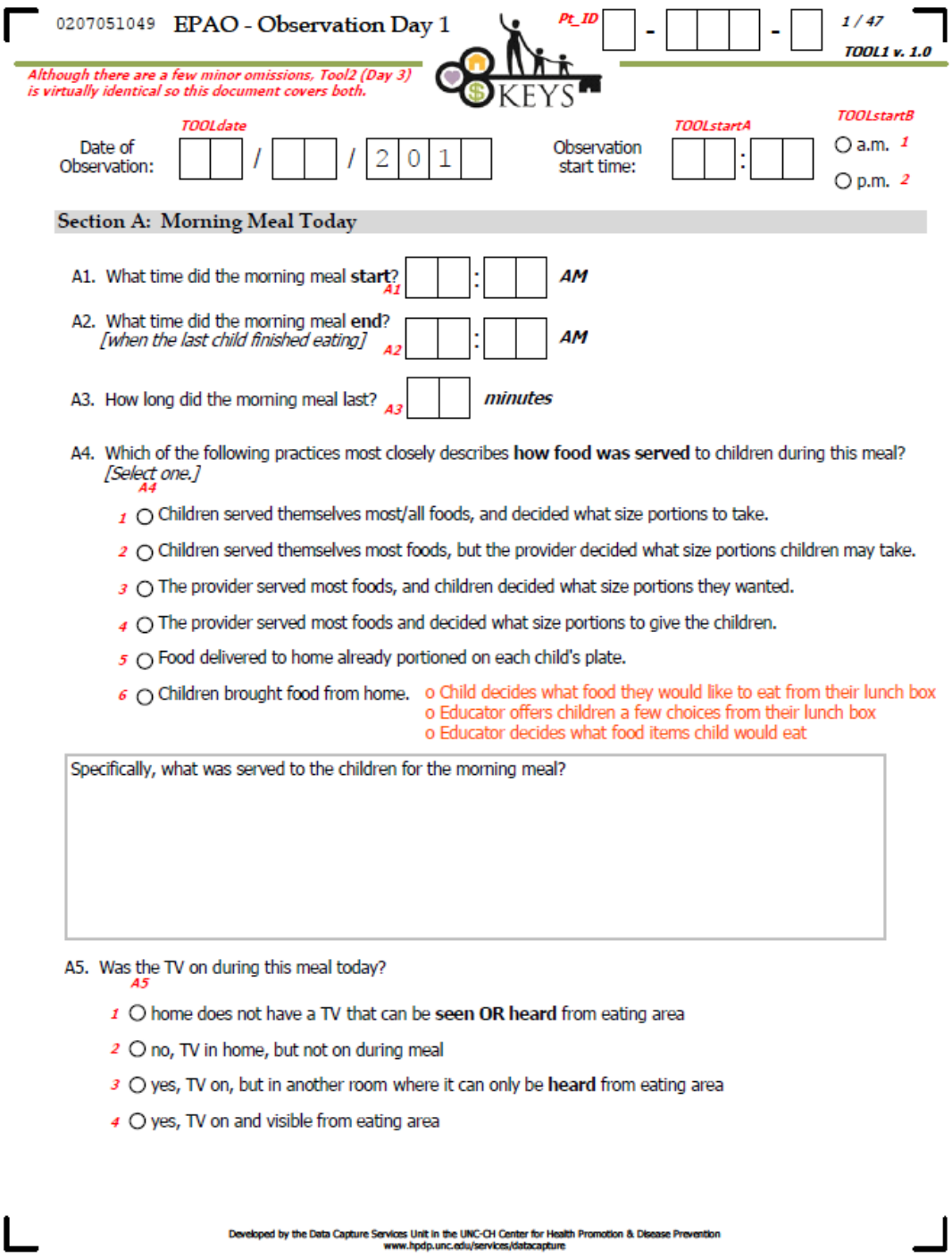
    Year:
12. Have you completed training in physical activity?

    o Yes o No

    Training description:

    Year:

Appendix AA: Environment and Policy Observation tool



0207051049 EPAO - Observation Day 1

Pt_ID ☐ - ☐☐☐ - ☐ 1 / 47

TOOL1 v. 1.0

Although there are a few minor omissions, Tool2 (Day 3) is virtually identical so this document covers both.

KEYS

Date of Observation: TOOLdate ☐☐ / ☐☐ / 2 0 1 ☐

Observation start time: TOOLstartA ☐☐ : ☐☐ TOOLstartB ○ a.m. 1 ○ p.m. 2

Section A: Morning Meal Today

A1. What time did the morning meal **start**? A1 ☐☐ : ☐☐ *AM*

A2. What time did the morning meal **end**? *[when the last child finished eating]* A2 ☐☐ : ☐☐ *AM*

A3. How long did the morning meal last? A3 ☐☐ *minutes*

A4. Which of the following practices most closely describes **how food was served** to children during this meal? *[Select one.]* A4

1 ○ Children served themselves most/all foods, and decided what size portions to take.

2 ○ Children served themselves most foods, but the provider decided what size portions children may take.

3 ○ The provider served most foods, and children decided what size portions they wanted.

4 ○ The provider served most foods and decided what size portions to give the children.

5 ○ Food delivered to home already portioned on each child's plate.

6 ○ Children brought food from home.
o Child decides what food they would like to eat from their lunch box
o Educator offers children a few choices from their lunch box
o Educator decides what food items child would eat

Specifically, what was served to the children for the morning meal?

A5. Was the TV on during this meal today? A5

1 ○ home does not have a TV that can be **seen OR heard** from eating area

2 ○ no, TV in home, but not on during meal

3 ○ yes, TV on, but in another room where it can only be **heard** from eating area

4 ○ yes, TV on and visible from eating area

Developed by the Data Capture Services Unit in the UNC-CH Center for Health Promotion & Disease Prevention
www.hpdp.unc.edu/services/datacapture

A6. During breakfast in this home did the provider eat any of the following foods in front of the children? *[Mark all that apply.]*

A6a ☐ the provider ate **fast food**.

A6b ☐ the provider ate a **salty snack** (e.g., chips).

A6c ☐ the provider ate a **sweet snack** (e.g., donuts, pastries, cookies, candy).

A6d ☐ the provider ate **fruits** or **vegetables** in front of the children.

A6e ☐ the provider drank a **soda** or other **sweetened beverage**.

A6f ☐ the provider ate the **same foods** as the children.

A7. How often were the following interactions observed between the provider and the children?		1 never	2 1-2 times	3 3+ times
a. The provider sat with the children during breakfast.	A7a	○	○	○
b. The provider **talked** with the children about the foods they were eating.	A7b	○	○	○
c. The provider **enthusiastically role modeled** eating healthy foods.	A7c	○	○	○
d. The provider **encouraged** (not forced or coerced) children to try the foods on their plates.	A7d	○	○	○
e. The provider **praised** a child for trying new or less preferred foods.	A7e	○	○	○
f. The provider used an **authoritative feeding style**.	A7f	○	○	○

Definition: *Authoritative feeding style strikes a balance between encouraging children to eat healthy foods and allowing children to make their own choices. Providers use reason and education, rather than bribes or threats.*

g. the educator lead or encouraged non-food conversation during meals.
h. the educator talked on the phone, text or work on the computer during meals.
i. the children were involved in meal preparation, planning clean-up.

