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Food insecurity and fruit and vegetable consumption among regional and remote Western Australian children: Determinants, prevalence and predictors

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Food insecurity and fruit and vegetable consumption among regional and remote Western Australian children: determinants, prevalence and predictors

This thesis is presented for the degree of

Doctor of Philosophy

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Edith Cowan University
School of Medical and Health Sciences
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DECLARATION

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ABSTRACT

Introduction

Living in a community with adequate availability of nutritious food, and the capacity to access and utilise it, are key food security determinants (FSD). However, inequities relating to these determinants exist between regional and remote Western Australian (WA) communities, particularly regarding fruit and vegetables (F&V). This negatively impacts vulnerable populations, especially children. In order to understand determinants, prevalence and predictors of F&V and food security (FS), three concepts were explored in this PhD; (1) ***F&V consumption among regional and remote WA children*** (including determinants of F&V consumption, quantities, types, varieties of F&V consumed); (2) ***FS among regional and remote WA children*** (children's FSD, prevalence of child food insecurity (FI) and socio-demographic predictors of FI); and (3) ***the relationship between FSD and F&V consumption among regional and remote WA children*** (FSD predictors of F&V consumption).

Methods

This mixed-methods study included semi-structured interviews with 20 key informants, to explore determinants of F&V consumption and FS among regional and remote WA children. Cross-sectional surveys were completed by caregiver-child dyads (n = 256), to understand children's F&V consumption behaviours, determine child FI prevalence and assess whether FSD predicted adequate F&V consumption. Twenty-four hour food diaries measured F&V amounts and varieties consumed. Data analyses were conducted using IBM SPSS (version 23), Microsoft Excel and QSR NVivo (version 10).

Results

The determinants of children's F&V consumption were explored using an Ecological Model of Health Behaviour. F&V quantities, types and varieties consumed were then quantified; more children achieved adequate fruit serves (65.8%) than vegetable serves (15.4%). Quantities consumed did not differ between regional and remote locations, however, F&V types and varieties consumed did. The FSD across food availability, access and utilisation dimensions were examined, illuminating inequities relating to food supply, social support and nutrition education. The calculation of prevalence and socio-demographic predictors of child FI revealed that one in five children were FI; family receipt of government income support (p = 0.022) and residency in a location of 'Medium disadvantage' (p = 0.023) predicted child FI. Subsequently, the association

between FSD and adequate fruit intake among WA children was examined. After controlling for socio-demographic predictors, no determinants were significantly associated with fruit intake. However, FSD were associated with vegetable consumption; varieties and types of vegetables consumed ($p = 0.007$), health message promotion ($p = 0.017$), location of food outlets ($p = 0.027$) and price ($p = 0.043$) significantly predicted adequate vegetable consumption.

Conclusion

This study contributed a greater understanding of the complex, interwoven factors that influence FS among regional and remote WA children, namely food availability, access, utilisation, and the impact on F&V consumption. Findings provide a basis for advocacy to improve inequities across WA, relating to **food supply**, **social support** and **nutrition education**. It also provides focus for health promotion practitioners who work with target groups affected by FI, to customise strategies to improve F&V consumption based on FSD, and has identified valuable future research pathways.

ACKNOWLEDGEMENTS

I would like to start by acknowledging my incredible, multidisciplinary supervisory team. There is no way I would have firstly undertaken a PhD, and secondly completed it, if it were not for your unwavering encouragement, guidance and faith in me. To have a group of professionals with such varied yet harmonious skill sets is a true gift for a PhD student and I feel extremely lucky to have had such a brilliant team by my side riding this PhD rollercoaster!

I was privileged to have Professor Amanda Devine as my Principal Supervisor. Amanda, you have been such a significant part of my life since my undergraduate studies began at Edith Cowan University in 2004. Your mentorship, guidance, attention to detail and efforts to push me outside of my comfort zone has absolutely moulded me into the person I am today. I am especially grateful for the vision, experience and skills you have shared with me over the past 13 years.

I am so grateful to have had Jill Darby as an Associate Supervisor and mentor, also since my undergraduate days. Jill, you continuously supported me during this PhD and always provided such logical, considered and practical advice. I am particularly thankful for your expertise in practice; many of the recommendations arising from this research were underpinned by discussions with you.

I am so appreciative of the contribution Dr Christina Davies has made to this project, as an Associate Supervisor and mentor. Christina, your substantial experience across all aspects of mixed-methods research and publishing meant you gave me such critical, in-depth guidance every step of the way. Both being ENTJ's (according to Myers Briggs personality profiling) made this an impassioned, thought-provoking experience! Working with you always made me want to extend myself that extra bit further. Your generous provision of time - particularly after hours and on weekends - and your joy expressed when I achieved each milestone, was absolutely cherished.

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ability to inspire and build confidence within your students. Thank you for your time, humour and playing such a critical part in this journey.

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I am grateful to have been a recipient of a Healthway Health Promotion Research Training Scholarship for the last two years of this project. To have full-time capacity to think, write and manage this significant project full-time, rather than at night and on weekends, was an incredible gift. I am certain the quality of this research is significantly higher as a result of the time afforded by this scholarship.

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I would never have finished this PhD if it were not for the support of my incredible husband, Luke. Thank you for your enduring patience all of the times I said "I've just got a *little bit* more work to do" and for being so tolerant when that almost always turned out to be *hours more* work to do. You listened, you encouraged, and you never let me lose sight of the 'end goal' this is all leading towards.

Finally, I would like to dedicate this thesis to the numerous children who captured my heart when I worked as a public health nutritionist in regional and remote communities across WA. You were the inspiration and reason why I started this journey almost eight years ago and the reason why I finished it. I hope the outcomes of this study help, even just a little bit, to make living a healthy life more achievable for you in the future.

LIST OF PUBLICATIONS INCLUDED IN THE THESIS

Journal articles

1. **Godrich, S.L.**, Davies, C.R., Darby, J., Devine, A. (2016). Which ecological determinants influence Australian children's fruit and vegetable consumption? *Health Promotion International*, 1-10. doi: 10.1093/heapro/daw063.
2. **Godrich, S.L.**, Lo, J., Davies, C.R., Darby, J., Devine, A. (2017). Are regional and remote Western Australian children eating for good health? An investigation into fruit and vegetable consumption. *Health Promotion Journal of Australia.* doi: 10.1071/HE16090.
3. **Godrich, S.L.**, Davies, C.R., Darby, J., Devine, A. (2017). What are the determinants of food security among regional and remote Western Australian children? *Australian and New Zealand Journal of Public Health.* doi: 10.1111/1753-6405.12636.
4. **Godrich, S.L**., Lo, J., Davies, C.R., Darby, J., Devine, A. (2016). Prevalence and socio-demographic predictors of food insecurity among regional and remote Western Australian children. Manuscript under review (*Australian and New Zealand Journal of Public Health*).
5. **Godrich, S.L.**, Lo, J., Davies, C.R., Darby, J., Devine, A. (2016). Do food security determinants predict adequate fruit consumption among regional and remote Western Australian children? Manuscript in preparation.
6. **Godrich, S.L.**, Lo, J., Davies, C.R., Darby, J., Devine, A. (2017). Which food security determinants predict adequate vegetable consumption among rural Western Australian children*? International Journal of Environmental Research and Public Health*, 14 (40), 1-15. doi:10.3390/ijerph14010040.

Conference presentations

1. **Godrich, S.**, Darby, J., Davies, C., Devine, A. (2014, July). What are the barriers and enablers to fruit and vegetable consumption among children in regional and remote Western Australia? Paper accepted for oral presentation at the *Aboriginal Health Conference*, Perth, Western Australia.
2. **Godrich, S.**, Darby, J., Davies, C., Devine, A. (2015, May). Key informant perceptions of factors that prevent or facilitate children's fruit and vegetable intake in regional and remote Western Australia. Paper accepted for oral presentation at the *13th National Rural Health Conference*, Darwin, Northern Territory.
3. **Godrich, S.**, Davies, C., Darby, J., Devine, A. (2016, May). Investigating individual and interpersonal determinants of fruit and vegetable consumption among regional and remote WA children. Paper accepted for poster presentation at the *Dietitians Association of Australia 33rd National Conference*, Melbourne, Victoria.
4. **Godrich, S.**, Davies, C., Darby, J., Devine, A. (2016, June). Community informant strategies to increase fruit and vegetable consumption among regional and remote WA children. Paper accepted for oral presentation at the *23rd National Australian Health Promotion Association Conference*, Perth, Western Australia.
5. **Godrich, S.**, Davies, C., Darby, J., Lo, J., Devine, A. (2016, June). Stories behind the statistics: an ecological mixed-methods investigation into drivers of WA children's fruit and vegetable consumption. Paper accepted for oral presentation at the *23rd National Australian Health Promotion Association Conference*, Perth, Western Australia.
6. **Godrich, S.**, Davies, C., Darby, J., Lo, J., Devine, A. (2016, September). Using mixed-methods to create a picture of food security among Western Australian children. Paper accepted for poster presentation, *World Nutrition Congress*, Cape Town, South Africa.
7. **Godrich, S.**, Lo, J., Davies, C., Darby, J., Devine, A. (2016, July). Which food security determinants are associated with remoteness in Western Australia? Paper accepted for oral presentation at the *International Conference on Public Health*, Colombo, Sri Lanka.

8. **Godrich, S.**, Lo, J., Davies, C., Darby, J., Devine, A. (2016, July). How do social and economic factors influence fruit and vegetable consumption amongst regional and remote Western Australian children? Paper accepted for oral presentation at the *International Conference on Public Health*, Colombo, Sri Lanka.
9. **Godrich, S.**, Lo, J., Davies, C., Darby, J., Devine, A. (2016, September). Are knowledge and preferences associated with adequate child fruit and vegetable consumption? Paper accepted for oral presentation, *Public Health Association of Australia 44th Annual Conference and 20th Chronic Diseases Network Conference*, Alice Springs, Northern Territory.
10. **Godrich, S.**, Davies, C., Darby, J., Lo, J., Devine, A. (2016, September). Top fruit and vegetable messages recalled in regional and remote Western Australia. Paper accepted for poster presentation, *Public Health Association of Australia 44th Annual Conference and 20th Chronic Diseases Network Conference*, Alice Springs, Northern Territory.

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Stephanie Louise Godrich

STATEMENT OF CONTRIBUTION OF OTHERS

I, Stephanie Louise Godrich, under the guidance of Principal Supervisor Professor Amanda Devine and Associate Supervisors Dr Christina Davies, Jill Darby and Dr Johnny Lo, wrote this thesis. Together with my supervisors, I conceptualised this study, developed the quantitative data collection instruments (child survey, caregiver survey), some questions of which were based on previous literature, and developed the qualitative data collection instrument (semi-structured interview guide). I collected and entered the data for quantitative and qualitative data streams, with the exception of 24-hour food diaries, which were entered by Tristan Schwartzkopff, data entry assistant. I was responsible for data cleaning, management and analysis of both qualitative and quantitative data, under the guidance of my supervisors. Data analysis strategies employed for each manuscript included in this thesis were decided upon and agreed by all team members. I was the lead author on all six manuscripts included within this Thesis with Publication.

During this study, I was supported by a Health Promotion Research Training Scholarship, administered by the Western Australian Health Promotion Foundation (Healthway), grant number 24233.

Stephanie Louise Godrich

I, as a Co-Author, endorse that this level of contribution by the Candidate indicated above is appropriate.

Johnny Lo	*Edith Cowan University*
Christina R. Davies	*The University of Western Australia*
Jill Darby	*Edith Cowan University*
Amanda Devine	*Edith Cowan University*

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

	Abbreviations
Aboriginal Islander Education Officer	AIEO
Association of Independent Schools WA	AISWA
Australian Bureau of Statistics	ABS
Australian Dietary Guidelines	ADG
Australian Statistical Geographical Standard	ASGS
Catholic Education WA	CEWA
Child Food Security Survey Module	CFSSM
Consent form	CF
Department of Education WA	DOE
Digital Video Disc	DVD
Edith Cowan University	ECU
Food diary	FD
Food Frequency Questionnaire	FFQ
Food insecurity	FI
Food security	FS
Food security determinants	FSD
Fruit and vegetables	F&V
Goods and Services Tax	GST
Food Security Survey Module	FSSM
Identification number	ID
Index of Relative Socio-economic Disadvantage	IRSD
Information letter	IL
Kimberley Aboriginal Health Planning Forum	KAHPF
National Health Priority Areas	NHPA
Non-communicable diseases	NCD
Remoteness Area	RA
Research Question	RQ
Semi-structured Interview	SSI
Social Determinants of Health	SDH

Socio-economic Indexes for Areas	SEIFA
Statistical Package for Social Sciences	SPSS
United Kingdom	UK
United States of America	USA
Western Australia	WA
Wilcoxon Signed Rank Tests	WSRT

CHAPTER 1: GENERAL INTRODUCTION

1.0 Foreword

This chapter provides an overview of this Thesis with Publication (also known as 'thesis by publications'). It will justify the need for this study; outline the study purpose and significance, conceptual framework underpinning the study, list the research questions, and an overview of the subsequent thesis chapters that are presented as individual manuscripts will be provided. A summary will conclude the chapter.

1.1 Rationale

Fruit and vegetable consumption

It is well established that fruit and vegetables (F&V) provide numerous nutrients for good health and may aid in risk reduction of non-communicable diseases (NCD) (National Health and Medical Research Council, 2013a). Despite the evidence, Australian children are consuming F&V in amounts inconsistent with national dietary recommendations (National Health and Medical Research Council, 2013a). Nationally, fruit consumption among Australian children is moderate, with over two-thirds of Australian children achieving the Australian Dietary Guidelines (ADG) for fruit (2 serves per day). However, less than three per cent of children meet the ADG for vegetables (5 serves per day for children 9-11 and girls aged 12-13 years, and 5.5 serves for boys aged 12-13 years) (Australian Bureau of Statistics, 2016b). In order to make meaningful change in health issues such as NCD, a thorough understanding of the determinants of F&V consumption is required. Currently, an understanding is lacking regarding the specific factors that influence dietary consumption among children in regional and remote Western Australia (WA). Given the determinants of food choice are multifactorial in nature, an investigation across levels of influence would significantly increase understanding of the determinants of F&V consumption. *An investigation of the leading determinants of children's F&V consumption, across multiple levels of influence, is required.*

Not all Australians, however, have the ability to make healthy food choices, with location a main factor. In Australia, remoteness is classified by *"the physical distance to the nearest urban centre and its population size"* (p. xii) (Australian Institute of Health and Welfare, 2016a), with the terms rural and remote used to describe locations outside

of metropolitan cities. The terms ‘rural and remote’ are often used interchangeably with ‘regional and remote’ by government bodies (Australian Institute of Health and Welfare, 2016a). The specific classification of remoteness is defined by the Australian Statistical Geography Standard (ASGS) Remoteness Areas (RA) (Australian Bureau of Statistics, 2014b). The RA areas are categorised as ‘Major Cities of Australia’, ‘Inner Regional Australia’, ‘Outer Regional Australia’, ‘Remote Australia’, ‘Very Remote Australia’ and ‘Migratory’. As the relevant categories for this study are ‘Inner Regional Australia’, ‘Outer Regional Australia’, ‘Remote’ and ‘Very Remote Australia’, herein, ‘Inner regional’ and ‘Outer regional’ will be referred to as ‘regional’ and ‘Remote’ and ‘Very remote’ will be referred to as ‘remote’. Regional and remote are at times collectively referred to as ‘rural’. The wider ASGS is a geographic framework that has been used since 2011 and, in addition to the RA, includes the main structure, which includes *Mesh Blocks* that categorise land use in Australia, a *Greater Capital City Statistical Area Structure*, which categorise the socio-economic extent of small towns on the perimeter of cities across the states and territories. The *Significant Urban Area Structure* identifies clusters of urban development, while the *Indigenous Structure* represents discrete Aboriginal communities. The *Urban Centres and Localities and Section of State Structures* are based on population density and identify concentrated urban development (Australian Bureau of Statistics, 2014b).

Residents living in regional and remote areas are at a significant disadvantage in relation to opportunities to live a healthy life (Australian Institute of Health and Welfare, 2016a). Key inequalities include reduced access to affordable, good quality, nutritious food (Pollard et al., 2015). Yet, to date, the impact of this regional and remote disadvantage on children’s F&V consumption has not been closely scrutinised. *Research is needed to determine the impact remoteness has on amounts, types and varieties of F&V consumed by WA children.*

Food security

Food security (FS) has been defined as:

> *“When all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, access, utilization and stability. The nutritional dimension is*

integral to the concept of food security" (Food and Agriculture Organization of the United Nations, 2009).

This definition incorporates the pillars of 'food availability', 'food access' 'food utilisation'; and stability of the first three pillars (Ecker et al., 2012; Rychetnik et al., 2003; United Nations Food and Agriculture Organisation, 1998; World Health Organization, 2012). Within these pillars, there are a number of FS determinants (FSD) that occur. Within the food availability dimension, FSD include location of food outlets, availability in outlets, price, quality, variety and promotion (Rychetnik et al., 2003). Food access FSD include financial resources, social support, transport to outlets, distance and mobility (Rychetnik et al., 2003). Food utilisation FSD include nutrition knowledge and cooking skills, food preferences, storage facilities, food preparation and cooking facilities, time to procure and purchase food (Rychetnik et al., 2003).

Evidence gaps across regional and remote WA relate to food availability and how families, especially welfare recipients, access food (Pollard et al., 2015). In addition, whether they have the resources and skills to utilise food. This is an under-researched concept in Australia, particularly among vulnerable groups such as children (Pollard, Nyaradi, et al., 2014). Therefore, more research is required at individual and community FS levels (Public Health Association of Australia, 2012). A useful framework to underpin research in this area is the Determinants of Food Security framework (Rychetnik et al., 2003), which incorporates a broad list of individual, household and community factors that influence FS. *In order to better understand FS, an exploration of the FSD among regional and remote WA children is needed, utilising the Determinants of Food Security framework.*

Food insecurity (FI) occurs when food access is restricted or availability of nutritionally adequate foods is reduced or uncertain (Life Science Research Office, 1990). Measurement of FI in Australia is currently suboptimal; the current national prevalence among adults is *estimated* to be 4% (Australian Bureau of Statistics, 2015a), with no national estimate for children. Given that 27% of WA's children live in regional and remote WA (Commissioner for Children and Young People, 2015), a thorough understanding of FI from WA children's perspectives is imperative. However, this prevalence is yet to be established. In addition, and to facilitate the development of strategies to mediate the issue, an understanding of the key factors that predispose WA children to FI is essential. *The measurement of FI prevalence among regional and*

remote WA children and the associated socio-demographic predictors of child FI are required.

Food security and fruit and vegetable consumption

A small number of studies to date have investigated whether an association between FS and F&V intake exists, mostly focusing on FS classification/status rather than the underlying FSD. The literature is currently inconsistent in its reports of the impact of FS on diet quality (Hanson et al., 2014), especially relating to F&V consumption among children. Evidence relating to the association between FS and fruit consumption among children is more consistent (Grutzmacher et al., 2011; Hanson et al., 2014), however, further investigation is required. An examination beyond FS *status*, such as the associations between the underlying FSD and F&V consumption, would create significant new opportunities for interventions to potentially improve FS. *The impact of the FSD on regional and remote WA children's F&V consumption is needed to build the currently sparse and inconsistent evidence base.*

1.2 Purpose of this research

1.2.1 Research aim

To explore the relationship between FSD and F&V consumption among 9-13 year old children living in regional and remote WA.