A8. How often did the provider support or hinder children's self-regulation?		never	1-2 times	3+ times
a. The provider **pressured** a child to **eat more** than they seemed to want (e.g., after the child said they were finished or full).	A8a	○	○	○
b. **Second helpings** were served to a child even when the child did not ask for more.	A8b	○	○	○
c. **Second helpings** were served only after a child requested seconds and the provider asked the child if (s)he was still hungry.	A8c	○	○	○
d. When a child ate less than half of a meal or snack, the provider removed the plate without asking the child if s(he) was full.	A8d	○	○	○
e. When a child ate less than half of a meal or snack, the provider asked the child if (s)he was full before removing the plate.	A8e	○	○	○
f. When a child ate less than half of a meal or snack, the provider required the child sit at the table until (s)he cleaned their plate.	A8f	○	○	○

g. the educator spoon-fed a child to get them to eat (when the child is capable of feeding themselves.
h. the educator talked about feelings of hunger and fullness with children.

A9. How often did the provider use rewards or bribes?		1 never	2 1-2 times	3 3+ times
a. The provider promised something **other than food** for eating a specific food (e.g., "If you eat your beans, we can play ball outside.")	A9a	○	○	○
b. The provider used **food** as a reward or withheld food as a punishment (e.g., "If you clean up your blocks, you can have a bigger helping of food.")	A9b	○	○	○
c. The provider used **food** as a reward or a bribe for eating a less preferred food (e.g., "You can't have dessert until you eat your beans.")	A9c	○	○	○

d. the educator used food to calm an upset child

Additional notes regarding the **morning meal**:

Section B: Activities Before Lunch Today

Outdoor Activities:

B1. Did the children play outside **before lunch** today? B1

0 ○ no → B1a. If no, why was there no outdoor time before lunch today? *[**Skip to B7** after marking all that apply.]*

1 ○ yes

if yes, continue to B2

B1a_1 ☐ No outside time was scheduled.
B1a_2 ☐ It was too hot.
B1a_3 ☐ It was too cold.
☐ It was raining/snowing. B1a_4
☐ The playground/equipment was too wet. B1a_5
☐ unsure B1a_6

	Session 1:	Session 2:	Session 3:
B2. What time did the outdoor play **start**?	B2_1 ☐☐:☐☐ B2_1a ○ a.m. (1) ○ p.m. (2)	B2_2 ☐☐:☐☐ B2_2a ○ a.m. ○ p.m.	B2_3 ☐☐:☐☐ B2_3a ○ a.m. ○ p.m.
B3. What time did the outdoor play **end**?	B3_1 ☐☐:☐☐ B3_1a ○ a.m. ○ p.m.	B3_2 ☐☐:☐☐ B3_2a ○ a.m. ○ p.m.	B3_3 ☐☐:☐☐ B3_3a ○ a.m. ○ p.m.

B4. While children were outside before lunch today, did the provider lead or begin any gross motor physical activities? *[For example: structured active games, dancing, exercises, gross motor development activities, etc.]*

B4 ○ 1 yes ○ 0 no → *if no, skip to B5*

B4a. Record the duration (minutes) and description of each occasion of teacher-led physical activity that occurred outside before lunch? *(an occasion is any time a new physical activity was started and lead by the provider with a child or group of children).*

Occasion:	Minutes:		Description:
1:	B4a_1	B4a_1text	
2:	B4a_2	B4a_2text	
3:	B4a_3	B4a_3text	
4:	B4a_4	B4a_4text	
5:	B4a_5	B4a_5text	

B5. On the scale below, please rate the average activity level of most children while they outside before lunch. *[Choose only one.]*

mostly sitting		*mostly slow or easy activities (e.g., walking or marching)*		*mostly moderate activities (e.g., walking fast or skipping)*		*mostly vigorous activities (e.g., running)*
B5 ○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

B6. How many times did the provider **verbally** encourage children to drink water while outside before lunch *(offering water, asking if thirsty, suggesting children stop and get some water)*? B6 ___ *number of times*

B6a. Record the times that the infant is allowed to move freely to explore the environment.
B6b. Record the times that the infant spends in equipment that restricts movement.

Indoor Activities:

Indoor Playtime:

B7. While children were inside before lunch today, was there designated **indoor play time**?

B7 ○ no → *if no, skip to B11*

○ yes

	Session 1:	Session 2:	Session 3:
B8. What time did indoor play **start**?	B8_1 ☐☐:☐☐ B8_1a ○ a.m. ○ p.m.	B8_2 ☐☐:☐☐ B8_2a ○ a.m. ○ p.m.	B8_3 ☐☐:☐☐ B8_3a ○ a.m. ○ p.m.
B9. What time did indoor play **end**?	B9_1 ☐☐:☐☐ B9_1a ○ a.m. ○ p.m.	B9_2 ☐☐:☐☐ B9_2a ○ a.m. ○ p.m.	B9_3 ☐☐:☐☐ B9_3a ○ a.m. ○ p.m.

B10. On the scale below, please rate the average activity level of most children during **indoor play time**. *[Choose only one.]*

mostly sitting		*mostly slow or easy activities (e.g., walking or marching)*		*mostly moderate activities (e.g., walking fast or skipping)*		*mostly vigorous activities (e.g., running)*
B10 ○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

Additional notes on **indoor playtime**:

Circle Time:

B11. While children were **inside** before lunch today, was there designated **circle time**?

B11 ○ no → *if no, skip to B15*

○ yes

↓

	Session 1:	Session 2:	Session 3:
B12. What time did circle time **start**?	B12_1 ☐☐ : ☐☐	B12_2 ☐☐ : ☐☐	B12_3 ☐☐ : ☐☐
	B12_1a ○ a.m. ○ p.m.	B12_2a ○ a.m. ○ p.m.	B12_3a ○ a.m. ○ p.m.
B13. What time circle time **end**?	B13_1 ☐☐ : ☐☐	B13_2 ☐☐ : ☐☐	B13_3 ☐☐ : ☐☐
	B13_1a ○ a.m. ○ p.m.	B13_2a ○ a.m. ○ p.m.	B13_3a ○ a.m. ○ p.m.

B14. On the scale below, please rate the average activity level of most children during **circle time**. *[Choose only one.]*

mostly sitting		*mostly slow or easy activities (e.g., walking or marching)*		*mostly moderate activities (e.g., walking fast or skipping)*		*mostly vigorous activities (e.g., running)*
B14 ○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

Additional notes on **circle time**:

Teacher-Led Lessons and Activities:

B15. When inside before lunch today, how many minutes did children participate in each of the following **nutrition-related lessons and activities**? *[Please record "0" for any activity the children did **not** do. This can include activities done during indoor play time and circle time.]*

Activity:	Minutes:	Description:
B15a ☐ planned nutrition lesson	B15a_min ☐☐	B15a_text
B15b ☐ healthy eating activity (not including mealtime) as part of another planned lesson	B15b_min ☐☐	B15b_text
B15c ☐ cooking activity	B15c_min ☐☐	B15c_text

B16. While children were **inside** before lunch today, did the provider lead or begin any **physical activities**? *[example: structured active games, dancing, exercises, gross motor development activities, etc.]*

B16 ○ yes (1) ○ no (0) → *if no, skip to B18*

B16a. Record the duration (minutes) and description of each occasion of teacher-led physical activity that occurred inside before lunch? *(an occasion is any time a new physical activity was started and lead by the provider with a child or group of children).*

Occasion:	Minutes:	Was it planned?	Description: *[Mark all that apply.]*	
1: B16a_1	☐☐	○ yes ○ no B16a_1a	B16a_1music ☐ music/dance B16a_1motor ☐ gross motor	B16a_1lesson ☐ part of another lesson B16a_1other ☐ other _____ B16a_1text
2: B16a_2	☐☐	○ yes ○ no B16a_2a	B16a_2music ☐ music/dance B16a_2motor ☐ gross motor	B16a_2lesson ☐ part of another lesson B16a_2other ☐ other _____ B16a_2text
3: B16a_3	☐☐	○ yes ○ no B16a_3a	B16a_3music ☐ music/dance B16a_3motor ☐ gross motor	B16a_3lesson ☐ part of another lesson B16a_3other ☐ other _____ B16a_3text
4: B16a_4	☐☐	○ yes ○ no B16a_4a	B16a_4music ☐ music/dance B16a_4motor ☐ gross motor	B16a_4lesson ☐ part of another lesson B16a_4other ☐ other _____ B16a_4text
5: B16a_5	☐☐	○ yes ○ no B16a_5a	B16a_5music ☐ music/dance B16a_5motor ☐ gross motor	B16a_5lesson ☐ part of another lesson B16a_5other ☐ other _____ B16a_5text

B17. For the **teacher-led physical activities**, please rate the **average** activity level of most children while they were participating in the above activities. *[Choose only one.]*

	mostly sitting		*mostly slow or easy activities (e.g., walking or marching)*		*mostly moderate activities (e.g., walking fast or skipping)*		*mostly vigorous activities (e.g., running)*
B17	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

Additional notes on **indoor teacher-led activities:**

B17a. Record the times that the infant is allowed to move freely to explore the environment.

General Sedentary Time:

(or screens)

B18. Did **children** watch TV before lunch today?

B18

0 ○ no → *skip to B23*

2 ○ home does not have a TV. → *skip to B24*

1 ○ yes

Was it educational?
Did it include physical activity?
Did the educator talk with the children about the screen time?

	Session 1:	**Session 2:**	**Session 3:**
B19. What time did TV time **start**?	*B19_1* ☐☐:☐☐ *B19_1a* ○ a.m. ○ p.m.	*B19_2* ☐☐:☐☐ *B19_2a* ○ a.m. ○ p.m.	*B19_3* ☐☐:☐☐ *B19_3a* ○ a.m. ○ p.m.
B20. What time TV time **end**?	*B20_1* ☐☐:☐☐ *B20_1a* ○ a.m. ○ p.m.	*B20_2* ☐☐:☐☐ *B20_2a* ○ a.m. ○ p.m.	*B20_3* ☐☐:☐☐ *B20_3a* ○ a.m. ○ p.m.

B21. Were children offered an alternative activity besides TV?

B21 *1* ○ yes *0* ○ no

What time of screen was watched?
- TV
- Computer
- Tablet
-Mobile
-Video game

B22. Please describe what the children watched on TV (show name, content, commercials, etc.).

B22 ☐

B23. Did **the provider** watch TV before lunch today?

B23 ○ yes → B23a. In all, how many minutes was the TV on for **provider use only** before lunch today *(example: news, weather, talk shows)*? total minutes: ☐☐☐ B23a

○ no

↓

if no, continue with B24

B24. Does the home have a **computer** available for use by **children**?

B24 ○ yes → ***Today, before lunch . . .***

○ no

↓

if no, continue with B25

B24a. About how many minutes was a computer available for use by children? total minutes: ☐☐☐ B24a

B24b. How many different children used the computer? # of children ☐☐ B24b

B24c. On average, how many minutes did each child spend at the computer? minutes per child ☐☐ B24c

B25. Does the home have a **video game system** available for use by **children**? (examples: v-tec, playstation, Nintendo) *(Do not count computer time reported above.)*

B25 ○ yes → ***Today, before lunch . . .***

○ no

↓

if no, continue with B26

B25a. How many different children used the video game system? # of children ☐☐ B25a

B25b. On average, how many minutes did each child spend using the video game system? minutes per child ☐☐ B25b

B26. Excluding **indoor play time, circle time, and TV time,** before lunch today, was there any seated time? *(time where the majority of children were seated)*

B26 ○ yes ○ no → *if no, skip to B27*

B26a. Record the duration (minutes) and description of each occasion of additional seated time.

Occasion:	Minutes:		Description:
1:	B26a_1 ☐☐	B26a_1text	
2:	B26a_2 ☐☐	B26a_2text	
3:	B26a_3 ☐☐	B26a_3text	
4:	B26a_4 ☐☐	B26a_4text	
5:	B26a_5 ☐☐	B26a_5text	

B26b. Record the times that the infant spends in equipment that restricts movement.

Additional notes on **seated time:**

B27. How many times did the provider **verbally** encourage children to drink water while inside before lunch *(offering water, asking if thirsty, suggesting children stop and get some water)*? B27 ☐☐ *number of times*

B28. How often did the provider use outdoor time to reward or punish child behavior?		1 never	2 1-2 times	3 3+ times
a. All children **lost** time outdoors because of misbehavior.	B28a	○	○	○
b. A child **lost** outdoor time because of misbehavior for **5 minutes or less**.	B28b	○	○	○
c. A child lost outdoor time because of misbehavior for **more than 5 minutes.**	B28c	○	○	○
d. All children **got extra** outdoor time for good behavior.	B28d	○	○	○
e. A child **got extra** outdoor time for good behavior.	B28e	○	○	○

B29. How often did the provider use screen time to reward or punish child behavior?		never	1-2 times	3+ times
a. All children **lost** TV/movie time because of misbehavior.	B29a	○	○	○
b. A child **lost** TV/movie time because of misbehavior.	B29b	○	○	○
c. All children **got extra** TV/movie time for good behavior.	B29c	○	○	○
d. A child **got extra** TV/movie time for good behavior.	B29d	○	○	○

B30. How often did the provider have these interactions with the children during play time?		never	1-2 times	3+ times
a. The provider **joined the children in a game** they were playing outside.	B30a	○	○	○
b. The provider **played with children** during outside time.	B30b	○	○	○
c. The provider **participated in a chasing/running game** with children during outside time.	B30c	○	○	○
d. The provider **talked with children about the importance of physical activity.**	B30d	○	○	○

		1 never	2 1-2 times	3 3+ times
B30.	*How often did the provider have these interactions with the children during play time?*			
	e. The provider prompted children to **increase** their physical activity. B30e	○	○	○
	f. The provider prompted children to **decrease** their physical activity. B30f	○	○	○

		0 no	1 yes
B31.	What kind of accessibility did children have to toys?		
	a. Children had to **take turns** playing with outdoor toys because not enough were available. B31a	○	○
	b. While outside, children could **easily get out** portable play equipment and toys (balls, tricycles, large trucks, wheel barrow, etc.) without help from the provider. B31b	○	○

		1 never	2 1-2 times	3 3+ times
B32.	What other provider behaviors did you notice?			
	a. The provider read a **book** to the children that included a positive **message about healthy eating**. B32a	○	○	○
	b. The provider read a **book** to the children that included a **positive message about physical activity**. B32b	○	○	○
	c. The provider used food to help calm a child who was upset. B32c	○	○	○
	d. The provider spoke with children about what they watched on TV. B32d	○	○	○
	e. The provider incorporated physical activity into a classroom routine or transition. B32e	○	○	○

Additional notes:

Section C: Lunch Today

C1. What time did lunch **start**? C1 ☐☐:☐☐ ○ a.m. ○ p.m. C1a

C2. What time did lunch **end**? *[when the last child finished eating]* C2 ☐☐:☐☐ ○ a.m. ○ p.m. C2a

C3. How long did lunch last? C3 ☐☐ *minutes*

C4. Which of the following practices most closely describes **how food was served** to children during this meal? *[Select one.]* C4

1 ○ Children served themselves most/all foods, and decided what size portions to take.

2 ○ Children served themselves most foods, but the provider decided what size portions children may take.

3 ○ The provider served most foods, and children decided what size portions they wanted.

4 ○ The provider served most foods and decided what size portions to give the children.

5 ○ Food delivered to home already portioned on each child's plate.