1.2.2 Research questions (RQ)

RQ1: What are the determinants of F&V consumption among regional and remote WA children?

RQ2: What quantities, varieties and types of F&V do children living in regional and remote WA consume and how do these compare to the serves recommended by the Australian Dietary Guidelines?

RQ3: What are the determinants of FS among regional and remote WA children?

RQ4: What is the proportion of children in regional and remote WA that are FI?

RQ5: Are FSD related to F&V consumption and which determinant has the greatest influence on consumption, among children in regional and remote WA?

1.3 Conceptual framework

Figure 1 provides an overview of the three key concepts explored in this PhD:

Concept 1: F&V consumption among regional and remote WA children;

Concept 2: FS among regional and remote WA children; and

Concept 3: The relationship between FSD and F&V consumption among regional and remote WA children.

The first concept, ***F&V consumption among regional and remote WA children***, includes the determinants of F&V, quantities, types, and varieties of F&V consumed. The second concept, ***FS among regional and remote WA children,*** explores FSD among children across food availability, access and utilisation dimensions. Further, prevalence and socio-demographic predictors of child FI are investigated. The third concept, ***the relationship between FSD and F&V consumption among regional and remote WA children,*** includes an exploration of whether FSD (independent variables) predict adequate F&V consumption (dependent variables), controlling for potential socio-demographic/confounding variables.

The theoretical framework underpinning the FS concepts in this study is the Determinants of Food Security framework (Rychetnik et al., 2003), while an Ecological Model of Health Behaviour (McLeroy et al., 1988) underpins the exploration of F&V determinants across various levels of influence. Both quantitative and qualitative data streams have been utilised in this study to provide multiple perspectives of the phenomena and used as a validation strategy.

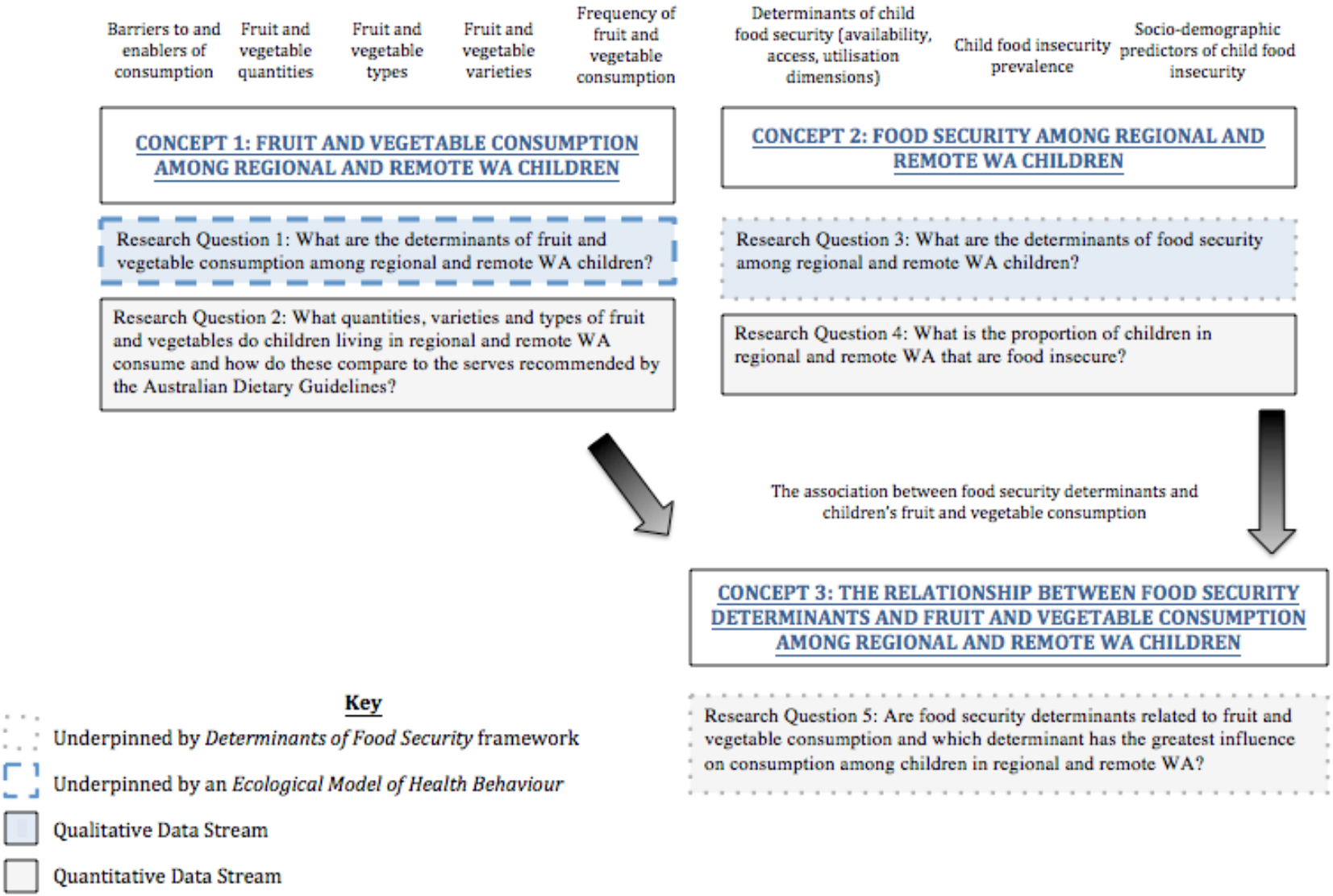


Figure 1: PhD conceptual framework

1.4 Significance of this research

This research has contributed substantial knowledge across the food supply, health, education and social welfare sectors. Specific contributions this study makes have been summarised below and relate to each RQ:

1.4.1 Increased understanding of the determinants of children's fruit and vegetable consumption across multiple levels of influence (RQ 1)

This research has provided deeper insight into the determinants of children's F&V consumption, across multiple levels of influence, by using an Ecological Model of Health Behaviour. This study's findings will provide new knowledge to improve practice and provide focus for community-based health promotion program development and delivery.

1.4.2 Enhanced awareness of how remoteness impacts the quantities, types and varieties of fruit and vegetables consumed by Western Australian children (RQ 2)

F&V intake in non-metropolitan areas has typically been grouped as 'rural', which precludes further examination of the effect of location on F&V consumption. The regional versus remote perspective provided by this research will enable a comparison between locations and increase awareness of the F&V consumption behaviours of regional and remote WA children. These findings will provide practitioners with a benchmark for regional and remote WA and will facilitate tailoring of specific strategies to increase F&V consumption. Importantly, evidence provided by this regional versus remote perspective has the potential to increase the relevancy of interventions for these locations.

1.4.3 Improved understanding of the determinants of food security among regional and remote Western Australian children (RQ 3)

Children's FSD are currently not well understood, particularly in regional and remote WA. This more in-depth understanding of FS, across food availability, access and utilisation dimensions, will reinforce aspects requiring policy advocacy, provide a focus for practice and identify valuable future research directions.

1.4.4 Improved understanding of the prevalence of food insecurity among regional and remote Western Australian children and the socio-demographic factors that predict child food insecurity (RQ 4)

This study makes a novel contribution to research and extends the current knowledge base, as (to our knowledge) the first published prevalence of child FI from a child's perspective in Australia. This research has determined the socio-demographic factors that impact FI, providing evidence for advocacy relating to food supply, social support and nutrition education implementation strategies. New policy may result in an increased mandate, funding and resources for service providers to target community-level and household-level FS issues pertinent to the communities in which they work.

1.4.5 Contribution to the currently sparse and inconsistent evidence base regarding the association between food security determinants and children's fruit and vegetable consumption (RQ 5)

This research has contributed significantly to the literature regarding the impact FSD have on children's F&V consumption. To date, the literature relating to associations between FS and F&V has largely been limited to a comparison of FS *status* and consumption, rather than FSD. This research will address the current research gap by providing an assessment of the association between FSD and F&V consumption. It is anticipated that these findings will assist practitioners to develop strategies to improve F&V consumption and build the evidence base relating to healthy food supply in regional and remote communities.

1.5 Thesis structure

The thesis is presented as ten chapters including an introduction to the research conducted; a background that provides an overview of relevant literature; an outline of the research approach and methods utilised; six manuscripts and their accompanying research translation activities; and a general discussion that summarises key findings and implications for policy, practice and research as well as planned research impact. A summary of each chapter is outlined below:

1.5.1 Chapter 1– General introduction

The first chapter (current chapter) is a *'General Introduction'* that provides the academic rationale for this study. A subsequent research purpose including aim, RQ and

conceptual framework follows. The research significance is outlined and an overview of the RQ and resulting publications and conference presentations are provided, demonstrating the contribution this study has made to the knowledge base and the potential impact on policy, practice and further research.

1.5.2 Chapter 2 - Background

Given each manuscript included in this thesis contains a review of relevant literature, the thesis *'Background'* chapter contains an overview of literature relating to the three themes explored in this PhD:

1. F&V consumption among regional and remote WA children;
2. FS among regional and remote WA children; and
3. The relationship between FSD and F&V consumption among regional and remote WA children.

1.5.3 Chapter 3 – Methods

Chapter three, *'Methods'*, contains the philosophical worldview that this research holds, an overview of the study design and a detailed description of the study phases undertaken for qualitative and quantitative data streams. The research methods used in this study are described and consideration of ethical issues in this research outlined.

1.5.4 Chapter 4 – Which ecological determinants influence Australian children's fruit and vegetable consumption? (RQ 1)

This chapter provides a qualitative examination of the determinants of F&V consumption among children. This chapter is published in *Health Promotion International (2016)* and is entitled *'Which Ecological Determinants influence Australian Children's Fruit and Vegetable Consumption?'* (doi: 10.1093/heapro/daw063). This chapter explores the various interwoven individual and environmental factors impacting F&V intake among children. This provides policymakers and practitioners with a new perspective on the issues affecting consumption, with recommendations focusing on various levels of influence.

1.5.5 Chapter 5 – Are regional and remote Western Australian children eating for good health? An investigation into fruit and vegetable consumption (RQ 2)

Chapter five commences with a contextual overview of F&V consumption among children in Australia and WA, before providing a regional versus remote investigation

into quantities, types and varieties of F&V consumed by WA children. The manuscript included in this chapter, *'Are Regional and Remote Western Australian children eating for good health? An investigation into fruit and vegetable consumption'*, is published in *Health Promotion Journal of Australia (2017)* (doi: 10.1071/HE16090).

1.5.6 Chapter 6 – What are the determinants of food security among regional and remote Western Australian children? (RQ 3)

This chapter presents a qualitative paper that utilises the Determinants of Food Security framework (Rychetnik et al., 2003) as a basis for investigation of FSD within a WA context. The chapter, entitled *'What are the determinants of food security among regional and remote Western Australian children?'* is published in *Australian and New Zealand Journal of Public Health (2017)* (doi: 10.1111/1753-6405.12636) and makes a substantial contribution to the currently scarce evidence base in WA. The complex issue of FS is explored across food availability, access and utilisation dimensions. This provides detailed insight into individual, household and community level FSD across regional and remote WA.

1.5.7 Chapter 7 – Prevalence and socio-demographic predictors of food insecurity among regional and remote Western Australian children (RQ 4)

Chapter seven contributes (to our knowledge) the first published prevalence of child FI, from children's perspectives, in Australia. The manuscript, entitled *'Prevalence and socio-demographic predictors of regional and remote Western Australian children's food insecurity'*, outlines the issue among children and determines the socio-demographic predictors of children's FI. This manuscript is currently *under review (Australian and New Zealand Journal of Public Health)*.

1.5.8 Chapter 8 – Do food security determinants predict adequate fruit consumption among regional and remote Western Australian children? (RQ 5)

This chapter formalises the association between FSD and fruit consumption among regional and remote WA children, through multivariable logistic regression analyses. The research is presented in the manuscript *'Do food security determinants predict adequate fruit consumption among regional and remote Western Australian children?'* This manuscript is currently *in preparation*.

1.5.9 Chapter 9 – Which food security determinants predict adequate vegetable consumption among rural Western Australian children? (RQ 5)

Chapter nine completes the picture of the association between FSD and F&V consumption. This chapter includes an examination of the relationship between FSD and adequate vegetable intake among children and is presented in the manuscript *'Which food security determinants predict adequate vegetable consumption among rural Western Australian children?'* This manuscript is published in *International Journal of Environmental Research and Public Health (2017)* (doi: 10.3390/ijerph14010040), in the special issue *'Environmental influences on maternal and child health'*.

1.5.10 Chapter 10 - General discussion

This final chapter outlines the key research findings and the policy, practice and research recommendations relating to each of this PhD's RQ. Strengths and limitations of this study and strategies implemented during the data collection and analysis phase to mitigate limitations are outlined. An outline of the expected research impact follows as a précis to a discussion of the overall novel contribution this study makes to the evidence base and concluding remarks, which completes the thesis. The following table (Table 1) depicts how each of the manuscripts included in this Thesis with Publication, and conference presentations delivered throughout the PhD, are linked to the RQ and thesis chapters:

Table 1: Publications included in this PhD thesis and conference presentations delivered, linked to this study's research questions.

RQ	Manuscripts included in thesis	Thesis chapter	Conference presentations delivered
RQ 1: What are the determinants of F&V consumption among regional and remote WA children?	1. **Godrich, S.L,** Davies, C.R., Darby, J., Devine, A. (2016). Which ecological determinants influence Australian children's fruit and vegetable consumption? *Health Promotion International*, 1-10. doi: 10.1093/heapro/daw063.	4	1. **Godrich, S.,** Davies, C., Darby, J., Lo, J., Devine, A. (2016, June). Stories behind the statistics: An ecological mixed-methods investigation into drivers of WA children's fruit and vegetable consumption. Paper accepted for oral presentation at the *23rd National Australian Health Promotion Association Conference*, Perth, Western Australia, Australia. 2. **Godrich, S**., Davies, C., Darby, J., Devine, A. (2016, June). Community informant strategies to increase fruit and vegetable consumption among regional and remote WA children. Paper accepted for oral presentation at the *23rd National Australian Health Promotion Association Conference*, Perth, Western Australia, Australia. 3. **Godrich, S.,** Davies, C., Darby, J., Devine, A. (2016, May). Investigating individual and interpersonal determinants of fruit and vegetable consumption among regional and remote WA children. Paper accepted for poster presentation at the *Dietitians Association of Australia 33rd National Conference,* Melbourne, Victoria, Australia. 4. **Godrich, S**., Darby, J., Davies, C., Devine, A. (2015, May). Key informant perceptions of factors that prevent or facilitate children's fruit and vegetable intake in regional and remote Western Australia. Paper accepted for oral presentation at the *13th National Rural Health Conference*, Darwin, Northern Territory, Australia. 5. **Godrich, S**., Darby, J., Davies, C., Devine, A. (2014, July). What are the barriers and enablers to fruit and vegetable consumption among children in regional and remote Western Australia? Paper accepted for oral presentation at the *Aboriginal Health Conference*, Perth, Western Australia, Australia.
RQ 2: What quantities, varieties and types of F&V do children living in regional and remote WA consume and how do these compare to the serves recommended by the ADG?	2. **Godrich, S.L**, Lo, J., Davies, C.R, Darby, J., Devine, A. (2017). Are regional and remote Western Australian children eating for good health? An investigation into fruit and vegetable consumption. *Health Promotion Journal of Australia*. doi: 10.1071/HE16090	5	Nil
RQ 3: What are the determinants of FS among regional and remote WA children?	3. **Godrich,** S.L, Davies, C.R., Darby, J., Devine, A. (2017). What are the determinants of food security among regional	6	6. **Godrich, S**., Davies, C., Darby, J., Lo, J., Devine, A. (2016, September). Using mixed-methods to create a picture of food security among Western Australian children. Paper accepted for poster presentation, *2nd World Nutrition Congress*, Cape Town, South Africa. 7. **Godrich, S.,** Lo, J., Davies, C., Darby, J., Devine, A. (2016, July). Which food security

	and remote Western Australian children? *Australian and New Zealand Journal of Public Health*. doi: 10.1111/1753-6405.12636			determinants are associated with remoteness in Western Australia? Paper accepted for oral presentation at the *2nd International Conference on Public Health*, Colombo, Sri Lanka.
RQ 4: What is the proportion of children in regional and remote WA that are FI?	4. **Godrich, S.L,** Lo, J., Davies, C.R, Darby, J., Devine, A. (2016). Prevalence and socio-demographic predictors of regional and remote Western Australian children's food insecurity. *Manuscript under review.*	7	Nil	
RQ 5: Are FSD related to F&V consumption and which determinant has the greatest influence on consumption, among children in regional and remote WA?	5. **Godrich, S.L,** Lo, J., Davies, C.R, Darby, J., Devine, A. (2016). Do food security determinants predict adequate fruit consumption among regional and remote Western Australian children? *Manuscript in preparation.* 6. **Godrich, S.L,** Lo, J., Davies, C.R, Darby, J., Devine, A. (2017). Which food security determinants predict adequate vegetable consumption among rural Western Australian children? *International Journal of Environmental Research and Public Health,* 14(40). doi: 10.3390/ijerph14010040	8 9	8. **Godrich, S.,** Lo, J., Davies, C., Darby, J., Devine, A. (2016, September). Are knowledge and preferences associated with adequate child fruit and vegetable consumption? Paper accepted for oral presentation, *Public Health Association of Australia 44th Annual Conference and 20th Chronic Diseases Network Conference*, Alice Springs, Northern Territory. 9. **Godrich, S.,** Davies, C., Darby, J., Lo, J., Devine, A. (2016, September). Top fruit and vegetable messages recalled in regional and remote Western Australia. Paper accepted for poster presentation, *Public Health Association of Australia 44th Annual Conference and 20th Chronic Diseases Network Conference*, Alice Springs, Northern Territory. 10. **Godrich, S.,** Lo, J., Davies, C., Darby, J., Devine, A. (2016, July). How do social and economic factors influence fruit and vegetable consumption amongst regional and remote Western Australian children? Paper accepted for oral presentation at the *International Conference on Public Health*, Colombo, Sri Lanka.	

1.6 Summary

Chapter 1: General introduction positioned this research within an academic context. It provided an outline of the research including the aim, RQ, study purpose and the thesis structure. The following chapter (Chapter 2: Background) will critically review the existing evidence around F&V consumption, FS, and the association between F&V and FS, such as to position this research within existing knowledge.

CHAPTER 2: BACKGROUND

2.0 Foreword

This chapter provides an overview of the three concepts explored in this Thesis with Publication. The first concept is F&V consumption among children. This section will include a definition and an overview of the health benefits provided by F&V, consequences of suboptimal F&V intake examined, dietary measurement techniques and the determinants of F&V consumption among children. The second concept, FS among children, includes a definition, overview of existing FSD explored in the literature and measurement techniques utilised nationally and internationally. The third concept, the relationship between FSD and F&V, will be examined through an overview of the current evidence base.