6 ○ Children brought food from home. o Child decides what food they would like to eat from their lunch box
o Educator offers children a few choices from their lunch box
o Educator decides what food items child would eat

Specifically, what was served to the children for lunch?

C5. Was the TV on during this meal today? C5

1 ○ home does not have a TV that can be **seen OR heard** from eating area

2 ○ no, TV in home, but not on during meal

3 ○ yes, TV on, but in another room where it can only be **heard** from eating area

4 ○ yes, TV on and visible from eating area

C6. During lunch in this home did the provider eat any of the following foods in front of the children? *[Mark all that apply.]*

- C6a ☐ the provider ate **fast food**.
- C6b ☐ the provider ate a **salty snack** (e.g., chips).
- C6c ☐ the provider ate a **sweet snack** (e.g., donut, pastries, cookies, candy).
- C6d ☐ the provider ate **fruits** or **vegetables** in front of the children.
- C6e ☐ the provider drank a **soda** or other **sweetened beverage**.
- C6f ☐ the provider ate the **same foods** as the children.

C7. How often were the following interactions observed between the provider and the children?

		1 never	2 1-2 times	3 3+ times
a.	The provider sat with the children during lunch.	C7a ○	○	○
b.	The provider **talked** with the children about the foods they were eating.	C7b ○	○	○
c.	The provider **enthusiastically role modeled** eating healthy foods.	C7c ○	○	○
d.	The provider **encouraged** (not forced or coerced) children to try the foods on their plates.	C7d ○	○	○
e.	The provider **praised** a child for trying new or less preferred foods.	C7e ○	○	○
f.	The provider used an **authoritative feeding style**.	C7f ○	○	○

Definition: *Authoritative feeding style strikes a balance between encouraging children to eat healthy foods and allowing children to make their own choices. Providers use reason and education, rather than bribes or threats.*

g. the educator lead or encouraged non-food conversation during meals.
h. the educator talked on the phone, text or work on the computer during meals.
i. the children were involved in meal preparation, planning clean-up.

C8. How often did the provider support or hinder children's self-regulation?

		never	1-2 times	3+ times
a.	The provider **pressured** a child to **eat more** than they seemed to want (e.g., after the child said they were finished or full).	C8a ○	○	○
b.	**Second helpings** were served to a child even when the child did not ask for more.	C8b ○	○	○
c.	**Second helpings** were served only after a child requested seconds and the provider asked the child if (s)he was still hungry.	C8c ○	○	○
d.	When a child ate less than half of a meal or snack, the provider removed the plate without asking the child if s(he) was full.	C8d ○	○	○
e.	When a child ate less than half of a meal or snack, the provider asked the child if (s)he was full before removing the plate.	C8e ○	○	○
f.	When a child ate less than half of a meal or snack, the provider required the child to sit at the table until (s)he cleaned their plate.	C8f ○	○	○

g. the educator spoon-fed a child to get them to eat (when the child is capable of feeding themselves.
h. the educator talked about feelings of hunger and fullness with children.

C9. How often did the provider use rewards or bribes?		never	1-2 times	3+ times
a.	The provider promised something **other than food** for eating a specific food (e.g., "If you eat your beans, we can play ball outside.")	C9a ○	○	○
b.	The provider used **food** as a reward or withheld food as a punishment (e.g., "If you clean up your blocks, you can have a bigger helping of food.")	C9b ○	○	○
c.	The provider used **food** as a reward or a bribe for eating a less preferred food (e.g., "You can't have dessert until you eat your beans.")	C9c ○	○	○

d. the educator used food to calm an upset child

Additional notes regarding **lunch**:

Section D: Nap/Rest Time Today

D1. What time did nap time **start**? D1 ☐☐:☐☐ ○ a.m. ○ p.m. D1a

D2. What time did nap time **end**? *[when the last child finished sleeping]* D2 ☐☐:☐☐ ○ a.m. ○ p.m. D2a

Record individual nap times

D3. How long did nap time last? D3 ☐☐ *minutes*

Were any children given a bottle during nap time?

D4. During nap in this home did the provider eat any of the following foods in front of the children? *[Mark all that apply.]*

- D4a ☐ the provider ate **fast food**.
- D4b ☐ the provider ate a **salty snack** (e.g., chips).
- D4c ☐ the provider ate a **sweet snack** (e.g., donuts, pastries, cookies, candy).
- D4d ☐ the provider ate **fruits** or **vegetables** in front of the children.
- D4e ☐ the provider drank a **soda** or other **sweetened beverage**.

Section E: Afternoon Snack Today

E1. What time did pm snack **start**? E1 ☐☐:☐☐ ○ a.m. ○ p.m. E1a

E2. What time did pm snack **end**? *[when the last child finished eating]* E2 ☐☐:☐☐ ○ a.m. ○ p.m. E2a

E3. How long did pm snack last? E3 ☐☐ ***minutes***

E4. Which of the following practices most closely describes **how food was served** to children during this meal? *[Select one.]* E4

1 ○ Children served themselves most/all foods, and decided what size portions to take.

2 ○ Children served themselves most foods, but the provider decided what size portions children may take.

3 ○ The provider served most foods, and children decided what size portions they wanted.

4 ○ The provider served most foods and decided what size portions to give the children.

5 ○ Food delivered to home already portioned on each child's plate.

6 ○ Children brought food from home. o Child decides what food they would like to eat from their lunch box
o Educator offers children a few choices from their lunch box
o Educator decides what food items child would eat

Specifically, what was served to the children for pm snack?

E5. Was the TV on during this meal today? E5

1 ○ home does not have a TV that can be **seen OR heard** from eating area

2 ○ no, TV in home, but not on during meal

3 ○ yes, TV on, but in another room where it can only be **heard** from eating area

4 ○ yes, TV on and visible from eating area

E6. During pm snack in this home did the provider eat any of the following foods in front of the children? *[Mark all that apply.]*

E6a ☐ the provider ate **fast food**.

E6b ☐ the provider ate a **salty snack** (e.g., chips).

E6c ☐ the provider ate a **sweet snack** (e.g., donut, pastries, cookies, candy).

E6d ☐ the provider ate **fruits** or **vegetables** in front of the children.

E6e ☐ the provider drank a **soda** or other **sweetened beverage**.

E6f ☐ the provider ate the **same foods** as the children.

E7. How often were the following interactions observed between the provider and the children?		1 never	2 1-2 times	3 3+ times
a. The provider sat with the children during pm snack.	E7a	○	○	○
b. The provider **talked** with the children about the foods they were eating.	E7b	○	○	○
c. The provider **enthusiastically role modeled** eating healthy foods.	E7c	○	○	○
d. The provider **encouraged** (not forced or coerced) children to try the foods on their plates.	E7d	○	○	○
e. The provider **praised** a child for trying new or less preferred foods.	E7e	○	○	○
f. The provider used an **authoritative feeding style**.	E7f	○	○	○

Definition: Authoritative feeding style strikes a balance between encouraging children to eat healthy foods and allowing children to make their own choices. Providers use reason and education, rather than bribes or threats.

g. the educator lead or encouraged non-food conversation during meals.
h. the educator talked on the phone, text or work on the computer during meals.
i. the children were involved in meal preparation, planning or clean-up.

E8. How often did the provider support or hinder children's self-regulation?		never	1-2 times	3+ times
a. The provider **pressured** a child to **eat more** than they seemed to want (e.g., after the child said they were finished or full).	E8a	○	○	○
b. **Second helpings** were served to a child even when the child did not ask for more.	E8b	○	○	○
c. **Second helpings** were served only after a child requested seconds and the provider asked the child if (s)he was still hungry.	E8c	○	○	○
d. When a child ate less than half of a meal or snack, the provider removed the plate without asking the child if s(he) was full.	E8d	○	○	○
e. When a child ate less than half of a meal or snack, the provider asked the child if (s)he was full before removing the plate.	E8e	○	○	○
f. When a child ate less than half of a meal or snack, the provider required the child to sit at the table until (s)he cleaned their plate.	E8f	○	○	○

g. the educator spoon-fed a child to get them to eat (when the child is capable of feeding themselves.
h. the educator talked about feelings of hunger and fullness with children.

E9. How often did the provider use rewards or bribes?		never	1-2 times	3+ times
a.	The provider promised something **other than food** for eating a specific food (e.g., "If you eat your beans, we can play ball outside.")	E9a ○	○	○
b.	The provider used **food** as a reward or withheld food as a punishment (e.g., "If you clean up your blocks, you can have a bigger helping of food.")	E9b ○	○	○
c.	The provider used **food** as a reward or a bribe for eating a less preferred food (e.g., "You can't have dessert until you eat your beans.")	E9c ○	○	○
d.	the educator used food to calm an upset child			

Additional notes regarding **pm snack**:

Section F: Activities After Lunch Today

Outdoor Activities:

F1. Did the children play outside **after lunch** today?

F1 ○ no → F1a. If no, why was there no outdoor time after lunch today? *[Mark all that apply.]*

○ yes

↓ *if yes, continue with F2*

F1a_1 ☐ No outside time was scheduled.
F1a_2 ☐ It was too hot.
F1a_3 ☐ It was too cold.
☐ It was raining/snowing. F1a_4
☐ The playground/equipment was too wet. F1a_5
☐ unsure F1a_6

	Session 1:	Session 2:	Session 3:
F2. What time did the outdoor play **start**?	F2_1 ☐☐:☐☐ F2_1a ○ a.m. ○ p.m.	F2_2 ☐☐:☐☐ F2_2a ○ a.m. ○ p.m.	F2_3 ☐☐:☐☐ F2_3a ○ a.m. ○ p.m.
F3. What time did the outdoor play **end**?	F3_1 ☐☐:☐☐ F3_1a ○ a.m. ○ p.m.	F3_2 ☐☐:☐☐ F3_2a ○ a.m. ○ p.m.	F3_3 ☐☐:☐☐ F3_3a ○ a.m. ○ p.m.

F4. While children were outside after lunch today, did the provider lead or begin any gross motor physical activities? *[For example: structured active games, dancing, exercises, gross motor development activities, etc.]*

○ yes ○ no → *if no, skip to F5*

F4a. Record the duration (minutes) and description of each occasion of teacher-led physical activity that occurred outside after lunch? *(an occasion is any time a new physical activity was started and lead by the provider with a child or group of children).*

Occasion:	Minutes: F4a_1	F4a_1text Description:
1:	☐☐	
2:	F4a_2 ☐☐	F4a_2text
3:	F4a_3 ☐☐	F4a_3text
4:	F4a_4 ☐☐	F4a_4text
5:	F4a_5 ☐☐	F4a_5text

F5. On the scale below, please rate the average activity level of most children while they outside after lunch. *[Choose only one.]*

mostly sitting		*mostly slow or easy activities (e.g., walking or marching)*		*mostly moderate activities (e.g., walking fast or skipping)*		*mostly vigorous activities (e.g., running)*
F5 ○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

F6. How many times did the provider **verbally** encourage children to drink water while outside after lunch *(offering water, asking if thirsty, suggesting children stop and get some water)*? F6 ☐☐ *number of times*

F6a. Record the times that the infant is allowed to move freely to explore the environment.
F6b. Record the times that the infant spends in equipment that restricts movement.

Indoor Activities:

Indoor Playtime:

F7. While children were inside **after lunch** today, was there designated **indoor play time**?

F7 ○ no → *if no, skip to F11*

○ yes

↓

	Session 1:	Session 2:	Session 3:
F8. What time did indoor play **start**?	F8_1 __:__ F8_1a ○ a.m. ○ p.m.	F8_2 __:__ F8_2a ○ a.m. ○ p.m.	F8_3 __:__ F8_3a ○ a.m. ○ p.m.
F9. What time did indoor play **end**?	F9_1 __:__ F9_1a ○ a.m. ○ p.m.	F9_2 __:__ F9_2a ○ a.m. ○ p.m.	F9_3 __:__ F9_3a ○ a.m. ○ p.m.

F10. On the scale below, please rate the average activity level of most children during **indoor play time**. *[Choose only one.]*

mostly sitting		*mostly slow or easy activities (e.g., walking or marching)*		*mostly moderate activities (e.g., walking fast or skipping)*		*mostly vigorous activities (e.g., running)*
F10 ○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

Additional notes on **indoor playtime**:

Circle Time:

F11. While children were **inside** after lunch today, was there designated **circle time**?

F11 ○ no → *if no, skip to F15*

○ yes

↓

	Session 1:	Session 2:	Session 3:
F12. What time did circle time **start**?	F12_1 ☐☐ : ☐☐	F12_2 ☐☐ : ☐☐	F12_3 ☐☐ : ☐☐
	F12_1a ○ a.m. ○ p.m.	F12_2a ○ a.m. ○ p.m.	F12_3a ○ a.m. ○ p.m.
F13. What time circle time **end**?	F13_1 ☐☐ : ☐☐	F13_2 ☐☐ : ☐☐	F13_3 ☐☐ : ☐☐
	F13_1a ○ a.m. ○ p.m.	F13_2a ○ a.m. ○ p.m.	F13_3a ○ a.m. ○ p.m.

F14. On the scale below, please rate the average activity level of most children during **circle time**. *[Choose only one.]*

mostly sitting		*mostly slow or easy activities (e.g., walking or marching)*		*mostly moderate activities (e.g., walking fast or skipping)*		*mostly vigorous activities (e.g., running)*
F14 ○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

Additional notes on **circle time**:

Teacher-Led Lessons and Activities:

F15. When inside after lunch today, how many minutes did children participate in each of the following activities? *[Please record "0" for any activity the children did **not** do. This can include activities done during indoor play time and circle time.]*

	Activity:	Minutes: F15a_min	Description: F15a_text
F15a	☐ planned music & dance activity	☐☐	
F15b	☐ planned gross motor development activity (not including dancing reported above)	F15b_min ☐☐	F15b_text
F15c	☐ physical activity as part of another lesson (not including those reported above)	F15c_min ☐☐	F15c_text

F16. While children were **inside** after lunch today, did the provider lead or begin any **physical activities**? *[example: structured active games, dancing, exercises, gross motor development activities, etc.]*

F16 ○ yes ○ no ➔ *if no, skip to F18*

↓

F16a. Record the duration (minutes) and description of each occasion of teacher-led physical activity that occurred outside after lunch? *(an occasion is any time a new physical activity was started and lead by the provider with a child or group of children).*

Occasion:	Minutes:	Was it planned?	Description: *[Mark all that apply.]*	
1: F16a_1	☐☐	F16a_1a ○ yes ○ no	F16a_1music ☐ music/dance F16a_1motor ☐ gross motor	F16a_1lesson ☐ part of another lesson F16a_1other ☐ other F16a_1text
2: F16a_2	☐☐	F16a_2a ○ yes ○ no	F16a_2music ☐ music/dance F16a_2motor ☐ gross motor	F16a_2lesson ☐ part of another lesson F16a_2other ☐ other F16a_2text
3: F16a_3	☐☐	F16a_3a ○ yes ○ no	F16a_3music ☐ music/dance F16a_3motor ☐ gross motor	F16a_3lesson ☐ part of another lesson F16a_3other ☐ other F16a_3text
4: F16a_4	☐☐	F16a_4a ○ yes ○ no	F16a_4music ☐ music/dance F16a_4motor ☐ gross motor	F16a_4lesson ☐ part of another lesson F16a_4other ☐ other F16a_4text
5: F16a_5	☐☐	F16a_5a ○ yes ○ no	F16a_5music ☐ music/dance F16a_5motor ☐ gross motor	F16a_5lesson ☐ part of another lesson F16a_5other ☐ other F16a_5text

F17. For the **teacher-led physical activities,** please rate the **average** activity level of most children while they were participating in the above activities. *[Choose only one.]*

F17 ○ 1 *mostly sitting* ○ 2 ○ 3 *mostly slow or easy activities (e.g., walking or marching)* ○ 4 ○ 5 *mostly moderate activities (e.g., walking fast or skipping)* ○ 6 ○ 7 *mostly vigorous activities (e.g., running)*

Additional notes on **indoor teacher-led activities**:

B26b. Record the times that the infant spends in equipment that restricts movement.