2.1 Concept 1: Fruit and vegetable consumption among children

2.1.1 Definition

Definitions of fruit relate to the part of the plant eaten (Oxford University Press, 2017a; World Cancer Research Fund/American Institute for Cancer Research, 2009), its sweet taste or method of consumption (World Health Organization, 2003c). Common examples of fruit include melons, apples, bananas and citrus fruits (National Health and Medical Research Council, 2015a). Similarly, vegetable definitions often relate to the part of the plant consumed (Oxford University Press, 2017b; World Cancer Research Fund/American Institute for Cancer Research, 2009) and the culinary uses, such as raw or cooked. Other perspectives relate to their nutritional value and health-promoting benefits (World Health Organization, 2003c). Examples of vegetables include non-starchy vegetables such as leafy vegetables (e.g. spinach), cruciferous (e.g. broccoli) and allium vegetables (e.g. garlic and onions) (National Health and Medical Research Council, 2015b).

2.1.2 Health benefits of fruit and vegetables

F&V provide numerous health benefits including dietary fibre, essential vitamins, minerals and powerful antioxidants, often termed ‘non-nutrients’ (National Health and Medical Research Council, 2013a). Consuming a variety of F&V ensures adequate intake of the nutrients found across types (National Health and Medical Research Council, 2013a). Adherence to a primarily plant based diet has been suggested to

contribute to weight regulation and reduce the risk of a number of chronic diseases (National Health and Medical Research Council, 2013a).

2.1.3 Health consequences of suboptimal intake

Short term consequences resulting from suboptimal F&V intake include reduced dietary diversity and nutrient density (Kendall, 1996; Wood, 2000). Given these nutrient-rich foods are often replaced with a high consumption of energy dense, nutrient poor foods (e.g. crisps or pastry foods), individuals are at increased risk of developing a range of adverse health and developmental problems. Such complications include nutrient deficiencies, mental health, cognitive development and social issues, obesity and preventable chronic diseases such as cancer, cardiovascular diseases and diabetes (Cook, 2008; Krebs-Smith et al., 2001; National Health and Medical Research Council, 2013a; Wood, 2000). NCD are continually being recognised as a significant contributor to the global burden of disease, the annual measure of the population health impact of a disease in relation to morbidity and mortality (World Health Organization, 2011).

2.1.4 Burden of disease

The World Health Organization reported that NCD were responsible for 68% of the total deaths worldwide (World Health Organization, 2014b), with deaths predicted to increase by 15% by the year 2020 (World Health Organization, 2011). The problem is not only isolated to higher income countries, with the developing world continuing to face population health issues (World Health Organization, 2011). In Australia, NCD such as cancers, coronary heart disease and Type 2 diabetes are at epidemic proportions and significantly contribute to our disease burden (Australian Institute of Health and Welfare, 2016a), with cancer (19%) and cardiovascular diseases (15%) making the highest contribution (Australian Institute of Health and Welfare, 2016b). Dietary risk factors contribute 12.1% of death and 11.3% of Years of Life Lost to Australia's disease burden (Australian Institute of Health and Welfare, 2016c). 'Diet low in fruit' and 'diet low in vegetables' contributes the highest proportions of 2.0% and 1.4% respectively to the overall effect (Australian Institute of Health and Welfare, 2016b).

Australians living in regional and remote locations experience higher levels of disease than their metropolitan counterparts (Australian Institute of Health and Welfare, 2016a). For example, disease prevalence of conditions such as diabetes, cancer and mental health conditions was higher in regional and remote areas, in comparison to major

cities. Further, the risk factors underpinning these diseases, such as overweight or obesity, were experienced by a higher proportion of regional and remote residents, in comparison to those living in major cities (Australian Institute of Health and Welfare, 2016a).

Given the accelerating rate of chronic diseases, effective action was suggested more than a decade ago to prevent adverse health outcomes in the future (World Health Organization, 2003a). Primary prevention, such as through food literacy education and mass media campaigns, has been proposed more recently as a 'best buy' option to reduce the global chronic disease epidemic (World Health Organization, 2011). If this action translates to successful behaviour change, it is estimated that 2.7 million lives would be saved annually from increased consumption of F&V (World Health Organization, n.d.-a). However, given regional and remote residents are at a disadvantage with respect to health service provision (Australian Institute of Health and Welfare, 2016a), and equitable availability, cost and quality of nutritious food options (Pollard, Landrigan, et al., 2014), a systematic approach is necessary. To do this, an understanding of health behaviour influencers across a range of levels is required.

2.1.5 Ecological Model of Health Behaviour

Interest in factors affecting health has progressed beyond individual factors, to social and environmental influences. Collectively, this comprehensive paradigm is known as an Ecological Model of Health Behaviour (Bronfenbrenner, 1981; McLeroy et al., 1988). This approach is based on the concept that there are multiple dimensions that influence health. Influences are considered at the *intrapersonal* level (i.e. knowledge); *interpersonal* level (i.e. social networks); *institutional* level (i.e. social institutions); *community* level (i.e. informal networks) and *public policy* level (i.e. national laws) (McLeroy et al., 1988; Stokols, 1994). This theory is particularly useful in understanding the determinants of F&V consumption. The theory can also underpin the development and implementation of effective strategies to increase consumption among target populations.

2.1.6 Determinants of fruit and vegetable consumption

While the use of theories can underpin and guide research design, as well as potential research translation and practice, a thorough understanding of the determinants of F&V consumption across various levels of influence is an essential component to ensure

research and contextual relevance. The following section briefly outlines the levels of influence of the Ecological Model of Health Behaviour in the context of F&V consumption.

At an intrapersonal or individual level, *taste preferences* have been linked to quality, with children hesitant to purchase healthy options, given the perceived risk of suboptimal quality (Heimendinger et al., 1995; Nicklas, 1997), e.g.: "S*ometimes you can get like bad fruit but you never get, like, bad chocolate"* (McKinley et al., 2005). Boyington et al (Boyington et al., 2009) identified food preferences as both a barrier and enabler for F&V consumption; however, preferences for specific fruits were facilitators. *Attitude towards F&V* has also been reported as a barrier to consumption, from child focus groups conducted by McKinley et al (2005) that suggested children did not perceive healthy foods as filling, and thought they would get better value for money if they purchased less healthy options, e.g.: *"Yeah, 'cos soup wouldn't fill you up as much as chips"* (McKinley et al., 2005). Students have also reported that healthy foods require both increased *preparation and consumption time* (Kubik, 2005; McKinley et al., 2005).

Interpersonal level influences relating to lower *financial resources* have also resulted in low income groups consuming fewer F&V, in comparison to their higher socioeconomic counterparts (Dong et al., 2009; Ministry of Agriculture, 1999). Respondents have reported the prohibitive cost of F&V, which were only purchased as a luxury item after the other 'basics' (Yeh et al., 2008). Rassmussen et al (Rasmussen et al., 2006) also found a positive association between low income and low F&V consumption in seven papers they reviewed. In WA, the 2010 Food Access and Cost Survey determined that people receiving welfare payments were required to spend more (50%) of their income on food, in comparison to non-welfare recipients who only spent 16% of their income on food (Landrigan, 2010). Another study investigated F&V intake in the home environment and found *provision of F&V* was not the only determinant of consumption; availability in a ready-to-eat form, and therefore *convenience,* was an important determinant of consumption (Wyse et al., 2011). *Parental nutrition knowledge and cooking skills* are essential factors to consider in the investigation of barriers and enablers of children's F&V consumption, such that specific skills in planning, decision-making, purchasing, preparing and understanding the impact of food on health are required to meet dietary needs (Vidgen, 2014). Adults have been suggested to lack

important food purchasing and preparation skills, which reduced their children's consumption of F&V (Goh et al., 2009; Niklas et al., 2013). This has previously been suggested to have resulted from a lack of understanding of how to transfer nutrition knowledge and skills to children, especially in relation to healthy food choices (Brimblecombe, 2015). However, WA evidence reinforced a spectrum of nutrition knowledge existed, with correct responses to a range of nutrition items varying from 17% -91% (Pettigrew, 2015). Parental attitude towards healthy eating, nutrition knowledge and 'perceived behavioural control' are important determinants of a household diet. Household diet satisfaction has also been linked with meal planning, using quick preparation methods and incorporating vegetables into meals (Reid et al., 2009).

At the institutional level, *school provision of fruit and vegetables* can increase a child's interest in and intake of F&V, particularly when provided fresh (Aarestrup et al., 2014). School canteens are a primary food source within the school environment, with students citing a lack of healthy options as a considerable barrier to healthy eating (McKinley et al., 2005). The provision of *school nutrition education* around the health-promoting qualities of F&V also has the potential to further increase intake (Gripshover et al., 2013), particularly when paired with caregiver education (Struempler et al., 2014; Williams et al., 2014). *Health service provision* is another issue that is emphasised in WA. Local evidence identified clear gaps in health service provision across regional and remote areas; potential is limited by the small public health nutrition workforce, in addition to a lack of understanding of the role of public health nutritionists and how they could assist with overcoming food access issues (Pollard, Nyaradi, et al., 2014).

Community level influencers include *food availability*, with access to nutrient-poor options deterring consumption of their nutritious counterparts among youth (Brimblecombe, 2015), parents and key stakeholders alike (Goh et al., 2009; Monge-Rojas, 2005). *Price* of F&V is often reported as an important determinant of healthy eating for disadvantaged groups and can lead to a diet inconsistent with dietary recommendations (Kamphuis, 2006; Turrell et al., 2002) due to the perceived high cost of perishable food (MacLellan et al., 2004), especially among population groups with limited disposable incomes (Greaney et al., 2009). This is particularly an issue for people living in remote WA locations (Landrigan, 2010), due to the lengthy food transport required. Research conducted by Brimblecombe et al (2014) supports this

perception, such that fruit and vegetables were purchased less frequently than other nutrient-poor foods, despite participants indicating their preference for these foods (Brimblecombe, 2015). Food *quality* is often linked with nutrition (Rychetnik et al., 2003) and poor quality poses a barrier to consumption (Aarestrup et al., 2014). Further impacting food quality, especially in WA, is the distance required to transport fresh produce from the metropolitan area to regional and remote locations (Landrigan, 2010).

Public policy level influencers include the implementation of *policy*, which can ensure change is 'led from the top'. Social marketing campaigns that focus on self-efficacy among household gatekeepers are important considerations. Future policies could include promotion of healthy foods and a reduction of 'junk food' marketing, such as removal of these items at point-of-purchase (i.e. supermarket checkouts) (Reid et al., 2009) where impulse purchases may occur. Policy implementation can also incentivise healthy food purchasing through altering vending machine contents, mandating choices via school canteen guidelines and food outlet healthy eating policies (Ganann et al., 2014).

Pricing policies in food outlets have been shown to be effective strategies to increase purchasing of healthy food products such as fruit and vegetables (Ni Mhurchu, 2010). Both experts and consumers in a study conducted in the Netherlands concurred that price reductions of healthy food could be a potentially effective strategy to increase purchasing of healthy foods, however suggested discounts should be paired with information and promotional strategies (Waterlander, 2010). Sustained increases in fruit and vegetable purchasing as a result of a 12.5% price discount were seen six-months post-intervention in New Zealand (Ni Mhurchu, 2010) and a discount of 20% seen over a three month period in Australia (Le, 2016). While in remote Australia, a 20% price discount alone on fruit and vegetables resulted in a 19.8% increase in fruit and vegetable purchasing; an additional element of consumer education resulted in a further 7.6% increase in vegetable purchasing, relative to total food purchases (Brimblecombe, 2017).

In WA, policy actions have included an investment in regional and remote areas through the Royalties for Regions program, which included, among other strategies, expansion of school breakfast programs across the state. However, there is currently no evidence relating to the impact of other policy initiatives such as introduced food price subsidies.

In order to more thoroughly understand the impact of the collective influences on behaviour, it is important to consider the capacity of the individual (the agent) as well as the contexts in which they live (i.e. social, economic 'structures') (Backholer et al., 2014). Backholer et al described a continuum, whereby agent and structure lie at opposite ends (Backholer et al., 2014). Therefore, the development of strategies to increase F&V consumption should include a collective consideration of the determinants of F&V consumption described above.

2.1.7 Measurement of fruit and vegetable consumption

The tools utilised to measure dietary intake are guided by the purpose of the collection, the characteristics of the study population and the time and resources available to conduct the assessment (Agudo, 2005). The following section provides an overview of common methods of dietary measurement among children.

2.1.7.1 Food diaries

Food diaries (FD) are considered the 'gold standard' of measurement tools (Australasian Child and Adolescent Obesity Research Network, 2010b) and involve the participant recording food consumed at time of consumption. FD are usually employed for between one and seven days, with the participant recording time of day, type and amount of food consumed. Amounts consumed can either be reported using measurement tools provided (such as cups, spoons) or by estimation using pictures or scales (Australasian Child and Adolescent Obesity Research Network, 2010b). Strengths of FD include the ability to record precise portion sizes, the lack of reliance on memory, and open-ended nature. They have been shown to be suitable for reasonably accurate completion by children from nine years of age (Australasian Child and Adolescent Obesity Research Network, 2010b; Watson et al., n.d.). This method is suitable for estimating group mean intake, and a single record is sufficient (Watson et al., n.d.). The limitations include high participant burden, the requirement of reasonable literacy levels among participants (Rockett, 1997), underreporting (Australian Bureau of Statistics, 2012b) and potentially biasing the food selected, given the need to record it (Thompson et al., 2013). Due to participant fatigue, the quality of dietary recording also decreases over time (Australasian Child and Adolescent Obesity Research Network, 2010b).

2.1.7.2 Diet recalls

Twenty-four-hour recalls are conducted in a structured interview setting where the participant is required to report the food and drinks consumed in the previous one day period to a trained interviewer (Australasian Child and Adolescent Obesity Research Network, 2010a). This method is one of the most frequently used methods to measure F&V consumption (Agudo, 2005). Advantages of this dietary measurement method include that group F&V intake can be measured (Agudo, 2005), it has a low participant burden, immediacy of the reporting period, and mitigation of literacy issues (Australasian Child and Adolescent Obesity Research Network, 2010a; Thompson et al., 2013). Limitations include underreporting, often due to demographic factors such as ethnicity and education levels (Thompson et al., 2013), and reliance on participant memory and perception. Further, this method is not a reliable measure for usual intake of F&V consumption, given the day-to-day variation in intake (Agudo, 2005; Australasian Child and Adolescent Obesity Research Network, 2010a).

2.1.7.3 Food frequency questionnaires

Food frequency questionnaires (FFQ) involve participants reporting frequency of dietary consumption via a list of food items, usually over a 12-month period. In addition to dietary recalls, FFQ are also commonly used techniques to measure F&V consumption (Agudo, 2005). Advantages of this method include that the tool is often machine readable, and self-administration among adults is feasible, thereby reducing administration cost (Rockett, 1997). Further, FFQ's are appropriate for child completion, particularly those aged 10-12 years of age (Australasian Child and Adolescent Obesity Research Network, 2010c). Disadvantages include that information such as amounts and cooking methods are not measured, completion can be time-consuming due to a lengthy tool (Thompson et al., 2013) and the method is inappropriate for the measurement of usual eating patterns (Australasian Child and Adolescent Obesity Research Network, 2010c).

2.1.7.4 Dietary surveys

Dietary surveys include questions relating to broad food-related behaviours and some information about dietary intake. They are suitable for delivery in a range of settings such as in the home environment and can be completed by children, especially from ten years of age. Questionnaires are useful when measuring dietary intake in large

populations, have low participant burden and are suitable for self-administration (Australasian Child and Adolescent Obesity Research Network, 2010d).

The dietary assessment method is imperative to the research design, in order to adequately ascertain F&V consumption from the target group. The research method must also ensure valid and reliable measures are employed and research processes are rigorous, to demonstrate differences within the target group.

2.1.8 Validity and reliability

2.1.8.1 Quantitative research

Validity in quantitative research refers to the accuracy of the measurement and that the intended measurement is being undertaken (Golafshani, 2003). In other words, validity is the capacity of the research *"to measure that which it was intended to measure; the truthfulness of the research."* (Joppe, n.d.). A number of possible 'threats' to validity have been outlined, such as the procedures undertaken (i.e. the instrument changes between pre-test and post-test), characteristics of the testing (i.e. increased familiarity among participants of the instrument) or that the characteristics of the setting within which the research is conducted results in findings that cannot be generalised across other settings (Creswell, 2014). Reliability in quantitative research relates to whether the research can be replicated, with elements including whether the tool is consistent, stable and uses similar measurements within the time it is used. It should also be repeatable over time (Golafshani, 2003; Joppe, n.d.).

2.1.8.2 Qualitative research

Given that qualitative research attempts to highlight a range of perspectives and provide an in-depth understanding of phenomenon, terms such as 'trustworthiness', 'transferability' and 'consistency' are often used to assess the validity and reliability of this type of research (Creswell, 2014). Creswell also discusses the use of triangulation in qualitative research, such that results are compared across methods, in addition to incorporating a variety of perspectives within themes. To further increase confidence in methods undertaken, a detailed documentation of research procedures conducted during data collection and analysis is suggested, as is checking transcripts for accuracy, and the maintenance of consistent definitions of criterion, which is warranted when coding within a theme. Further, it is recommended that a number of team members check coding of results to ensure this stage is conducted appropriately (Creswell, 2014).

2.1.9 International and national recommendations for fruit and vegetable consumption

F&V recommendations differ substantially between countries internationally. Table 2 provides an overview of key F&V recommendations in selected developed countries. Across countries, differences in recommended amounts exist. Australian recommendations exceed those recommended by the World Health Organization. Differences are also seen for grouping of recommendations for both F&V collectively (i.e. World Health Organization), as opposed to separately (Australia).

Table 2: Fruit and vegetable recommendations, internationally and in Australia

Recommendations per country			
	Globally*	**USA****	**Australia*****
Year published	2003-2016	2015	2013
Child gender	Both	Both	Both
Child age	All	9-13 years	9-13 years
Fruit recommendation per day	400g of F&V each day	1.5 cups	2 serves (300 grams)
Vegetable recommendation per day		2.5 cups (male) 2 cups (female)	5 serves (375 grams) for children 9-11 years and girls 12-13 years 5.5 serves (412.5 grams) for boys 12-13 years

*(World Health Organization, 2016); **(U.S Department of Health and Human Services and the U.S Department of Agriculture, 2015; United States Department of Agriculture, 2016); ***(National Health and Medical Research Council, 2013b).

2.1.10 Adherence to dietary guidelines among children

Globally, a relatively low proportion of the population consumes fruit and vegetables consistent with dietary guidance (Australian Bureau of Statistics, 2015b; U.S Department of Health and Human Services and the U.S Department of Agriculture, 2015; Yngve et al., 2005). Table 3 below presents proportions of children in selected countries that are meeting respective dietary guidelines for F&V.

Table 3: Fruit and vegetable dietary guideline adherence by population, internationally and in Australia

Dietary guideline adherence by country				
	Europe* [+]	**USA****	**Australia*****	**WA******
Year guidelines published	2003-2016	2015	2013	2014
Child age	11 years	1 year and above	9-13 years	9-15 years
Percentage of the population meeting country/world dietary guidelines for Fruit	17.6%	25.0%	68.9%	64.0%
Percentage of the population meeting dietary guidelines for vegetables		13.0%	2.6%	8.8%

*(Yngve et al., 2005); [+] including the following countries: Austria, Belgium, Denmark, Iceland, Netherlands, Norway, Portugal, Spain, Sweden; **(U.S Department of Health and Human Services and the U.S Department of Agriculture, 2015)' ***(Australian Bureau of Statistics, 2015b, 2016b); ****(Tomlin et al., 2014).