General Sedentary Time:

(or screens)

F18. Did **children** watch TV after lunch today?

F18
0 ○ no ➔ *skip to F23*
2 ○ home does not have a TV. ➔ *skip to F24*
1 ○ yes

Was it educational?
Did it include physical activity?
Did the educator talk with the children about the screen time?

	Session 1:	Session 2:	Session 3:
F19. What time did TV time **start**?	F19_1 ☐☐:☐☐ F19_1a ○ a.m. ○ p.m.	F19_2 ☐☐:☐☐ F19_2a ○ a.m. ○ p.m.	F19_3 ☐☐:☐☐ F19_3a ○ a.m. ○ p.m.
F20. What time TV time **end**?	F20_1 ☐☐:☐☐ F20_1a ○ a.m. ○ p.m.	F20_2 ☐☐:☐☐ F20_2a ○ a.m. ○ p.m.	F20_3 ☐☐:☐☐ F20_3a ○ a.m. ○ p.m.

F21. Were children offered an alternative activity besides TV?

F21 ○ yes ○ no

What time of screen was watched?
- TV
- Computer
- Tablet
-Mobile
-Video game

F22. Please describe what the children watched on TV (show name, content, commercials, etc.).

F22 ☐

F23. Did **the provider** watch TV after lunch today?

F23 ○ yes → F23a. In all, how many minutes was the TV on for **provider use only** after lunch today *(example: news, weather, talk shows)*? total minutes: ☐☐☐ F23a

○ no

if no, continue with F24

F24. Does the home have a **computer** available for use by **children**?

F24 ○ yes → ***Today, after lunch . . .***

○ no

if no, continue with F25

F24a. About how many minutes was a computer available for use by children? total minutes: ☐☐☐ F24a

F24b. How many different children used the computer? # of children ☐☐ F24b

F24c. On average, how many minutes did each child spend at the computer? minutes per child ☐☐ F24c

F25. Does the home have a **video game system** available for use by **children**? (examples: v-tec, playstation, Nintendo) *(Do not count computer time reported above.)*

F25 ○ yes → ***Today, after lunch . . .***

○ no

if no, continue with F26

F25a. How many different children used the video game system? # of children ☐☐ F25a

F25b. On average, how many minutes did each child spend using the video game system? minutes per child ☐☐ F25b

F26. Excluding **indoor play time, circle time, and TV time**, after lunch today, was there any seated time? *(time where the majority of children were seated)*

F26 ○ yes ○ no → *if no, skip to F27*

F26a. Record the duration (minutes) and description of each occasion of additional seated time.

Occasion:	Minutes: F26a_1	F26a_1text Description:
1:	☐☐	
2:	F26a_2 ☐☐	F26a_2text
3:	F26a_3 ☐☐	F26a_3text
4:	F26a_4 ☐☐	F26a_4text
5:	F26a_5 ☐☐	F26a_5text

F26b. Record the times that the infant spends in equipment that restricts movement.

Additional notes on **seated time**:

F27. How many times did the provider **verbally** encourage children to drink water while inside after lunch *(offering water, asking if thirsty, suggesting children stop and get some water)*?

F27 ☐☐ *number of times*

F28. How often did the provider use outdoor time to reward or punish child behavior?

		1 never	2 1-2 times	3 3+ times
a. All children **lost** time outdoors because of misbehavior.	F28a	○	○	○
b. A child **lost** outdoor time because of misbehavior for **5 minutes or less**.	F28b	○	○	○
c. A child lost outdoor time because of misbehavior for **more than 5 minutes**.	F28c	○	○	○
d. All children **got extra** outdoor time for good behavior.	F28d	○	○	○
e. A child **got extra** outdoor time for good behavior.	F28e	○	○	○

F29. How often did the provider use screen time to reward or punish child behavior?

		never	1-2 times	3+ times
a. All children **lost** TV/movie time because of misbehavior.	F29a	○	○	○
b. A child **lost** TV/movie time because of misbehavior.	F29b	○	○	○
c. All children **got extra** TV/movie time for good behavior.	F29c	○	○	○
d. A child **got extra** TV/movie time for good behavior.	F29d	○	○	○

F30. How often did the provider have these interactions with the children during play time?

		never	1-2 times	3+ times
a. The provider **joined the children in a game** they were playing outside.	F30a	○	○	○
b. The provider **played with children** during outside time.	F30b	○	○	○
c. The provider **participated in a chasing/running game** with children during outside time.	F30c	○	○	○
d. The provider **talked with children about the importance of physical activity.**	F30d	○	○	○

Section G: Activities In General For Today

G1. Today, did children sit and listen to a planned lesson that taught them about why exercising or being physically active is good for them (muscles, heart, mind), but that did not include any gross motor activity?

G1 ○ yes → G1a. About how many minutes did this planned lesson last? G1a ☐☐

○ no

↓

if no, continue with G2

G2. Below is a list of activities. Mark the box for any activity that the children did while **inside** today. *[Mark all that apply.]*

G2a ☐ a. balance		G2n ☐ n. run in place	
G2b ☐ b. bounce (balls)		G2o ☐ o. hang	
G2c ☐ c. punch (bag, mat, stuffed animal, pillow)		G2p ☐ p. chase	
G2d ☐ d. stretch		G2q ☐ q. slide	
G2e ☐ e. hop		G2r ☐ r. leap	
G2f ☐ f. jump from height		G2s ☐ s. tumble	
G2g ☐ g. kick		G2t ☐ t. catch	
G2h ☐ h. climb		G2u ☐ u. lift	
G2i ☐ i. roll		G2v ☐ v. skip	
G2j ☐ j. hit (ball, birdie, etc.)		G2w ☐ w. throw	
G2k ☐ k. swing		G2x ☐ x. gallop	
G2l ☐ l. crawl		G2y ☐ y. pedal	
G2m ☐ m. run around		G2z ☐ z. flip (somersault)	

Section H: Equipment, Environment, and Space

H1. How would you rate the home in terms of the space available for active play games/gross motor activities? *[Mark only one.]*

no room, only able to use for quiet play		*room for limited movement activities (walking, skipping, hopping, jumping, etc.)*		*room for all gross motor activities including running*
H1 ○ 1	○ 2	○ 3	○ 4	○ 5

H2. Which of the following items does the play kitchen contain? *[Mark all that apply.]*

H2a ☐ They do not have a play kitchen → *skip to H3*
H2b ☐ fruit
H2c ☐ vegetables
H2d ☐ canned goods
H2e ☐ commercial fast food (French fries, items with logos)
H2f ☐ dessert items (cookies, cakes, ice cream, etc.)
H2g ☐ bread/grain products (rice, pasta, bread, etc.)
H2h ☐ milk
H2i ☐ soda
H2j ☐ juice
H2k ☐ hamburgers/hot dogs
H2l ☐ other meats/beans/eggs
H2m ☐ dairy besides milk
H2n ☐ other → *specify on the line below*