While many countries around the world have recommended that people consume a minimum of 400 grams per day, the recommendations do vary. This is due to the variances in populations, cultural preferences, and availability of F&V across countries. Similarly, measurement of F&V consumption differs across countries, making comparisons difficult (Agudo, 2005). The differences observed above may, in part, be due to different measurement methodologies and different recommendations for dietary intake (Agudo, 2005). A possible explanation for greater compliance of fruit guidelines rather than vegetable guidelines could be due to the contribution of juice and dried fruit to fruit serves (Australian Bureau of Statistics, 2016b).

2.1.11. Current evidence gaps regarding fruit and vegetable consumption

Currently, there are large gaps in the evidence base regarding children's F&V intake. It is clear that, both nationally and across WA, children consume F&V in suboptimal amounts. Consumption is driven by a complex set of determinants such as location; regional and remote children are at a disadvantage regarding access to healthy food options. However, large gaps still remain and there is a paucity of data. In particular, this relates to: (1) the determinants of F&V consumption among WA children across various levels of influence; and (2) how remoteness impacts F&V consumption among

WA children. In order to improve the diet quality of children living in these areas, further research is warranted.

2.2 Concept 2: Food security and food insecurity

2.2.1 Definition

The World Food Summit of 1996 agreed on a definition of FS, that is:

> *"FS exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life." (Food and Agriculture Organization, 1996).*

This definition was reaffirmed in 2009, with the addition of the dimensions of 'food availability', 'food access' 'food utilisation'; and stability of the first three dimensions. In addition, an emphasis on the importance of nutrition was included (Ecker et al., 2012; Rychetnik et al., 2003; United Nations Food and Agriculture Organisation, 1998; World Health Organization, 2012):

> *"FS exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of FS are availability, access, utilisation and stability. The nutritional dimension is integral to the concept of food security" (Food and Agriculture Organization of the United Nations, 2009).*

This term acknowledges the link between FS and food systems, such that for a person to be food secure, culturally and socially appropriate food must be physically and economically available. From a **national** perspective, physical availability of food refers to the food supply chain (Innes-Hughes et al., 2010). In Australia, increasing globalisation of food production and uncertainty of international export markets is influencing our food supply (Spencer, 2012). This has an impact for local producers who are required to compete with cheaper, imported products. The increased cost of agriculture and low yields, may in turn impact food prices, which impacts the economic accessibility of food for people (Stoeckel, 2008). There is also uncertainty regarding climate change and water availability for producers, which will particularly impact farmers of fresh produce (Spencer, 2012). Further, food availability at a **community** level may be impacted and disrupted by long transportation distances (Pollard et al., 2015). Food distribution should ensure that food available to purchase in food outlets is

nutritionally adequate, culturally appropriate and secure (Booth et al., 2001). However, guaranteeing a safe, affordable and nutritious supply of food is available in WA is particularly challenging, given the geographically expansive state (Pollard et al., 2015).

Household or individual social factors that impact FS include determinants such as unemployment, single parenthood, living in locations deemed high level of social disadvantage (Foley et al., 2009). People should also be free from anxiety about where they will be able to source food from (Booth et al., 2001). Further, people must have the nutrition knowledge, cooking skills, food preparation and storage facilities to utilise it in a way that ensures food safety (Innes-Hughes et al., 2010).

However, there are certain subsets of the population that cannot achieve FS (Foley et al., 2009) according to the above definition. Conversely, FI occurs when food access is restricted or availability of nutritionally adequate and acceptable foods is reduced or uncertain (Life Science Research Office, 1990). Further, this includes the notion of an unsustainable food source, whereby people resort to food relief such as food banks or charities and there is an additional element of stress and anxiety relating to obtaining food (Hamelin, 2002). FI occurs across a continuum, ranging from FI with diminished food quality (without hunger) to FI with extreme hunger. In the latter case, an individual often undertakes behaviour such as omitting meals as a result of an inadequate quantity of food (Burns, 2004; Connell et al., 2005).

2.2.2 Determinants of food security

As outlined above, there are four pillars of FS; food availability, food access, food utilisation, and stability of these dimensions. These dimensions comprise a number of specific FS determinants. This section will explore the existing literature relating to food security determinants that comprise each of the FS pillars.

2.2.2.1 Food availability determinants

Within the food availability dimension, key FSD include *location of food outlets* (Morland, 2002). Specifically, locations of lower socio-economic status have been found to have lower supermarket density (Ball et al., 2009). Limited *food availability,* particularly of food products in line with ADG recommendations (Cheadle, 1993; Le et al., 2015; National Health and Medical Research Council, 2013a) has been found in remote locations (Harrison et al., 2007; Harrison, 2007; Pollard, Nyaradi, et al., 2014). The availability of nutrient-dense options such as fresh fruit and vegetables is a

particular challenge for regional and remote WA, given its geographically expansive nature and inefficient food supply chains (Pollard, Landrigan, et al., 2014). Similarly, high food *price* is an issue people living in remote areas often face, being at a disadvantage when it comes to access to affordable and quality healthy food (Landrigan, 2010; Le et al., 2015; Pollard, Nyaradi, et al., 2014). In WA, the price of a healthy food basket was 23.5% higher across areas classified as 'very remote', in comparison to metropolitan Perth (Pollard, Landrigan, et al., 2014). This increased pricing can lead to dietary patterns inconsistent with national dietary recommendations (Kamphuis, 2006; Turrell et al., 2002), due to the prohibitive cost of perishable food (Giskes et al., 2002). Suboptimal *quality* is also strongly linked with nutrition (Rychetnik et al., 2003) which can result in residents shopping in towns other than where they live, given the inferior quality, low variety and high cost of food (Hendrickson et al., 2006; Le et al., 2015). Quality was shown to decrease with increasing remoteness in WA, with the exception of locations that harnessed locally produced fruit (Pollard, Landrigan, et al., 2014). A healthy diet is defined as one that contains a *variety* of food (Food and Agriculture Organization of the United Nations, 2016), both within and across each of the five food groups (Better Health Channel., 2014). Consumption of a dietary pattern that includes a range of foods increases the likelihood that nutrient needs will be met (National Health and Medical Research Council, 2013a), benefiting health (Kakinami et al., 2014). People experiencing FI, and those from poorer households, have been shown to consume fewer nutrients due to a limited range of F&V, in comparison to their FS counterparts (Giskes et al., 2002; Mello et al., 2010; Turrell et al., 2002). Stability of availability, price, quality and variety, particularly in regional and remote areas, is impacted by environmental events such as adverse weather causing flooding and bushfires (Gallegos et al., 2017). In Australia, convenience foods have better *promotion* than healthy foods, with the exposure of children to junk food advertising being one of the highest worldwide (Kelly et al., 2010). The marketing of these foods, in conjunction with their widespread availability increases the risk for adoption of unfavourable lifelong eating habits, contributing to obesity (Committee on Food Marketing and the Diets of Children and Youth, 2006).

2.2.2.2 Food access determinants

A key food access FSD includes household *financial resources*. The WA Food Access and Cost Survey found that, on average, welfare recipients would need to spend almost

50% of their disposable income on food, compared with 16% of those on an average income (Landrigan, 2010). Parents have also reported purchasing less nutritious options due to budget constraints, or purchasing less desirable types of F&V (i.e. canned instead of fresh) due to cost (Hoisington et al., 2002). Another issue is centralisation of towns outside of metropolitan areas, which adds *distance and transport* to shops as significant factors to food access. Participants have reported living at an inconvenient distance away from the main shopping precincts, which increased purchasing difficulty (Drewnowski et al., 2004; Hendrickson et al., 2006; Le et al., 2015; Nolan et al., 2006). In WA, there are more food outlets located in areas that have higher accessibility via main roads. This poses challenges for residents living in remote areas who have limited purchasing options (Pollard, Landrigan, et al., 2014). Previous research has also indicated that transportation issues were a barrier to accessing formal *social support* services, such as emergency food relief, when respondents ran out of food (Le et al., 2015). Other formal social support options include government-facilitated food assistance programs, such as those delivered through schools (i.e. School breakfast programs, Supplemental Nutrition Assistance Program, National School Lunch Program) (Nord, 2009). Informal social support commonly associated with running out of food includes children being asked to eat food with extended family, friends or neighbours, or borrowing food and money (Connell et al., 2005). These informal measures were believed to fill the gap left by non-existent formal options in remote WA, with community members assisting those most vulnerable to food insecurity such as children and the elderly (Pollard, Nyaradi, et al., 2014). Another concern highlighted by previous literature includes *mobility*, with respect to food access issues (Nolan et al., 2006). The presence of young children made physical travel to food outlets difficult and disabilities often led to a reliance on convenience outlets, rather than larger outlets with a superior range, quality and lower prices (Le et al., 2015).

2.2.2.3 Food utilisation determinants

Possession of *knowledge and skills* to make informed food purchasing and preparation decisions (Australian Institute of Health and Welfare and Commonwealth Department of Health and Family Services, 1997; Hoisington et al., 2002) and balance a household budget are important components of FS (Gallegos et al., 2017). Those with poor nutrition knowledge or food preparation skills may waste food unnecessarily or consume meals of lower nutrient density (Browne et al., 2009; Burns, 2004). Further, it

has been suggested that disadvantaged socio-economic groups have poorer nutrition knowledge and cooking skills, preparing meals that are less complex than high-income parents (Grutzmacher et al., 2011). *Food preferences* are also closely linked to consumption, with FI children reporting that they had to consume foods they disliked, as they were often the only foods provided (Connell et al., 2005). Parents were concerned that their children would dislike the food provided (Hoisington et al., 2002). *Food preparation and storage facilities* are critical household resources needed to consume a healthy diet (Le et al., 2015), and have been reported to be inefficient in some areas of Australia (Bailie, 2001))(Australian Institute of Health and Welfare, 2008a). *Time* has also been reported as a barrier to obtaining money for food, and subsequently, purchasing food; participants have reported the demands of work, study and household food preparation are difficult to balance (Hoisington et al., 2002). Low-income parents were more likely to be concerned with convenience when preparing meals (Grutzmacher et al., 2011), while the majority of rural residents in one study reported shopping for food multiple times per week or weekly, with food storage implications for those shopping less frequently. Further, almost half of these participants reported they were prepared to invest time in travelling to another town in order to purchase foods unavailable in their town (Le et al., 2015).

Figure 2 provides a graphical presentation of the determinants described above.

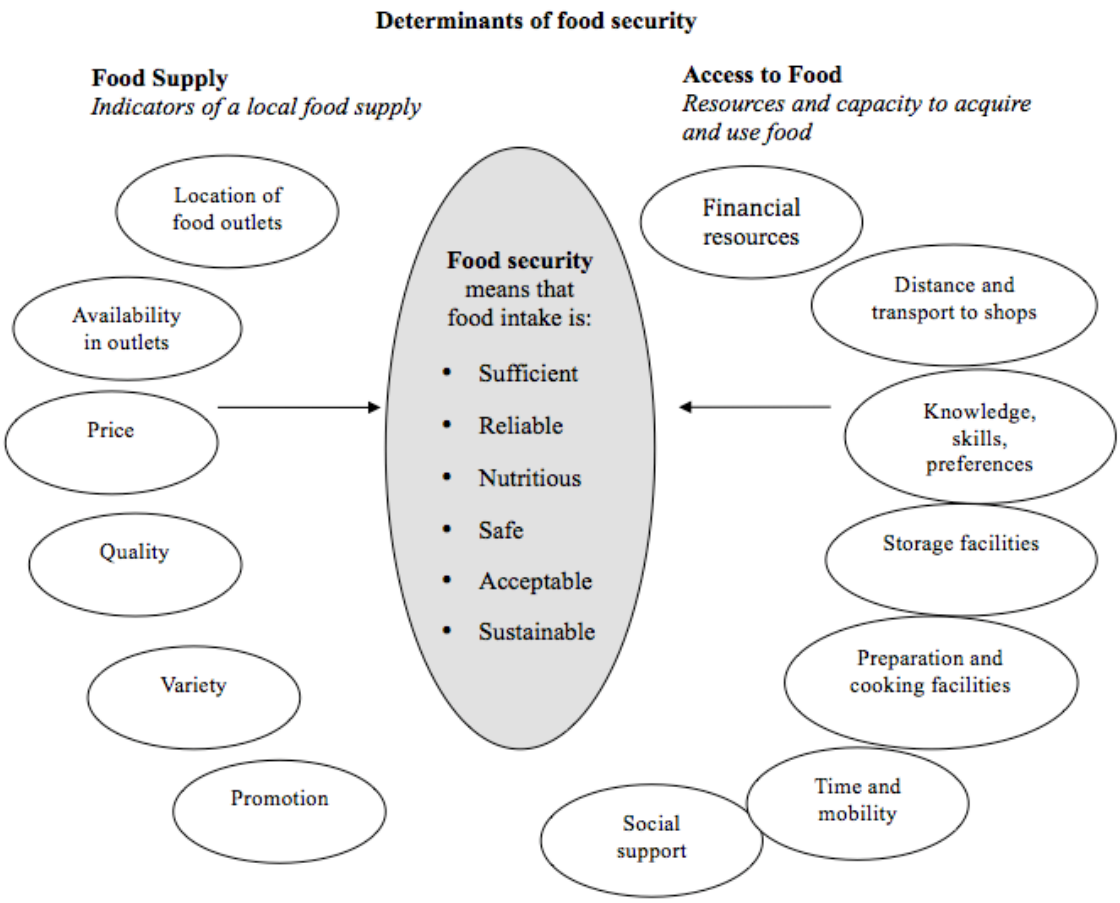


Figure 2: Determinants of Food Security framework. Reproduced from Rychetnik et al. (2003) Food Security Options Paper, NSW Centre for Public Health Nutrition.

The model developed by Rychetnik et al (Figure 2) was developed as a result of an international and national literature review relating to food security, to identify key conceptual frameworks and food security definitions. It was primarily based on a model developed by McComb, Webb and Marks (McComb, 2000). In addition, a number of consultations with nutrition experts informed the document entitled 'Food Security options paper: A planning framework and menu of options for policy and practice interventions' (Rychetnik et al., 2003).

2.2.3. Health consequences of food insecurity

There are numerous poor health outcomes relating to FI, including mental health conditions such as anxiety, depression and lethargy (Vic Health, 2005; Vozoris et al., 2003), frequent illness leading to increased hospitalisation, behavioural issues, a lower scholastic achievement in children, and dietary changes resulting in nutrient deficiencies (Nord, 2007). Adults may try to avoid hunger by cutting the size of meals, skipping meals and going without food. However, when food is extremely limited, the means to

avoid hunger are ineffective and cause severe personal hunger and hunger that effects the family and children (Burns, 2004). There is, however, a FI-obesity paradox, whereby incidence of obesity has been found to be 20-40% higher for FI females (Burns, 2004), placing individuals at increased risk of various chronic diseases, many of which have been classified as National Health Priority Areas (NHPA's) given the significant burden of disease they contribute (Australian Institute of Health and Welfare, 2016b).

2.2.4 Measurement of food insecurity

2.2.4.1 International measurement of food insecurity

There are inconsistencies between measurements of FI globally. Tools vary from a single question in self-completed surveys to multi-item questionnaires delivered via trained interviewers. Radimer (Radimer, 2002; United States Department of Agriculture, 2008) in association with Cornell University, developed the 18-item United States of America (USA) household Food Security Survey Module (FSSM), which incorporates anxiety about running out of food, personal perceptions around food reduction and reduced food intake. A six item short form includes specific questions sourced from the original 18-item version, and can be used where time restraints exist (Blumberg S.J. et al., 1999). The short form has demonstrated high sensitivity and specificity with minimal bias (Blumberg S.J. et al., 1999). Connell et al (Connell et al., 2004) adapted the FSSM and incorporated the child-related items from the 18-item FSSM. The child-form of the FSSM, the Child Food Security Survey Module (CFSSM), comprises nine-items, each of which has response options of 'a lot', 'sometimes' and 'never'. Each response of 'a lot' or 'sometimes' is allocated a score of one, with the sum of the nine responses determining the raw score. A raw score of zero is categorised as 'High FS', raw score of one defined as 'Marginal FS', two-five categorised as 'Low FS' and respondents with a score of six-nine are classified as having 'Very low FS' (Connell et al., 2004). The CFSSM has been validated by the USA Department of Agriculture and is considered an excellent indicator of FI experienced by children (Nord, 2007). It has been recommended that this instrument be administered with caution to children younger than 12 years of age, given validation tests have resulted in more consistent results among older children (Connell et al., 2004). However, validation tests were with a small sample and children as young as six years of age have been suggested to adequately report their experiences of FI (Herjanic et al., 1975; Nalty et al., 2013).

Children's descriptions of FI have also strongly resembled those of adults' in another study (Connell et al., 2005).

2.2.4.2 National measurement of food insecurity

In Australia, one question has typically been used to measure *household FI* in national surveys of adults 18 years and above, including 1995 National Nutrition Survey, Australian Bureau of Statistics Population Health Measure and 2001 National Health Survey:

> *"In the last 12 months, were there any times that you ran out of food and couldn't afford to buy more?"* (McLennan, 1995).

The most recent Australian Health Survey (2011-2012) used two questions to explore two limited aspects of FI; the above question, in addition to enquiring about the resulting consequences of not having enough money to buy more food (Australian Bureau of Statistics, 2013d). Smaller scale studies focussing on specific geographical locations have used questions of a similar nature relating to food depletion and reduced intake (Temple, 2008) or used more comprehensive USA tools (Ramsey et al., 2011) within limited samples.

Despite access to food being recognised around the world as a fundamental human right (World Health Organization, 2014a), FI has been slow in its political prioritisation in Australia, given its consideration as a problem of the 'developing countries' (Foley et al., 2009).

2.2.5 Estimated prevalence of child food insecurity

Table 4 outlines the estimated international and national prevalence of FI among children.

Table 4: Estimated prevalence of child food insecurity, internationally and within Australia

Country	Reference	Year	Sample population	Instrument	Prevalence
United Kingdom (UK)	(Gordon et al., 2013)	2013	Adults	Poverty and Social Exclusion in the U.K. Survey (Dermott et al., 2012)	4.0% of children not fed 'acceptable diets'
USA	(United States Department of Agriculture Economic Research Service, 2016)	2015	Adults	FS Supplement To the Current Population Survey (Coleman-Jensen et al., 2016)	7.8% of households with children <18 years old
	(Nalty et al., 2013)	2013	Children and Adults	CFSSM (Connell et al., 2004) 18-item Household FSSM (Bickel et al., 2000)	64.0% child FI 56.0% adult-reported child FI
Australia	(Ramsey et al., 2011)	2011	Adults	18-item Household FSSM (Bickel et al., 2000)	34.0% of households with children
	(Nolan et al., 2006)	2006	Adults	18-item Household FSSM (Bickel et al., 2000)	21.9% in New South Wales households
	(Australian Bureau of Statistics, 2013c)	2011-2012	Adults	Single item question (Australian Bureau of Statistics, 2013c)	4.0% of households
	(Australian Bureau of Statistics, 2015a)	2011-2012	Adults	Single item question (Australian Bureau of Statistics, 2015a)	4.8% of WA households

2.2.6 Current evidence gaps regarding food insecurity among children

Given the single-item question most frequently used in Australia only measures some aspects of FI, it has been suggested as a measurement of *risk* rather than actual prevalence of FI (Nolan et al., 2006; Ramsey et al., 2011). The true magnitude of the problem is likely to be underestimated in Australia, given previous surveys neglected to assess levels of hunger and did not measure the extent, nature and distribution of the issue. FI is much more complex than one domain alone (Nolan et al., 2006; Ramsey et al., 2011). Further, no Australian research has measured FI among children from a child's perspective; despite the fact an accurate assessment would elucidate potential effects of the issue on children and adolescent's future health and wellbeing (Connell 2005), in addition to the key FSD that impact children's food intake and strategies for change. The full scale and nature of FI among Australian children is unlikely to be revealed unless (i) contributing factors are included in assessments; and (ii) targeted studies are conducted among hard-to-reach groups (Harrison et al., 2007). Hence, an adequate assessment of the extent and distribution of child FI in Australia is necessary and could be utilised as key evidence for advocates working to change the currently meagre Australian food and nutrition security policy actions.

2.3 Concept 3: The relationship between food security determinants and fruit and vegetable intake

2.3.1 Existing literature

A small number of studies have investigated whether an association between FS and F&V intake exists, mostly focusing on FS *status* rather than the FSD. The existing evidence base is inconsistent regarding whether any associations exist between FS and F&V consumption. A recent study conducted by Amaro (2015) involved surveying a sample of 143 participants at farmers' markets in the USA. The authors hypothesised that lower household FS status would result in lower F&V consumption among their children aged 5-10 years of age. The results demonstrated that household FI was neither related to fruit consumption ($p = 0.71$) nor vegetable consumption ($p = 0.71$) (Amaro, 2015). Another recent study found no association between child FS status and F&V consumption among 5,136 children aged 2-15 years (Rossen et al., 2015). However, an association was found between household FI and consumption of fruit juice ($p < 0.05$); whereby FS children drank fewer cups of juice than FI counterparts. A systematic review of 16 USA articles resulted in either limited or inconsistent findings regarding whether FI adversely affected children's vegetable intake (Hanson et al., 2014). However, some studies indicated an association with fruit intake. One of the studies included in Hanson's review found an association with particular aspects of F&V consumption; a significantly higher mean intake of fresh and canned fruit ($p = 0.007$) and vegetable juice ($p = 0.029$) was found among FS children (Dave et al., 2009). Another USA study (Grutzmacher et al., 2011) used matched parent-child surveys ($n = 92$) to determine whether a relationship existed between household FS and children's F&V consumption. Only fruit consumption was associated with FI; children living in households categorised as Low FS consumed more fruit than FS households ($p < 0.01$).

It has been suggested that the inconsistency in findings within existing literature are due to the various criteria to establish level of FS with which to compare, differing sampling methods, unaccounted confounding variables (Rossen et al., 2015) and variations in diet quality measurement (such as using parent proxy reports and the dietary assessment technique itself used). Further, a publication bias against studies reporting no association between FS and F&V intake has also been suggested (Hanson et al., 2014).

2.3.2 Current evidence gaps regarding the association between food security determinants and fruit and vegetable intake

Literature is currently inconsistent regarding FS and F&V, especially among children. Further research is warranted, particularly of the underlying FSD, to determine whether there is any relationship between FS and F&V consumption, especially in regional and remote areas of Australia.

2.4 Current Australian political context of nutrition and food security

2.4.1 National policy context

Australia currently lacks an overarching national food and nutrition security policy, despite diet being the leading risk factor for burden of disease (Australian Institute of Health and Welfare, 2016a; Institute for Health Metrics and Evaluation, 2014). In addition, over two thirds of adults (63%) and over one quarter of children (25%) are currently classified as overweight or obese (Australian Bureau of Statistics, 2013b). Numerous federal and state government reports cite the importance of access to and use of nutritious food among Australians (Commonwealth of Australia, 2004; Council of Australian Governments, 2009; Prime Minister's Science, 2010; South Metropolitan Population Health Unit, 2014; Tasmanian Food Security Council, 2012) and a comprehensive scoping study complete with recommendations to guide the development of a national nutrition policy has been completed (School of Public Health and Social Work and School of Exercise and Nutrition Sciences, 2013). Though, to date, limited action has occurred.

However, examples of the national policies or political leadership currently in place relating to food and nutrition security include:

- *The ADG* – the ADG provide the Australian population with guidance relating to the serves of food for optimal health and wellbeing, and are based on comprehensive scientific evidence. The intention is for health service providers to use the ADG in their education of client groups, which is supported through an Educator Guide; (National Health and Medical Research Council, 2013a);
- *Goods and Services Tax* (GST) – The GST is a 10% taxation on most goods and services in Australia, with the exemption of products such as fresh F&V (Australian Taxation Office, 2016);

- *Australian and New Zealand Food Regulatory System* – This collection of policy makers, the standard-setting body (Food Standards Australia and New Zealand), and the implementation and enforcement bodies contribute to public health protection, safety, information and regulation relating to the Australian food supply (Commonwealth of Australia, 2013). This includes the voluntary Health Star Rating food labelling scheme (Commonwealth of Australia, 2014);
- *National Quality Framework* (NQF) – The NQF outlines the requirements of day care, preschools and out-of-school-hours care, including the provision of nutritious food. The NQF operates under the Education and Care Services National Law and the Education and Care Services National Regulations (Australian Children's Education and Care Quality Authority, 2016);
- *National Healthy School Canteens Guidelines for Healthy Food and Drinks Supplied in School Canteens* – These national guidelines, which are based on the ADG, provide Australian schools with the requirements for food and beverages sold through school canteens. The guidelines categorise products into green 'always on the canteen menu', amber 'select carefully' and red 'not recommended on the canteen menu' categories (Australian Government Department of Health, 2014);
- *Social security safety net* – Government income support is available to vulnerable households in Australia, with eligibility criteria and income and asset testing conducted for each payment type (Australian Government Department of Human Services, 2016).

2.4.2 Western Australian policy context

Similarly to national policy leadership, limited progress in WA has been made. The following are key examples of state health promotion policy in WA:

- *Public Health Act 2016* – The objects of the recent Act relate to the promotion of public health and wellbeing and protection of people and communities from diseases. This is implemented through the creation of healthy environments, provision of public health screening and information campaigns, disease monitoring and reporting, reduction of inequalities in disadvantaged communities (Government of Western Australia, 2016);
- *WA Health Strategic Intent* – An overarching WA Health policy which prioritises health promotion, health service provision, development of infrastructure, utilisation

of Information and Communications Technology, facilitation of health research, workforce and partnership development (Government of Western Australia Department of Health, 2015b);

- *WA Health Promotion Strategic Framework* (HPSF) – The HPSF 2017-2020 aims to increase health-related behaviours and environments among residents in WA. One main principle includes equity and inclusivity, with an emphasis on the development of strategies to address health influences. The priority areas related to nutrition include 'Healthy Eating' and 'Curbing the Rise in Overweight and Obesity'. Suggested 'domains for action', include *"healthy policies, legislation and regulation, economic interventions, supportive environments, public awareness and engagement, community development, strategic coordination, building partnerships and workforce development, and targeted interventions"* (Department of Health, 2016). In particular, specific population groups of focus include people of low socio-economic status and rural and remote communities (Department of Health, 2016);
- *Healthy Options WA: Food and Nutrition Policy for WA Health Services and Facilities.* This policy relates to the provision of healthy environments that support nutrition through food provision within WA Health venues, such as hospital food outlets (but not food service) and WA Country Health Service locations. A traffic light system is utilised to categorise food and drinks available in cafes, cafeterias, vending machines etc. (Government of Western Australia Department of Health, 2015a);
- *WA Healthy Food and Drink Policy (HFDP)* – The HFDP requires that schools in WA adopt a 'whole school approach' to healthy eating. Similarly to other policies, foods are categorised in a traffic light system, whereby the policy bans provision of red foods unless they are *"essential to the learning program"* (Department of Education WA, 2014). All state government schools are required to develop a healthy eating policy and ensure their canteen complies with the relevant procedures (Department of Education WA, 2014).

2.4.3 Current policy gaps in food and nutrition security

Some examples of key policy gaps as identified by academics and government departments include:

- Improved social security actions, such as ensuring that welfare recipients can afford to purchase healthy food with the financial support they receive (Public Health Association of Australia, 2012; School of Public Health and Social Work and School of Exercise and Nutrition Sciences, 2013);
- Equitable and more frequent health service provision in regional and remote areas, such as through the provision of nutrition knowledge and cooking skills, especially in school settings (Public Health Association of Australia, 2012);
- A reduction in marketing of unhealthy foods to children (Public Health Association of Australia, 2012);
- Strengthening of local FS advocacy groups and food policy coalitions (Rychetnik et al., 2003);
- Sustained action to create environments conducive to accessing and purchasing nutrient-dense food, such as ensuring availability of quality, affordable core foods and core food subsidies (Bastian et al., 2011; Pollard et al., 2015; Public Health Association of Australia, 2012; Tasmanian Food Security Council, 2012);
- Incorporation of a human rights-based approach to FS strategies, such as through food supply improvements described above. This may contribute to prevention of FI, as opposed to merely management of the issue (Gallegos et al., 2017).
- More considered town planning that ensures access to healthy food, especially for disadvantaged groups, such as through public transport routes, location of food outlets (Public Health Association of Australia, 2012) and considers provision for community gardens and edible landscapes (Rychetnik et al., 2003);
- Improved nutrition monitoring of food prices and availability, especially in regional and remote areas (Pollard et al., 2015; Public Health Association of Australia, 2012; School of Public Health and Social Work and School of Exercise and Nutrition Sciences, 2013);
- National public health information campaigns that promote consumption of healthy foods, such as the rescinded Go for 2&5® campaign, which specifically promoted F&V consumption (State of Western Australia, 2011).

The above list provides some context of current nutrition policy in Australia and WA, while some examples of existing gaps that could be filled with a combination of upstream, midstream and downstream interventions have been highlighted. These could contribute to addressing some of the structural factors that influence FS, facilitate

healthy environments that support individuals to make informed health decisions and improve food supply (Rychetnik et al., 2003). The filling of these policy gaps could contribute to a reduction in disparity between health outcomes of vulnerable groups and the wider population (National Health and Medical Research Council, 2013a; School of Public Health and Social Work and School of Exercise and Nutrition Sciences, 2013).

2.5 Conclusion

Despite the established evidence that F&V contribute a myriad health benefits to dietary patterns, many children in Australia and WA consume F&V in amounts inconsistent with the ADG. With suboptimal consumption resulting in implications including reduced dietary diversity, developmental problems, social issues and increased risk of developing chronic NCD, an understanding of the factors that determine F&V consumption is imperative. The literature suggests use of theories of health behaviour, such as an Ecological Model of Health Behaviour, is advantageous for the interpretation of research findings and development of strategies to mediate low F&V consumption. The body of evidence advocates for the use of mixed methods such as food diaries and dietary surveys to measure F&V intake, with children considered capable of reliably reporting their intake.

While a broad definition of FS has been agreed globally, measurement of the complex issue remains inconclusive. However, it is clear that Australia lags behind in measurement, particularly among children. There is currently no established prevalence of child FI in Australia, from the child's perspective. However, a growing body of evidence has documented the adverse effects of FI including mental health issues, illness, developmental problems and obesity. The time has come to 'catch up' with other countries. Given the complexity of the multifactorial issue, investigating the problem through use of the comprehensive and extensively tested USA instruments, as well as investigating the underlying FSD, is suggested. This approach would investigate the key FSD across food availability, access and utilisation dimensions, would allow comparisons, and furthermore, would facilitate an investigation from a range of perspectives.

In addition, there is little published evidence relating to the association between a range of FSD and F&V intake among children. Most of the available literature relates to the

relationship between FS status and F&V intake, with many studies finding no association due to differences in research design, methodology and FS status criteria.

A key strategy to impact diet quality is through evidence-based government policy. Australia currently lacks consistent, sustained and effective policy actions to address health disparities between vulnerable groups within our population. Political leadership is required to ensure Australians, regardless of where they live, have access to affordable, nutritious and good quality food, and the associated food literacy required to live a healthy life.

Current research gaps that will be filled by this study include:

- A comprehensive investigation of the determinants of WA children's F&V consumption;
- A comparison between regional and remote WA children's F&V consumption in relation to quantities, types and varieties;
- An exploration of the FSD among regional and remote WA children;
- Establishing, to our knowledge, the first published prevalence of child FI in Australia from children's perspectives;
- Contributing to the scarce evidence base regarding whether an association exists between FSD and F&V consumption among children in regional and remote WA;
- Contribution of recommendations for consideration, to improve nutrition and FS-related policy.

2.6 Summary

The following chapter, Chapter 3: Methods, provides a detailed explanation of the methods utilised in this mixed-methods research, to fill the abovementioned research gaps in the current evidence base.

CHAPTER 3: METHODS

3.0 Foreword

This chapter provides an overview of the methods undertaken to complete this research and addresses each of the selected RQ. Additional detail is included in each of the six manuscripts within this Thesis with Publication (Chapters 4 to 8). This chapter begins with an overview of the philosophical worldview that guided the research. The second section justifies the study design and methodologies utilised in this study. The third section outlines the study phases undertaken to complete the research, such as the literature review, instrument development, pilot testing, sampling, data collection and data analysis. The fourth section of this chapter provides an overview of the ethical considerations, while the fifth section provides a summary of this chapter.

3.1 Philosophical foundation

The philosophical worldview or paradigm this study holds is pragmatism, a problem-centred, solutions-focused approach that uses mixed-methods to draw conclusions about the phenomena in question (Creswell, 2014). The concepts and issues at hand are complex and impacted by numerous factors on multiple levels of influence. Thus, this approach enabled flexibility in the analysis of the problems of suboptimal F&V, child FI and the association of FSD and F&V. Figure 3 illustrates the research framework for the study.

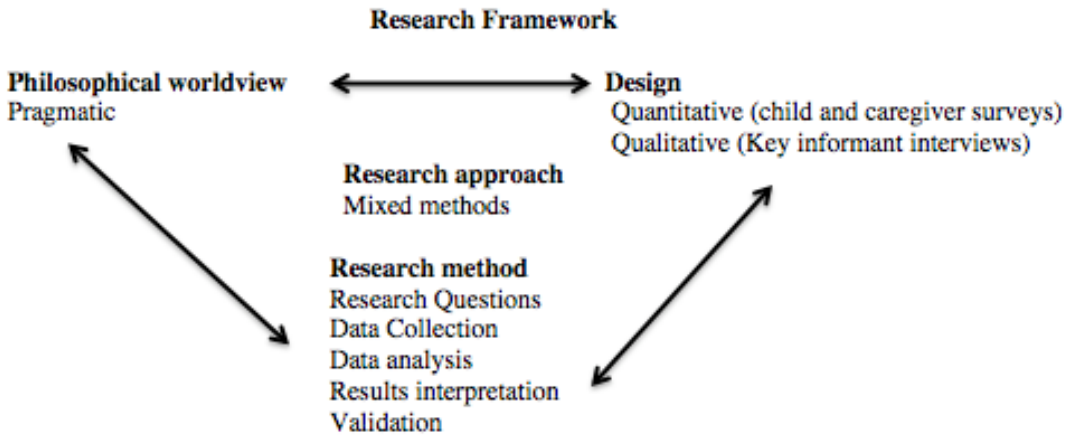


Figure 3: PhD research framework (Creswell, 2014).

3.2 Study design and methods

A parallel mixed-methods approach was utilised for this study. This approach is often chosen due to its ability to comprehensively analyse and interpret research problems. Both the qualitative and quantitative data streams were initially piloted then concurrently collected and analysed side by side, then collectively interpreted (Chapter 10: Discussion) to understand the overall contribution this study made to knowledge (Creswell, 2014). Figure 4 (below) provides a graphical representation of the study's approach.

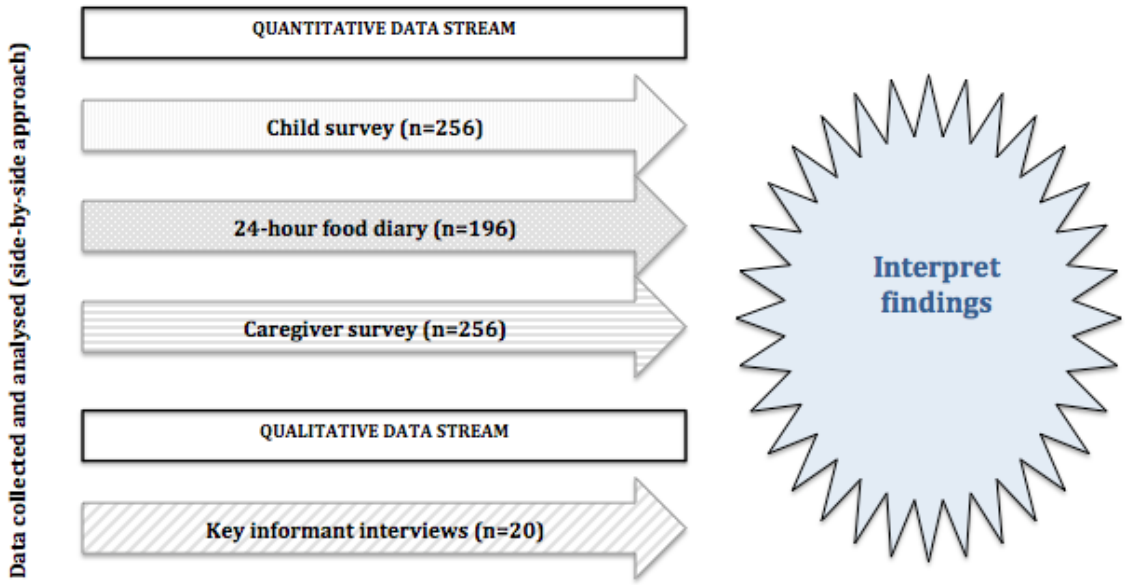


Figure 4: Mixed methods study framework

3.2.1 Study location

Covering one third of Australia's land mass, WA spans a vast 2.5 million square kilometres (Australian Bureau of Statistics, 2014c). As previously described, the remoteness of Australian locations is defined by their access to services (Australian Bureau of Statistics, 2014b), through the ASGS RA. The relevant categories for this study are 'Inner Regional Australia', 'Outer Regional Australia', 'Remote' and 'Very Remote Australia'. Figure 5 provides a graphical representation of the study locations; the dark grey area is considered by the ASGS as regional (Inner regional and outer regional), while the light grey area is considered as remote (remote and very remote) (Australian Bureau of Statistics, 2014b).

Figure 5: Regional and remote Western Australia

3.2.2. Methods employed

This mixed-methods study utilised concurrent qualitative and quantitative data streams. This enabled a comprehensive approach to facilitate understanding from a range of perspectives (Creswell, 2014). Methods selected for each data stream were based on evidence provided in Chapter 2: Background.