H2n_text _____

H3. Where is drinking water for children located? *[Mark all that apply.]*

H3a ☐ from the **faucet/tap** or **refrigerator dispenser** in the kitchen
H3b ☐ **inside, in the observed** classroom from a **pitcher** or **water cooler** with **cups**
H3c ☐ **outside,** from a **pitcher** or **water cooler** with **cups**

Children have their own bottles

H4. Which of the following does the home have? *[Mark all that apply.]*

H4a ☐ books that encourage children to eat foods that are good for them
H4b ☐ books that encourage children to eat less healthy foods
H4c ☐ books that encourage children to be physically active
H4d ☐ posters and pictures that encourage children to be physically active
H4e ☐ posters and pictures that encourage children to watch TV shows or movies
H4f ☐ posters and pictures that encourage children to eat healthy foods
H4g ☐ posters and pictures that encourage children to eat less healthy foods

H5. Which of the following does the home have **outside** where children are allowed to play? *[Mark all that apply.]*

H5a	☐ a. large trees (8 feet or taller)	H5f	☐ f. variation in ground (hills, mounds)
H5b	☐ b. small trees (less than 8 feet tall)	H5g	☐ g. grassy area
H5c	☐ c. tree(s) that children can climb	H5h	☐ h. rocks large enough to climb
H5d	☐ d. shrubs	H5i	☐ i. a hill for rolling down or climbing up
H5e	☐ e. flowering plants	H5j	☐ j. shaded area with room for most children *(e.g., porch overhang, shade structures [tent/tarp], trees, umbrellas)*

H6. Which statement best describes the area **outside** the home where children are allowed to play? *[Mark only one.]*

H6
- ○ space for large group running games (e.g., tag with entire class)
- ○ space for small group (2-3 children) running games
- ○ only space for individual running/skipping/hopping
- ○ no space for running games (individual or group)

H7. Is there a garden available at the home for children to plant/grow items?

H7 ○ Yes → H7a. If yes, what is in the garden? *[Mark all that apply.]*
- H7a_1 ☐ flowers
- H7a_2 ☐ herbs
- H7a_3 ☐ vegetables
- H7a_4 ☐ fruits

○ No ↓ *skip to H8*

H8. Which of the following is visible for use by children? *[Mark all that apply." If it was used by children today, mark "yes."]*

			If available, was it used by children?
H8a	☐ balancing surfaces (balance beams, boards, etc.)	→	H8a_1 ○ yes
H8b	☐ basketball hoop(s)	→	H8b_1 ○ yes
H8c	☐ climbing structures (that cannot be moved, such as jungle gyms, ladders, etc.)	→	H8c_1 ○ yes
H8d	☐ merry-go-round	→	H8d_1 ○ yes
H8e	☐ swimming pool (fixed, in-ground)	→	H8e_1 ○ yes
H8f	☐ sandbox (large enough for child to sit in)	→	H8f_1 ○ yes

			If available, was it used by children?
H8g	☐ water play area (not including a water table)	→	H8g_1 ○ yes
H8h	☐ see-saw	→	H8h_1 ○ yes
H8i	☐ slide (that cannot be moved)	→	H8i_1 ○ yes
H8j	☐ swinging equipment (swings, ropes, etc.)	→	H8j_1 ○ yes
H8k	☐ tricycle track or paved area	→	H8k_1 ○ yes
H8l	☐ tunnels (fixed, not movable)	→	H8l_1 ○ yes
H8m	☐ benches	→	H8m_1 ○ yes
H8n	☐ picnic tables	→	H8n_1 ○ yes
H8o	☐ small stage or raised deck	→	H8o_1 ○ yes
H8p	☐ play house	→	H8p_1 ○ yes

Balance toys, e.g. balance beams

H9. Which of the following is available for use by children?

			If available, was it used by children?
H9a	☐ balls	→	H9a_1 ○ yes
H9b	☐ climbing structures (that can be moved by staff or children)	→	H9b_1 ○ yes
H9c	☐ floor play equipment (tumbling mats, etc.)	→	H9c_1 ○ yes
H9d	☐ jumping play equipment (jump ropes, hula hoops, mini tramps. etc.)	→	H9d_1 ○ yes
H9e	☐ parachute	→	H9e_1 ○ yes
H9f	☐ push/pull toys (wagon, scooters, wheelbarrows, big dump trucks etc.)	→	H9f_1 ○ yes
H9g	☐ riding toys (tricycles, cars, scooters, etc.)	→	H9g_1 ○ yes
H9h	☐ rocking or twisting toys (rocking horse, sit and spin, etc.)	→	H9h_1 ○ yes
H9i	☐ sand/water tables	→	H9i_1 ○ yes
H9j	☐ sand/water play toys (shovels, scoops, buckets, etc.)	→	H9j_1 ○ yes
H9k	☐ slides (that can be moved by staff or children)	→	H9k_1 ○ yes
H9l	☐ twirling play equipment (ribbons, scarves, batons, etc.)	→	H9l_1 ○ yes
H9m	☐ small portable pool used for swimming, splashing or other water play	→	H9m_1 ○ yes

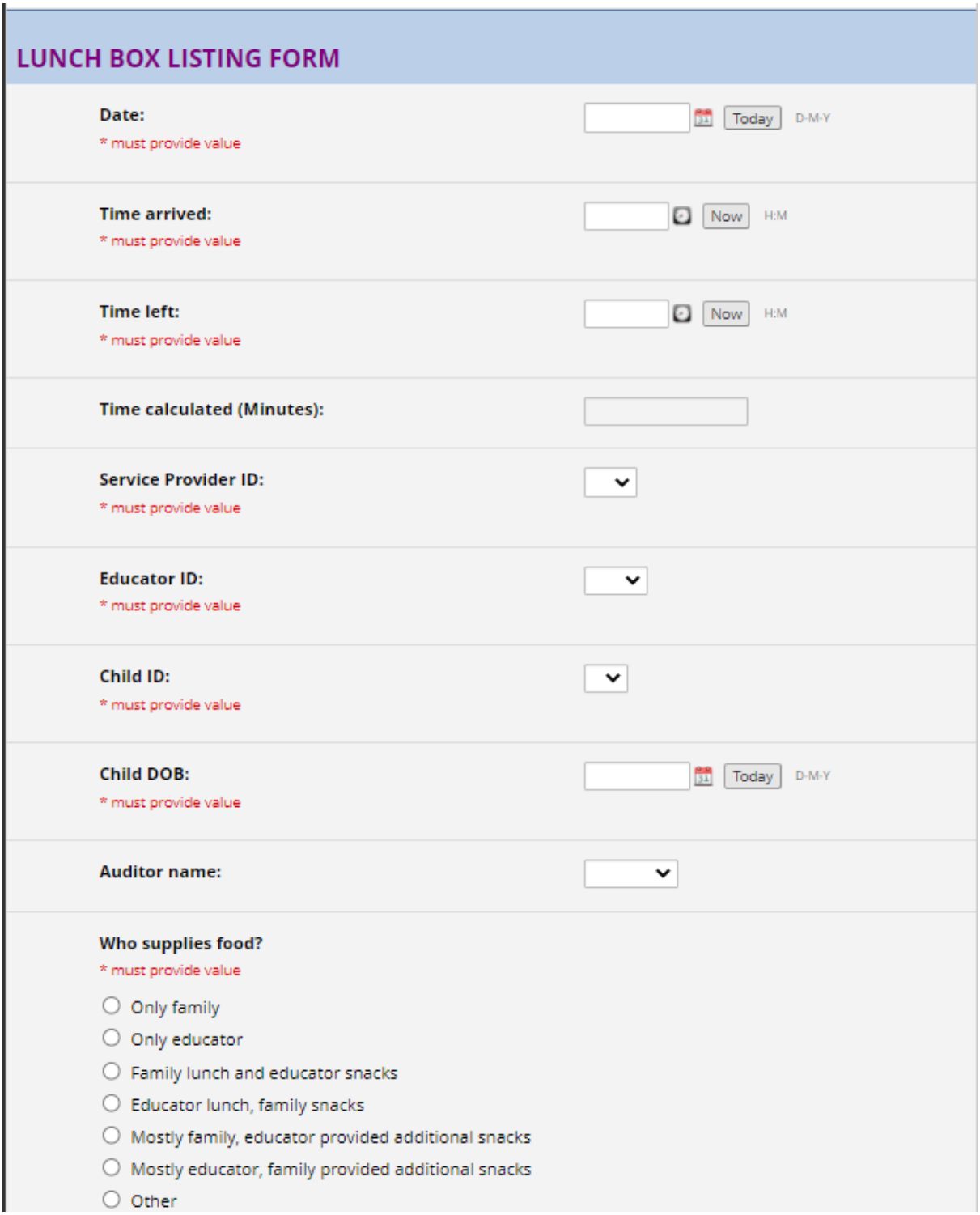
			If available, was it used by children?
H9n	☐ portable tunnels (that can be moved by staff or children)	➔	H9n_1 ○ yes
H9o	☐ TV	➔	H9o_1 ○ yes
H9p	☐ DVE/VCR	➔	H9p_1 ○ yes
H9q	☐ computer(s)	➔	H9q_1 ○ yes
H9r	☐ video game system(s) (v-tech, X-box, Playstation, Game boy, etc.)	➔	H9r_1 ○ yes