The quantitative data stream included:

- **Child survey:** A cross-sectional, self-administered, paper-based pictorial survey was used to collect data relating to children's self-reported F&V intake (i.e. usual serves, types), FS status and household demographics was conducted through WA schools.
- **24-hour FD:** A FD was utilised to report quantities (serves) and varieties of F&V consumed and was conducted through WA schools.
- **Caregiver survey:** A cross-sectional, self-administered, paper-based pictorial survey similar to the child survey included questions relating to household demographics, FSD and their child's consumption of F&V.

Both the child survey and caregiver survey components formed a *caregiver-child dyad*, which was selected to facilitate data analyses that incorporated data from both surveys and compare findings where required.

The qualitative data stream included:

- **Key informant interviews:** In-depth interviews with health, school/youth and food supply workers across WA were chosen to obtain insights about children's F&V consumption and FSD.

Table 5 outlines the data stream method used to answer each RQ and the respective manuscripts included in the thesis.

Table 5: Link between study research questions, methodologies and thesis chapter publication.

RQ	Literature review	Child survey	24-hour food diary	Caregiver survey	Key informant interviews	Thesis Chapter
RQ 1: What are the determinants of F&V consumption among regional and remote WA children?	✓				✓	4
RQ 2: What quantities, varieties and types of F&V do children living in regional and remote WA consume and how do these compare to the serves recommended by the ADG?	✓	✓	✓	✓	✓	5
RQ 3: What are the determinants of FS among regional and remote WA children?	✓	✓		✓	✓	6
RQ 4: What is the proportion of children in regional and remote WA that are FI?		✓				7
RQ 5: Are FSD related to F&V consumption and which determinant has the greatest influence on consumption, among children in regional and remote WA?	✓	✓		✓		8 9

3.3 Study phases

The methods used to conduct this study are described in each manuscript presented in this Thesis with Publication, but are described more fully in the following section and in related study phases. ***Phase 1*** included development of the research proposal and obtaining necessary study approvals. ***Phase 2*** included the pilot study. ***Phase 3*** included sampling and recruitment. ***Phase 4*** included data collection, while ***phase 5*** included data analysis. ***Phase 6*** included research results dissemination such as publishing of manuscripts, conference presentations and preliminary development of research translation strategies.

3.3.1 Phase 1: Development and study approvals

3.3.1.1 Research proposal development

This phase commenced with the development of the research proposal. The study concept was shaped by the candidate's work experience as a nutrition practitioner across regional and remote WA, informal conversations held in this capacity with key stakeholders, community members and personal observations. The study aim and RQ were determined and refined after conducting a literature review. The review provided an understanding of current evidence relating to FS and F&V consumption among children. Databases utilised included Pub Med, Proquest Health and Medical Complete and Medline databases. The search criteria included peer-reviewed full-text papers written in English, with a date limitation of 1975. The literature review has continued throughout the phases of this project, to ensure current research is included. Figure 6 demonstrates how the study topics were identified.

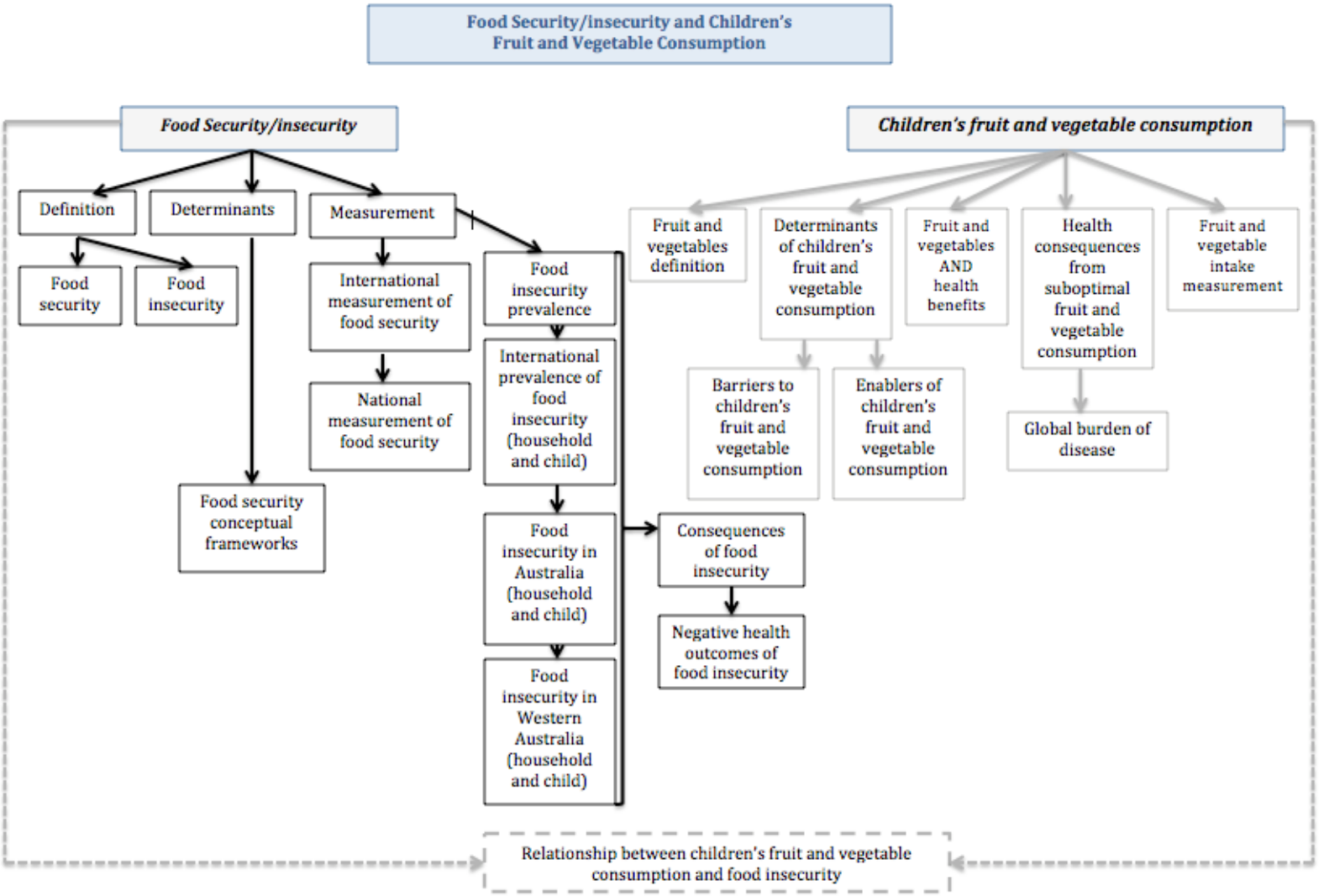


Figure 6: Literature search terms used for each concept

3.3.1.2 Child survey development

A self-administered, paper-based child survey was selected for this study component. The survey was designed for completion in school class, to reduce barriers associated with computer and internet availability and avoid possible technical issues associated with online surveys. The four-page survey was pictorial in nature to accommodate varying literacy levels.

International and national instruments to measure FS and dietary intake were reviewed to identify potential questions for the child survey. Validated questions were selected where possible to address the RQ (Table 6). Investigator-initiated questions were devised where validated questionnaires or tools that would answer this study's RQ were not found. The Determinants of Food Security conceptual framework (Rychetnik et al., 2003) underpinned survey questions relating to FSD.

Existing validated tools used in the child survey included:

- The CFSSM Module (Connell et al., 2004);
- Usual intake of F&V serves (Martin et al., 2008), including a prompt of what constitutes a serve of F&V (National Health and Medical Research Council, 2013a).

Investigator-initiated questions used in the child survey included:

- Demographics such as town, gender, age, number of people living in the household;
- FSD questions relating to distance and transport to shops, household food preparation and storage facilities; nutrition knowledge, skills and preferences questions; social support questions, based on the Determinants of Food Security framework (Rychetnik et al., 2003);
- Recall of F&V types;
- Recall of health messages or slogans relating to F&V;
- Recall of why we should eat F&V;
- Frequency of consumption of F&V types (i.e. fresh, frozen, tinned, dried, juice);
- Food preferences for F&V;
- Whether the child purchases food for themselves and their family to eat;

- Whether the child had prepared a meal or snack for themselves and their family in the last week.

(See *Appendix A - Study Instruments* for a copy of the child survey).

3.3.1.3 24-hour food diary

The FD used in the 2008 Child and Adolescent Physical Activity and Nutrition Survey conducted across WA (Martin et al., 2008) was used with permission. This tool was included for the purpose of triangulating findings from the child and caregiver surveys and to provide understanding around F&V varieties consumed. These methodologies were selected based on a review of evidence relating to data collection tools, particularly guided by the *Australian Children and Adolescents Obesity Research Network* (Australasian Child and Adolescent Obesity Research Network, 2016).

The 24-hour FD included the following components:

- Space to document the child's name;
- School name;
- Year level;
- Instructions on how to complete each section of the food diary;
- An example of a completed food record;
- Space to complete the start and finish date and time;
- Source codes (i.e. where the food was obtained from);
- Space to record the name, type, brand and cooking method used for the food consumed;
- Space to record the amount of the food eaten (to source *serves* and *varieties* of F&V eaten);
- Whether the intake was usual, less than usual, more than usual and the reason why;
- A section for notes and to record recipes of homemade items.

See *Appendix A - Study instruments*.

3.3.1.4 Caregiver survey

A five-page survey similar to the child survey to facilitate comparisons was developed. As per the child survey, the survey was paper-based so as to not exclude potential participants that did not have access to a computer or internet. The survey was pictorial to account for varying literacy levels.

Existing tools used in the caregiver survey included:

- The FSSM Short Form (United States Department of Agriculture, 2008). This tool was used to determine household FS classification. This short form was selected due to informal consultations that indicated further investigation of sensitive topics would be distressing for parents. Therefore, the short form, which does not probe about families' inability to feed their children, was used instead of the full 18-item tool.
- F&V consumption behaviours of children such as usual daily F&V serves consumed (Martin et al., 2008), including prompts of what constitutes a serve (National Health and Medical Research Council, 2013a);
- Food availability FSD data regarding healthy food availability, price, variety and quality (Hendrickson et al., 2006).

Investigator-initiated questions used in the caregiver survey included:

- Demographic data such as gender, age, number of children and adults residing in the household, employment status, receipt of government income support and highest level of education;
- Whether there was a supermarket in the respondent's town selling F&V;
- The F&V purchasing habits of the respondent;
- Availability of F&V in the local supermarket;
- Food access FSD measuring social support, household financial resources, transport and distance to shops;
- Food utilisation FSD measuring knowledge, skills, child food preferences, household food preparation and storage facilities, time available to purchase food;
- Frequency of consumption of F&V types (i.e. fresh, frozen, tinned, dried, juice);
- Whether their child liked the taste of F&V;

- Recall of health messages or slogans relating to F&V;
- Number of days this week their child ate F&V.

See *Appendix A - Study instruments.*

Table 6 (below) outlines the existing tools incorporated into instruments used in this study.

Table 6: Existing tools utilised in study components

Existing tool	Source	Component included in study tools	Study tool utilising existing tool
CFSSM	Connell, C., Nord, M., Lofton, K., Yadrick, K. (2004). Food Security of Older Children Can Be Assessed Using a Standardized Survey Instrument. The Journal of Nutrition, 134(10), 2566.	CFSSM	Child Survey
FSSM	United States Department of Agriculture. (2008). U.S. Household Food Security Survey Module.	Household FSSM (short form)	Caregiver Survey
Child and Adolescent Physical Activity and Nutrition Survey	Martin, K., Rosenberg, M., Miller, M., French, S., McCormack, G., Bull, F., Giles-Corti, B., Pratt, S. (2008). Move and Munch Final Report. Trends in Physical Activity, Nutrition and Body Size in Western Australian Children and Adolescents: the Child and Adolescent Physical Activity and Nutrition Survey (CAPANS) 2008.	1. 24-hour food diary 2. Food Frequency Questionnaire 3. Serve size information	1. 24-hour food diary 2. Caregiver Survey 3. Child Survey Caregiver Survey
Food Choice and Access Survey	Hendrickson, D., Smith, C., Eikenberry, N. (2006). Fruit and vegetable access in four low-income food deserts communities in Minnesota. Agriculture and Human Values, 23, 371-383.	Selected questions from Food Choice and Access Survey	Caregiver Survey

3.3.1.5 Semi-structured interview guide

The Semi-Structured Interview (SSI) guide commenced with broad, initial questions such as an informant description of the food environment within the town/s/areas they worked/lived in. The remainder of the interview guide comprised two key themes:

The first theme, *FSD* included FSD questions underpinned by the Determinants of Food Security framework (Rychetnik et al., 2003), such as the informant's perspective about:

- The location of food outlets in the town/s they worked/lived in;
- Food availability in outlets;
- Food price;
- Food quality;
- Food variety;

- Promotion of healthy/unhealthy food;
- Financial resources of residents;
- Distance to food outlets;
- Transport to food outlets;
- Knowledge, skills preferences of community members;
- Household storage facilities;
- Preparation and cooking facilities;
- Time to procure and prepare food;
- Mobility issues associated with procuring or preparing food;
- Social support.

The second theme, *F&V*, included questions relating to:

- The amount, variety and quality of F&V children in the area/s they lived/worked consumed;
- Barriers to and enablers of F&V consumption among children;
- Motivators for consumption;
- How they think children feel about the consequences of low F&V consumption;
- Proposed and existing strategies to increase F&V consumption.

See *Appendix A - Study instruments.*

3.3.1.6 Study approvals

A range of approvals was required to undertake this study. Firstly, the Edith Cowan University (ECU) Human Research Ethics Committee (HREC) approved the study (Project 8635) (See *Appendix B - Study approvals*). Secondly, considerable consultation with the WA Department of Education (DOE) was required; given the majority of this research study was being conducted through WA schools. An *Application Form for External Parties to Conduct Research on Department of Education Sites* was completed and submitted to the DOE. This research study was approved in a staged approach. Firstly, approval was received to conduct a pilot study in one regional school. Further approval from the DOE Evaluation and Accountability Directorate was provided, after the PhD candidate submitted a pilot study report and feedback from the pilot school's principal was received (See *Appendix B - Study approvals*). An application to conduct research on Catholic Education WA school sites was also made to Catholic Education WA (CEWA) after DOE approval was received, and was

subsequently approved (See *Appendix B - Study approvals*). Kimberley Aboriginal Health Planning Forum (KAHPF) (Research Subcommittee) approval was sought and provided to conduct the study within the Kimberley region, due to the substantially higher proportion of Aboriginal and Torres Strait Islander people residing within Kimberley region towns (*Appendix B - Study approvals*).

3.3.1.7 Information letters and consent forms

As a requirement of study approvals, a range of information letters (IL), consent forms (CF) and accompanying information were developed. These included:

1) Principal IL and CF;
2) Teacher IL and CF;
3) Caregiver IL and CF (one CF for caregiver participation and one CF for caregiver approval for their child's participation);
4) Child IL and CF;
5) Key informant IL and CF;
6) Information regarding caregiver/family support services available in the caregiver respondent's town and region, as a precautionary measure in case some survey questions were distressing for some respondents.

The IL contained information including the title of the study, research topic, confidentiality information, ethics and governance approvals obtained, use of data, an overview of study processes and contact details (*Appendix C - Information Letters and Consent Forms*).

3.3.2 Phase 2: Pilot study

3.3.2.1 Pilot study procedure

Consultations occurred with other experienced school-based researchers and the DOE Evaluation and Accountability Directorate prior to commencement of the pilot study, to guide the selection of appropriate school-based research processes. The quantitative data stream of this PhD was pilot tested with one regional school in WA. The principal and two class teachers provided consent for children (n = 55) to be invited to join the research study, via provision of signed CF.

The PhD candidate attended the school site and visited the participating pilot classes to deliver a teacher and class briefing session (5-10 minutes in duration), which included the following components:

- Introduction of the PhD candidate, her background, and the proposed study;
- An outline of study requirements;
- Presentation of the IL/CF envelope and survey tools;
- Provision of a due date for children to return the signed CF and explanation of timeline to teachers and students; and
- Answering any questions teachers or children had about the study.

Please see *Appendix D - data collection process tools* for a copy of the sample teacher and class briefing session script.

The teachers were provided with a study pack including:

- Teacher IL;
- CF and caregiver surveys enclosed in individual caregiver envelopes;
- Child surveys and privacy stickers;
- 24-hour FD;
- Instructional DVD for completing FD;
- FD example pictures (class pack) for estimating serve sizes;
- Duplicate child and caregiver surveys (in clearly marked envelopes to identify them as reliability testing surveys);
- Pre-paid post packs for sending completed surveys to the PhD candidate.

Teachers were asked to distribute the IL/CF envelope, which contained the caregiver and child IL, CF and the caregiver survey, to children at the end of the day. The class teachers received the signed CF and the sealed envelopes containing the caregiver survey from the children within a one-week timeframe, which enabled them to determine which children had caregiver consent and child consent to participate in the child survey.

3.3.2.2 Child survey

Consenting children (n = 26) completed the child survey, which took approximately 15-20 minutes in class. Teachers were instructed to distribute a privacy sticker for each child to close their survey upon completion. The class teachers placed CF envelopes, child surveys into a large envelope which was delivered to the school administration for

posting in pre-paid Australia Post satchels to the PhD candidate. The same child survey was then retested seven days after the first survey (test-retest). No adaptations to the child survey were required based on the findings from the pilot study. The child surveys were entered into Microsoft Excel and imported into IBM Statistical Package for Social Sciences (SPSS) Statistics version 17 (IBM Corp, 2008) where descriptive statistics were obtained. Wilcoxon Signed Rank Tests (WSRT) were conducted to assess the reliability of the survey tools. Data from the pilot sample was included in the main sample.

3.3.2.3 24-hour food diary

An instructional FD Digital Video Disc (DVD), developed by the PhD candidate and supplied to participating classes, was played to children prior to the first diary entry. The DVD, which was approximately three minutes in duration, took viewers through each component of the FD. This was anticipated to assist children to complete the FD and to optimise dietary assessment quality. A set of pictures of food amounts (Cancer Council Victoria, 1994) was also supplied to school classes to assist children in quantifying food amounts consumed to record in their FD.

The 24-hour FD and DVD were piloted alongside the child and caregiver survey. Given participant burden to complete a FD is considered high, and those completing the FD must have reasonable literacy levels (Rockett, 1997), teachers and caregivers were asked to assist children with FD entries where required. Children completed the FD over a 24-hour period after watching the instructional DVD. Teachers collected diaries and posted them along with other study materials to the PhD candidate, who performed a manual calculation of F&V serve sizes consumed. This was conducted to enable comparison with the ADG (National Health and Medical Research Council, 2013a). No amendments to the tool were made as a result of piloting.

3.3.2.4 Caregiver survey

As described above, pilot testing of instruments occurred with one regional school. Along with the caregiver survey that was completed at home, a tailored list of support and emergency relief services for the town/region was provided (*Appendix D - Data collection process tools*). The purpose of this information was as a safeguard in case survey questions caused distress among caregiver respondents. Completed caregiver surveys (n = 27) were returned to school with children in the sealable A4 consent form

envelope within a one-week timeframe. As with the child survey process, a duplicate caregiver survey was completed by caregivers. It was planned that the caregiver reliability testing surveys would be repeated seven days after the first round; however the teachers were concerned that as the school holidays were fast approaching, few completed surveys were anticipated to be received back. Therefore, as guided by teaching staff, repeat caregiver surveys were sent home after four days to maximise collection time and follow up.

The completed caregiver surveys were matched (a total of n = 26 caregiver-child dyads) entered into Microsoft Excel and imported into IBM SPSS statistics version 17 (IBM Corp, 2008), where descriptive statistics were obtained. WSRT were conducted to assess the reliability of the survey tools between test-retest time points. Data from the pilot sample was included in the main sample.

Caregivers and teachers were asked to provide feedback to the PhD candidate about the pilot study processes and tools using investigator-initiated feedback forms (*Appendix D - Data collection process tools*). While the feedback was primarily positive, some comments included that some children had difficulty quantifying portions of food consumed. Strategies to mediate this included asking teachers and caregivers to assist children in completion of their FD where required. Only minor adjustments of the caregiver survey were made as a result of pilot feedback and statistical analyses, such as removal of FFQ to reduce survey length. Table 7 outlines the characteristics of participants in the pilot sample.

Table 7: Pilot study sample characteristics (n = 26 dyads)

Characteristic	n	%
Caregiver age (*n* = 26)*	40.3 ± 4.8	-
Caregiver gender (*n* = 26)		
Female	24	92.3
Male	2	7.7
Caregiver employment status (*n* = 26)		
Not in labour force/Volunteer	4	15.4
Part-time work	13	50.0
Full-time work	9	34.6
Caregiver educational attainment (*n* = 24)		
Primary school/secondary school	13	54.2
Diploma/apprenticeship	7	29.2
Undergraduate/postgraduate university degree	4	16.7
Receipt of government income support (*n* = 23)		
Yes	5	21.7
No	18	78.3
Number of adult residents in the household (*n* = 26)*	1.8 ± 0.5	-
Number of child residents in the household (*n* = 26)*	2.3 ± 0.8	-
Child age (*n* = 26)*	11.1 ± 0.8	-
Child gender		
Female	20	76.9
Male	6	23.1

*Continuous variables presented as mean and standard deviation.
Categorical variables include n and %.

3.3.2.5 Key informant interviews

The SSI guide was piloted in one interview with a health worker in the same town as the pilot testing of the quantitative data stream. The in-person interview was conducted at the participant's office and recorded with participant permission. Notes were taken in case of device failure. After the interview, brief notes were made, including a reflection of the method and general themes arising. Alterations were made to the SSI guide prior to further use.

3.3.2.6 Validity and reliability

A number of methods were employed during the study to validate quantitative study elements, such as F&V intake and FS information. In the pilot study, class teachers and caregivers were asked to provide feedback relating to study processes and instrument questions, as well as their perception of whether their students or their child understood the instrument questions and study processes. In addition, a 24-hour FD was utilised as a dietary measurement method, to triangulate child and caregiver-reported F&V intake (Figures 7 and 8). However, due to a lower sample of FD participants, caregiver-reported F&V data was utilised and FD were used to report F&V varieties consumed.

The qualitative study utilised a number of methods to ensure validity. Firstly, the resulting strategies in the General Discussion chapter consider results from both the qualitative and quantitative studies (triangulation). Secondly, a 'rich, thick' description provided a range of viewpoints for each theme, through the inclusion of key informants from a range of professions and locations. Contradictory information within themes was also included, to provide contrasting perspectives (Creswell, 2014).

To ensure reliability, FS data was verified by the child survey, caregiver survey and key informant interviews. These verifications are included in the discussion sections of each manuscript included in the thesis, where information from the other respective data stream is cited to aid interpretation of findings.

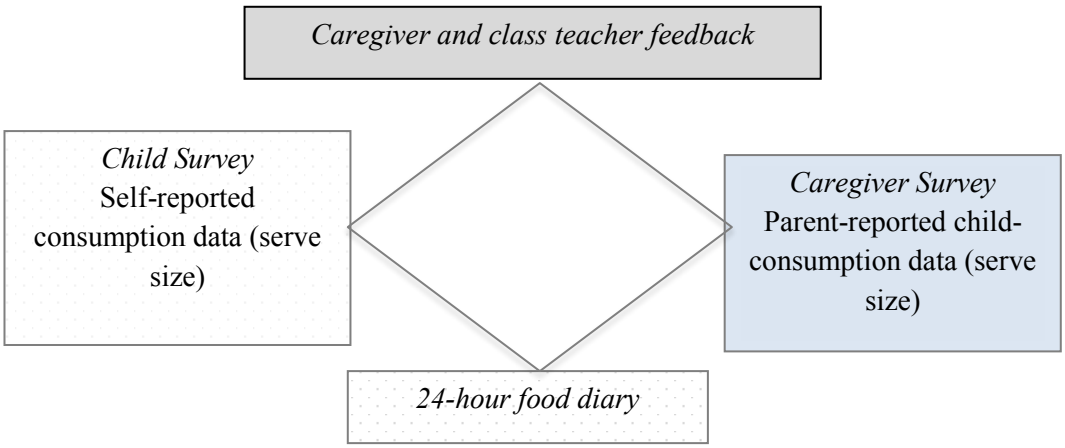


Figure 7: Validation of dietary measurement

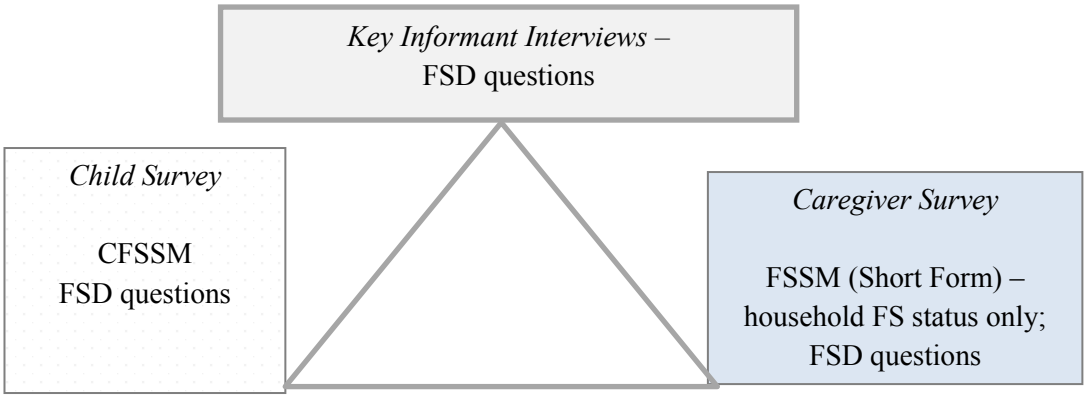


Figure 8: Validation of food security measurement

3.3.3 Phase 3: Sampling/recruitment

3.3.3.1 Child and caregiver surveys and food diary

Children aged 9-13 years were selected as the child sample. This was to facilitate comparisons with the Australian Dietary Guideline F&V serve size recommendations (National Health and Medical Research Council, 2013a).

Sample size calculations were determined using the Creative Research Systems Sample Size Calculator website (Creative Research Systems, 2012). The total number of students attending schools within the desired age range (58,962) was included in the 'population' line of the calculator and was drawn from the Department of Education's annual census (Department of Education WA, 2012b). A sample of 385 caregiver-child dyads was deemed required. Midway through data collection, recruitment was proving difficult; reportedly due to the comprehensive consent processes required. Therefore, sample size calculations were undertaken with preliminary results for each RQ. The

sample size determined for quantitative RQ two and four was *n* = 245 caregiver-child dyads. For RQ 5, a sample of *n* = 160 was required. For precision purposes, the minimum sample size was determined with an effect size of 0.15, 80% power at the 5% level of significance. Again, the Creative Research Systems Sample Size Calculator website (Creative Research Systems, 2012) was used to determine the sample sizes required, using the population figure of 58,962 students. As RQ 1 and 3 were qualitative RQ, Bertaux's guidelines were used to guide a minimum proposed sample of 15 interviewees (Mason, 2010).

The proportion of schools located in each WA region was determined, based on the nine Department of Regional Development regions. These regions are managed under Regional Development Commissions, which were established based on the Regional Development Commissions Act 1993 for economic development purposes (Government of Western Australia, 1993). The delineation of the regions enabled the calculation of a representative sample across all regions. A master database was created including all WA DOE schools, CEWA and Association of Independent Schools WA (AISWA). Government school information was obtained from the DOE Schools Online website 'Advanced Search' function (Department of Education WA, 2012a). Catholic Education school information was obtained from the CEWA website's 'School Profiles' page (Catholic Education WA, 2012) and independent schools were sourced from the AISWA website (Association of Independent Schools of Western Australia (Inc). 2012).

The ASGS RA was used to classify each school on the list into 'Inner regional', 'Outer regional', 'Remote' and 'Very remote' categories. In order to ascertain the proportion of schools in each ASGS RA category, the Locality 2011 to Remoteness 2011 worksheet (Australian Bureau of Statistics, 2012a) was obtained from the ABS, which listed every town/suburb in WA with its postcode and ASGS RA. Each school in the Master Schools Database was subsequently categorised by ASGS RA. This determined the proportion of schools in each ASGS RA category by geographical region, and provided a guideline to ensure the schools selected were as representative as possible of the school distribution across RA. Further, schools located in towns ranging in Socio-economic Index For Areas (SEIFA) Index of Relative Socio-Economic Disadvantage (IRSD) from one (highest level of disadvantage) to 10 (lowest level of disadvantage) were included

in the sample and identified through the ABS IRSD 2011 worksheet (Australian Bureau of Statistics, 2013f).

Schools from WA locations registered with Foodbank WA and thus scheduled to participate in the *Food Sensations*® nutrition education program were included in the prospective quantitative sample. Schools were eligible to register for Foodbank WA if they had a Community Socio-Educational Advantage (ICSEA) decile of 6-10 and/or students at risk of disadvantage (Godrich, 2016a). The ICSEA value indicates the level of education advantage of a school's population in comparison to other schools (Australian Curriculum Assessment and Reporting Authority, 2015). This method was selected given the PhD candidate was employed with and consulted for this organisation during the course of this PhD. The statewide travel required for her employment was a critical enabler of informal consultations, on-site rapport building activities with schools, recruitment of potential study participants and building of stakeholder contacts. However, it is acknowledged that this may bias the study such that disadvantage is a factor of consideration for registration.

A final sample of 32 schools that were registered with Foodbank WA were approached via an initial telephone call to introduce the researcher and the research study. Once principal interest was established, an email detailing the study and providing the DOE approval letter, the personalised IL and CF was sent. A Microsoft Excel database was used to record school contact details and tracked school communication methods and frequency of contact. A total of 23 school principals consented for their school to participate (71.8%). Schools went in a study-wide draw to receive a small school kitchen garden kit. Schools were asked to either nominate classes or seek expressions of interest from teachers of children aged between 9-13 years of age for invitation, a strategy recommended by DOE to increase school participation. The principal provided the school class teacher details on the signed CF.

The PhD candidate contacted the individual class teachers via email to outline the study requirements and seek their consent to participate in the study, which included provision of a personalised teacher IL and CF that included a study schedule pin-up sheet to enable tracking of progress. A total of 69 teachers (of 74 classes) consented to participate in the research (97%) by signing and returning the CF. All teachers

consenting to participate in the study were from the 23 schools where the principal provided consent to participate.

Once the CF was received, the researcher contacted the teachers to determine a mutually suitable time to visit the class to deliver a teacher and class briefing session (where possible). This was used as a rapport building strategy during recruitment (Martin et al., 2008; Trapp et al., 2011). Alternatively, where briefing sessions were not required or not possible, the teachers were informed of the process by posting materials for distribution to children. A total of 51 classes received on-site briefings and 23 classes received the study materials via post.

Children were generally allocated one week to bring back signed CF envelopes, which included the caregiver IL, child IL, CF (with space for caregiver consent for their own participation, caregiver consent for child participation and child consent for child participation), caregiver survey and emergency relief contacts. However, some school classes required more time due to school activities, holidays or difficulty retrieving the paperwork from children or caregivers.

Children were instructed to bring back signed CF envelopes to their class teacher, with the child survey subsequently conducted in class with consenting children. A total of 1,814 children and their caregivers were invited to participate with 347 caregivers and 340 children providing written consent to participate. The average number of children and caregivers per school that consented to participate was 14.78 and 15.08 respectively.

Figure 9 below demonstrates the quantitative sampling strategy used, incorporating the caregiver-child dyad (child and caregiver surveys) and FD.

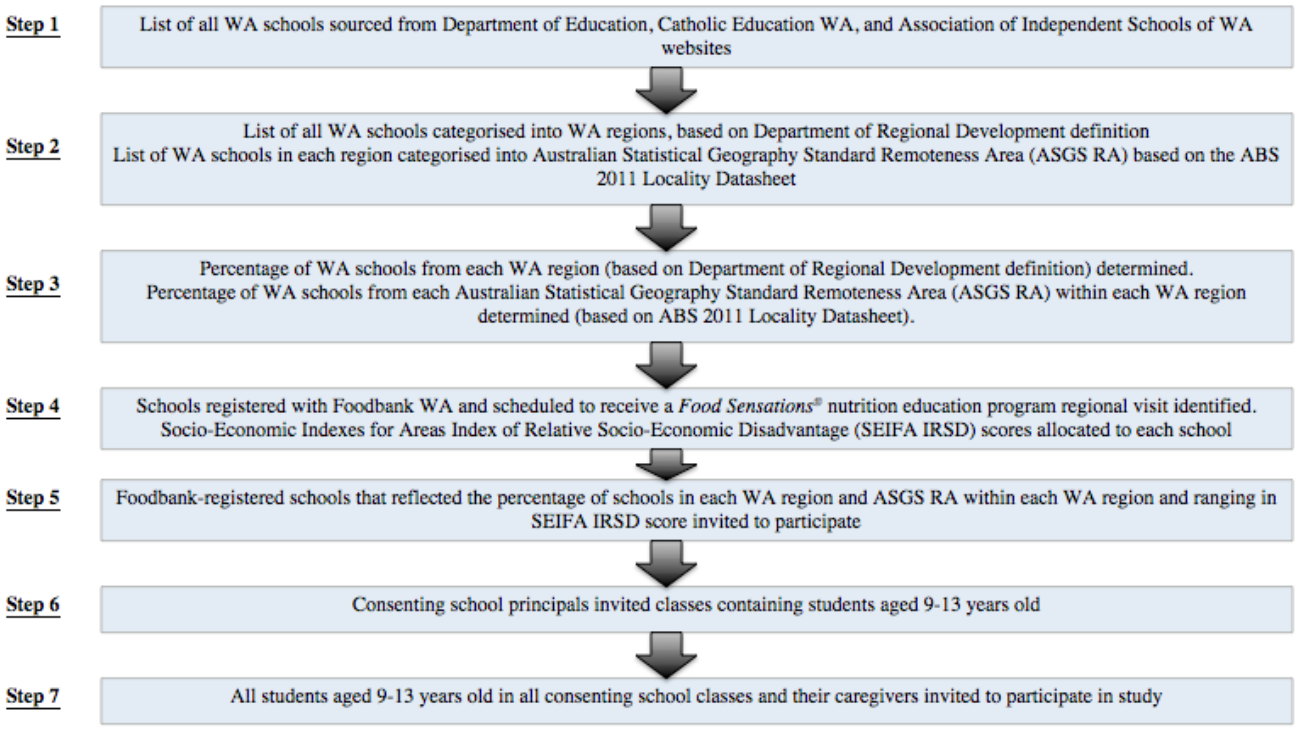


Figure 9: Quantitative data stream sampling methods

3.3.3.2 Key informant interviews

The PhD candidate compiled a database of contacts during the conceptualisation phase of the project. Key informant types included 'Health workers' (individuals such as public health nutritionists, dietitians or staff facilitating health promotion programs), 'School and youth worker' informants (school principals, teachers and youth workers) and 'Food supply worker' informants (food retail sector involvement at a community level independent, co-operative supermarket or farmers' markets). Health and school/youth contacts listed in the database were sourced from existing professional networks, while food supply worker contacts were sourced through Google search.

These particular worker types were selected to provide insight into children's F&V consumption and food security. They were believed to possess knowledge on the topic from a range of perspectives given their role related to children's F&V consumption or food security. For example, some health workers delivered nutrition education programs, some school worker types facilitated school breakfast programs, and food supply workers could provide insight into community food supply.

Where possible, individuals invited to participate in this study were representative of the population distribution across WA regions (e.g. Pilbara, Kimberley, Goldfields, Midwest, Wheatbelt, Peel, South West and Great Southern) and each ASGS RA as determined by the Australian Bureau of Statistics (Australian Bureau of Statistics, 2012a, 2014b). Participants also represented towns ranging in SEIFA IRSD (Australian Bureau of Statistics, 2013f).

Key informants were invited to participate in an interview of up to 60 minutes with the PhD candidate. This invitation was firstly undertaken via telephone to seek interest, followed by an email containing an IL and CF (*Appendix C – Information letters and consent forms*). Thirty key informants were invited to participate, with 20 providing written consent to participate in an interview (67% response rate).

Figure 10 below illustrates the qualitative sampling strategy utilised in this study.

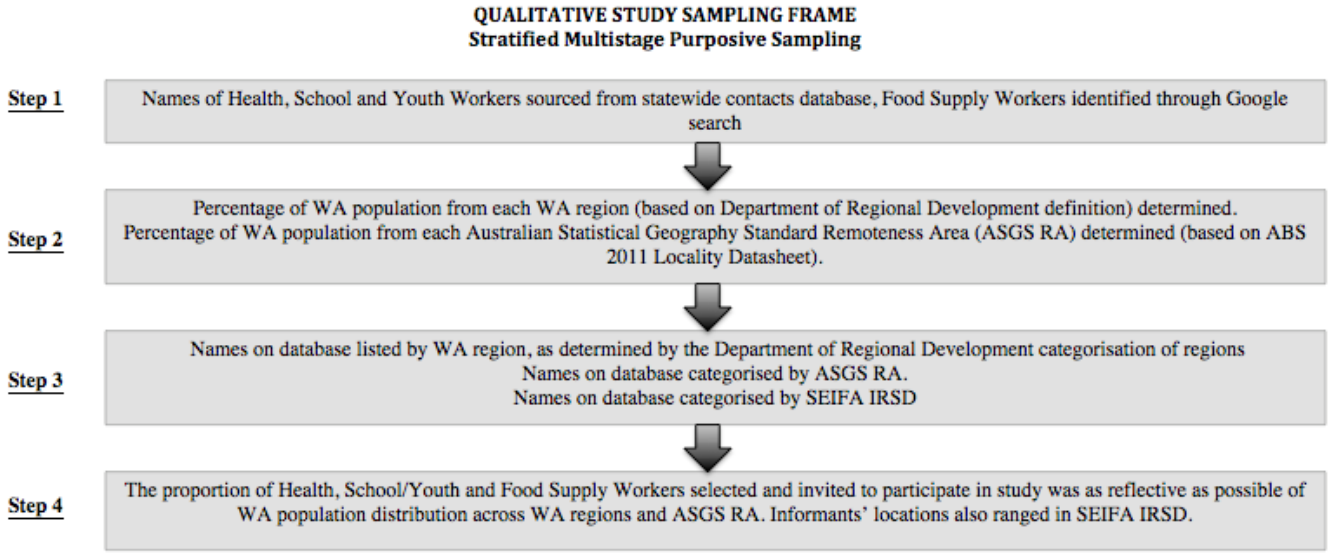


Figure 10: Qualitative data stream sampling methods

3.3.4 Phase 4: Data collection

3.3.4.1 Child survey

The child survey data collection used the same method as the pilot study; surveys were distributed to consenting children in class. The child survey took up to 20 minutes to complete by children, under the supervision of teachers. Where children required assistance completing the survey, teachers were instructed not to probe for personal answers to the questions. They were asked to read the question in a neutral manner to aid in understanding of the question. In some locations, the school's Aboriginal Islander Education Officer (AIEO) reviewed survey tools and was present in the classroom at the time of the child survey completion. The purpose was to ensure cultural safety for participating children. One school recommended their students should not be asked to complete the CFSSM section of the survey, due to the anticipated underreporting that would occur for these questions. Therefore, children at that school were not asked to complete that set of questions. Once surveys were completed, teachers were asked to distribute a privacy sticker to each child, to seal the surveys closed. The class teachers placed the CF envelopes and child surveys into an envelope and delivered it to the school administration for posting in pre-paid Australia Post satchels to the study centre.