Tablet

H10. In the box below, please provide a crude drawin (with measured distances) of the outdoor play area. Note from what areas of the playground photographs are taken.

Appendix BB: Food audit tool

Images from REDCap



LUNCH BOX LISTING FORM

Date: Today D-M-Y
* must provide value

Time arrived: Now H:M
* must provide value

Time left: Now H:M
* must provide value

Time calculated (Minutes):

Service Provider ID:
* must provide value

Educator ID:
* must provide value

Child ID:
* must provide value

Child DOB: Today D-M-Y
* must provide value

Auditor name:

Who supplies food?
* must provide value

- ○ Only family
- ○ Only educator
- ○ Family lunch and educator snacks
- ○ Educator lunch, family snacks
- ○ Mostly family, educator provided additional snacks
- ○ Mostly educator, family provided additional snacks
- ○ Other

FAMILY PROVIDED FOOD

Service Provider ID: 60

Educator ID: 03

Child ID: 2

What meals were provided?

- [ ] Breakfast
- [x] Morning tea
- [x] Lunch
- [x] Afternoon tea
- [ ] Dinner

1. FRUIT

- (•) Yes
- ( ) No

reset

How many fruits have been provided? ( ) 1 (•) 2 ( ) 3 ( ) 4 ( ) 5

reset

FRUIT 1

Fruit 1 Description:	Apple
Fruit 1 Type:	Fresh
Fruit 1 Weight (grams):	120
Fruit 1 Container Weight (grams):	0
Fruit 1 Weight calculated (grams):	120

Notes:

Expand

FRUIT 2

Fruit 2 Description:	Sultana
Fruit 2 Type:	Dried
Fruit 2 Weight (grams):	100
Fruit 2 Container Weight (grams):	60

2. VEGETABLES

(•) Yes
( ) No

reset

How many vegetables have been provided? (•) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5

reset

VEGETABLE 1

Vegetable 1 Description:

Vegetable 1 Type:

Vegetable 1 Weight (grams):

Vegetable 1 Container Weight (grams):

Vegetable 1 Weight calculated (grams):

Notes:

Expand

Notes:

Expand

3. DAIRY

( ) Yes
(•) No

reset

4. OTHER DRINKS

( ) Yes
(•) No

reset

5. SWEET SNACKS

(•) Yes
( ) No

reset

How many sweet snacks have been provided? (•) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5

reset

SWEET SNACK 1

6. SAVOURY SNACKS

(•) Yes
( ) No

reset

How many savoury snacks have been provided? (•) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5

reset

SAVOURY SNACK 1

Savoury Snack 1 Description: Potato snacks

Savoury Snack 1 Brand/details:

Savoury Snack 1 Flavour: Plain

Savoury Snack 1 Quantity (grams): 200

Savoury Snack 1 Container Weight (grams): 50

Savoury Snack 1 Weight calculated (grams): 150

Notes:

Expand

7. GRAINS/CEREALS

(•) Yes
( ) No

reset

How many grains & cereals have been provided? (•) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5

reset

GRAINS/CEREALS 1

Grains/cereals 1 Type: Crispbreads

Grains/cereals 1 Brand:

Grains/cereals 1 Variety: Wholemeal

Grains/cereals 1 Flavour:

Grains/cereals 1 Quantity (grams): 60

Grains/cereals 1 Container Weight (grams): 0

8. MAIN MEAL

HOMEMADE MEAL

(•) Yes
( ) No

reset

Homemade Meal Description:	Pasta dish
Homemade Meal Weight (grams):	250
Weight of container (grams):	50
Homemade Meal Weight calculated (grams):	200
$8a_1$. CEREALS	Pasta
Cereal Variety:	White
$8a_2$. FISH/MEAT OR ALTERNATIVES	Salmon, Tuna, White fish or Other
$8a_3$. VEGETABLES	Cooked vegetables
$8a_4$. DAIRY	Hard cheese, such as tasty, cheddar
$8a_5$. DISCRETIONARY FOOD:	
$8a_6$. OTHER INGREDIENT:	Tomato Passata/pasta sauce

Notes:

Expand

SANDWICH/ROLL/WRAP

( ) Yes
(•) No

reset

FAST FOOD

( ) Yes
(•) No

reset

Main Meal Notes:

SANDWICH/ROLL/WRAP

(•) Yes
( ) No

reset

Sandwich/roll/wrap Description:	Roll
Sandwich/roll/wrap Variety:	Wholegrain/mixed grain
Sandwich/roll/wrap Filling:	Cheese and ham
$8b_1$. FISH/MEAT OR ALTERNATIVES	
$8b_2$. VEGETABLES	
$8b_3$. DAIRY	Hard cheese, such as tasty, cheddar
$8b_4$. DISCRETIONARY FOOD 1:	Processed meat such as sausages, ham, chicl
$8b_4$. DISCRETIONARY FOOD 2:	
$8b_5$. OTHER INGREDIENT:	
Sandwich/roll/wrap Weight (grams):	200
Sandwich/roll/wrap Container Weight (grams):	0
Sandwich/roll/wrap calculated (grams):	200

Notes:

Expand

9. MEAT & ALTERNATIVES

(•) Yes
( ) No

reset

How many meat & alternatives have been provided? (•) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5

reset

MEAT & ALTERNATIVES 1

Meat & Alternatives 1 Description: Nuts/seeds

Meat & Alternatives 1 Weight (grams): 30

Meat & Alternatives 1 Contained Weight (grams): 0

Weight calculated: 30

Notes:

Expand

10. INFANT FORMULAE & FOODS

(•) Yes
( ) No

reset

How many infant formulae & foods have been provided? (•) 1 ( ) 2 ( ) 3

reset

INFANT FORMULAE & FOODS 1

Infant Formulae & Foods 1 Description: Infant formula, prepared

Infant Formulae & Foods Quantity (mL/grams): 350

Infant Formulae & Foods Contained Weight (grams): 100

Weight calculated: 250

Notes:

Expand