3.3.4.2 24-hour food diary

Class teachers were asked to play the 24-hour FD DVD to demonstrate to children how to complete the FD. Children then received their FD book to commence entries. Caregivers and teachers were asked to assist with entries where required. A class pack containing photographs of serve sizes (Cancer Council Victoria, 1994) was provided to each participating class to assist with this task. Children completed all food and drink consumed over a 24-hour period, with some entries completed at school and some at home. Some school classes chose to complete the FD as a class activity. The class teacher collected completed FD the following day.

Figure 11 provides a graphical illustration of the child survey and FD methods used in this study.

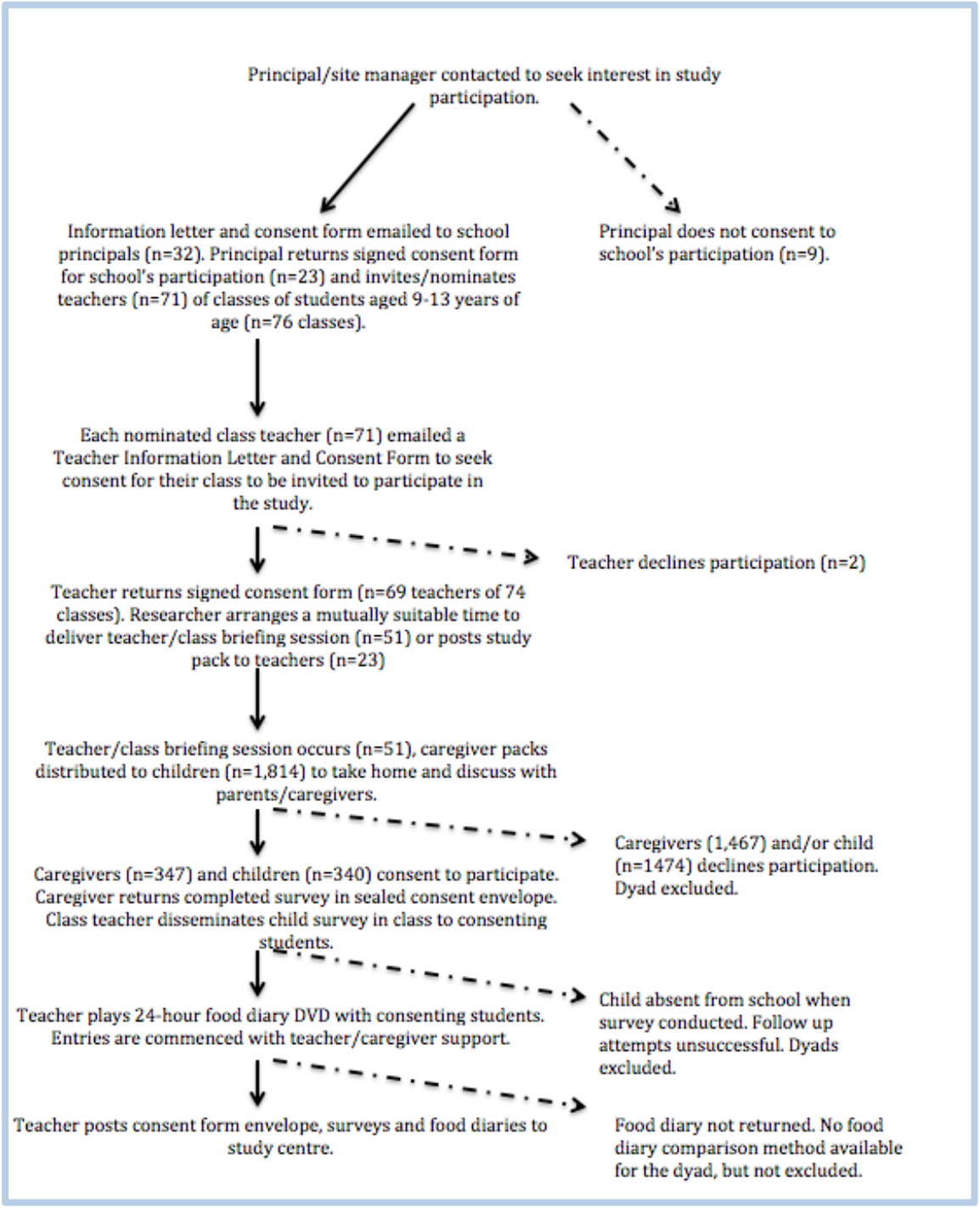


Figure 11: Child survey and 24-hour food diary recruitment and data collection overview.

3.3.4.3 Caregiver survey

This study component was used to obtain a caregiver perspective on F&V serves consumed by child participants, a FS score and a measure of FSD. Caregivers were invited to complete the caregiver survey contained in the CF envelope brought home by their child from school at the time of consent. In some locations, a cover sheet with the contact details of the school's AIEO was also provided, with details supplied by the school and discussed with the AIEO. This was to ensure cultural safety for caregivers wishing to discuss the study with a person that was not a member of the research team. Caregivers were asked to complete the survey, place it in the CF envelope and seal it to ensure confidentiality. Caregivers were asked to give the CF envelope containing their survey to their child to return to the class teacher for collection. The class teachers placed CF envelopes into an envelope, along with the child survey and 24-hour FD, and delivered it to the school administration for posting in pre-paid Australia Post satchels to the PhD candidate. Figure 12 demonstrates the caregiver survey data collection processes conducted.

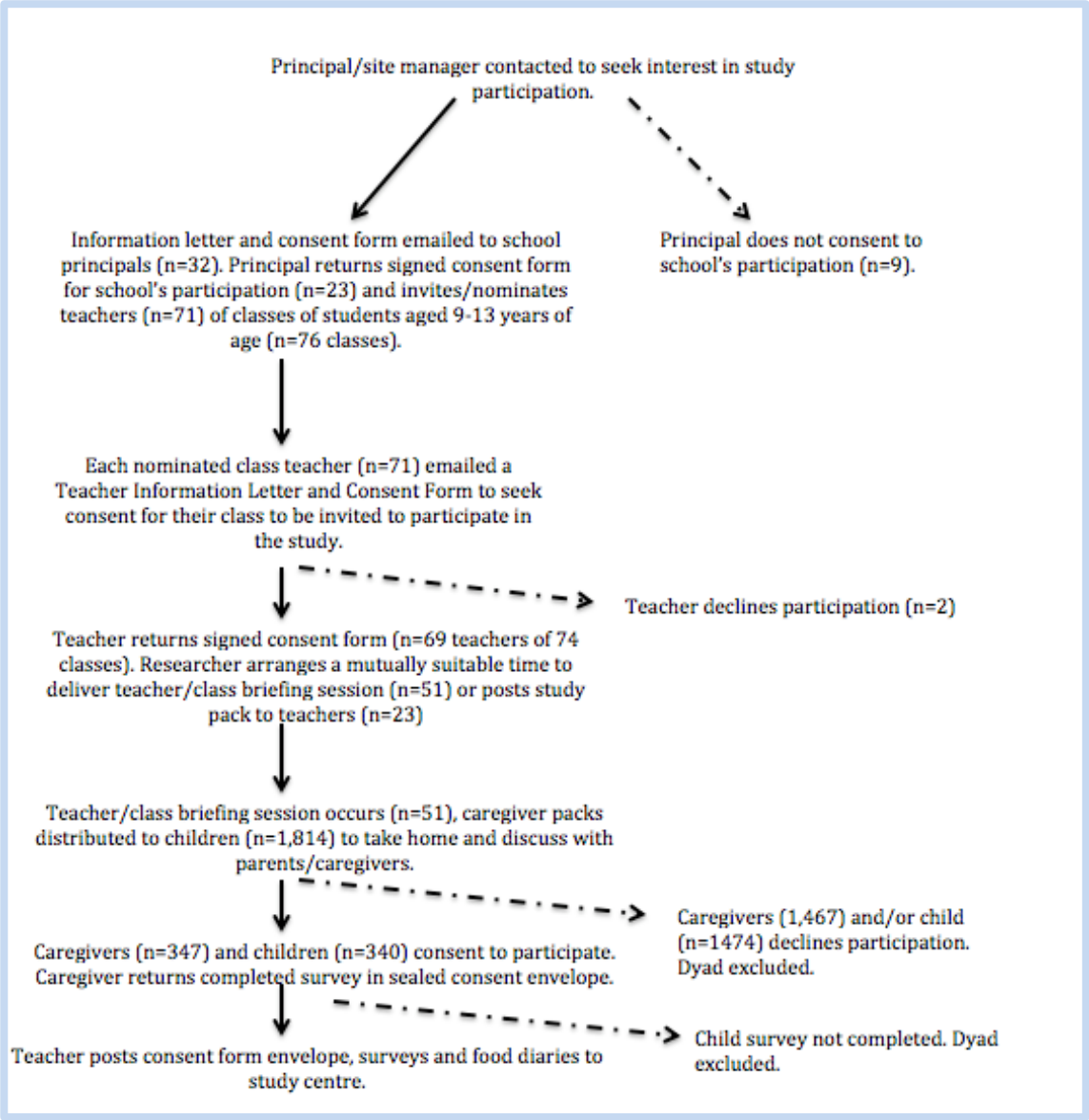


Figure 12: Caregiver survey recruitment and data collection overview

3.3.4.4 Key informant interviews

SSI were conducted between June 2013 and September 2015 with purposefully sampled key informants that included health workers, school/youth and food supply workers. Due to budgetary constraints or scheduling issues, 16 interviews were conducted via the telephone and four face-to-face at a time convenient to participants. The same SSI guide was used for all interviews, however, due to time constraints for some participants, not all respondents answered all questions contained in the guide. All SSI were recorded with participant permission; interview notes were also taken in case of device failure, however, the device did not fail on any occasion.

Figure 13 illustrates the recruitment and data collection processes conducted for the key informant interviews.

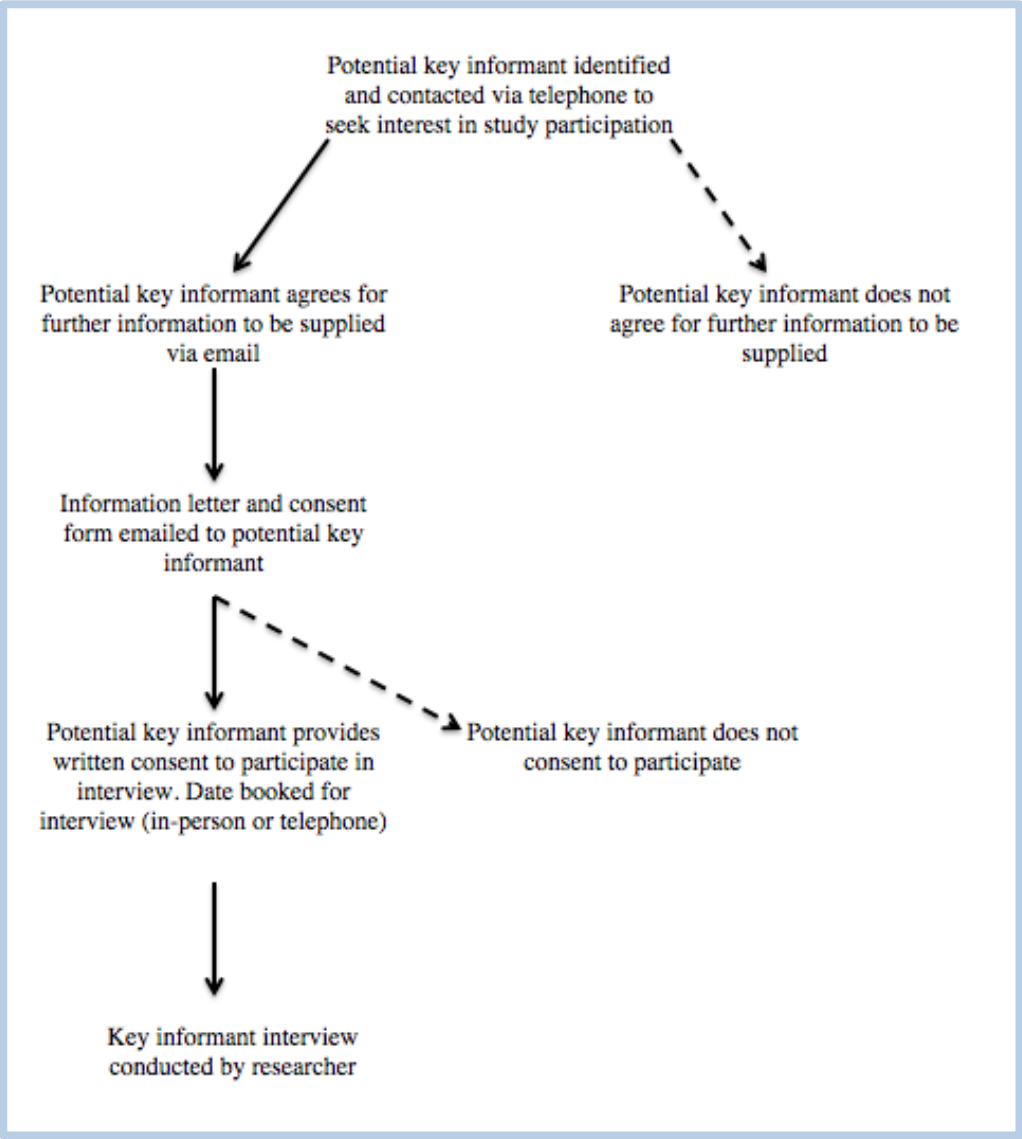


Figure 13: Key informant interview methods

3.3.5 Phase 5: Data analysis

3.3.5.1 Child survey

Once received, all completed surveys, FD and signed CF were filed and placed into locked cabinets. Surveys were crosschecked against CF, were allocated a unique identification number (ID) and de-identified. Child surveys were entered into a Microsoft Excel database, saved onto a password-protected computer and backed up onto a USB, which was locked in a filing cabinet when not in use. The database was

backed up to a password-protected DropBox folder after each period of data entry and secured by only sharing with the supervisory team.

The Microsoft Excel database was imported into IBM SPSS Statistics software, version 23 (IBM Corp, 2015), where the Child Database was created. Normality of distribution was assessed and dataset cleaned and checked for erroneous coding. Any data entry queries were checked against original paper-based surveys and rectified through retyping the correct value.

A number of variables required recoding in SPSS due to low cell counts. For example, the CFSSM categories were collapsed to a dichotomous variable 'food secure' (High FS and Marginal FS categories' or 'food insecure' (Low FS and Very Low FS categories). F&V amount as a continuous number of serves was dichotomised to either adequate F&V intake or inadequate F&V intake, criteria based on serves of fruit (2 serves per day) and vegetables (5 serves per day) for children 9-13 years. The Australian Dietary Guidelines recommends children within this age range consume at least two serves of fruit and five serves of vegetables per day (National Health and Medical Research Council, 2013a). Descriptive statistics, Chi-square tests, simple and multivariable regression analyses were then conducted using the recoded variables where appropriate. In the child survey, the CFSSM was the primary tool utilised, which ascertained FS status from the child's perspective. Categorisation of FS status is as described in Chapter 7. Other variables utilised included demographic data, which were used in simple logistic regression analyses (inclusion criteria into the full model was a conservative $p = 0.20$) and multivariable regression analyses (significance set at $p = 0.05$).

Statistical analyses included:

1. Frequencies to perform an initial investigation of the data, determine the proportion of the sample that consumed adequate F&V (amount), types and varieties of F&V and ascertain FI prevalence;
2. Chi-square tests to examine associations between F&V varieties consumed and:
    a. Remoteness;
    b. Adequate F&V consumed (amount).
3. Simple and multivariable logistic regression analyses to determine:
    a. The demographic factors that increased child FI;

b. The socio-demographic factors/confounding variables that predicted adequate F&V intake.

The manuscripts included in Chapters 7, 8 and 9 further outline data analyses undertaken.

3.3.5.2 24-hour food diary

A FD coding protocol (See *Appendix E – Data analysis*) was developed by the PhD candidate for entry of FD F&V entries into Xyris FoodWorks Professional (Xyris Software Australia Pty Ltd 2012). The protocol included the following sections:

- Study background;
- Data entry process;
- Coding of foods;
- Installation and use of AUSNUT 2013 with FoodWorks;
- Process for entering 'Amounts Not Otherwise Specified' based on the child's age and gender;
- A reference for Table 2. Median Daily Intake: Fine Age Group, By Sex' from the National Nutrition Survey (Australian Bureau of Statistics, 1999).

One trained nutritionist (Research Assistant) entered the gram weight, cup size or estimated amount into FoodWorks for each ID (that matched their child survey). FoodWorks automatically assigned serves from F&V groups once the Research Assistant entered the appropriate weight or cup measurement. The median daily intake amount from the National Nutrition Survey (Australian Bureau of Statistics, 1999) was used where 'Amounts Not Otherwise Specified' was selected, based on the child's age and gender.

The serves for each F&V variety group were imported into a Microsoft Excel database. This database was then imported into IBM SPSS Statistics, version 23 (IBM Corp, 2015) and was merged with the main Child Database, with ID's matched. Descriptive statistics were undertaken to determine F&V variety groups and number of F&V serves consumed.

Further detail regarding the FD analyses can be found in chapter five.

3.3.5.3 Caregiver survey

Caregiver surveys were allocated an ID number that mirrored that of their child, e.g. a sample child ID was 01 and their parent 01. A column entitled 'matched' was included in the Microsoft Excel Caregiver Database, where a '1' indicated a match and was used to tally total matches. The Caregiver Database also included a 'missing column' where either 'child survey', 'caregiver survey' or 'both' was typed to enable the researcher to identify cases where follow up was required.

The Microsoft Excel Caregiver Database was imported into IBM SPSS version 23 (IBM Corp, 2015), where the SPSS Caregiver Database was created. As with the child survey, normality of distribution was assessed, the dataset cleaned and checked for erroneous coding. Any data entry queries were checked against original paper-based surveys and rectified through retyping the correct value. To explore the data, the PhD candidate conducted descriptive statistics for each question contained in the caregiver survey.

As with the child survey, a number of variables required recoding due to low cell counts. For example, caregiver educational attainment had the response options of 'primary school', 'secondary school', 'diploma or apprenticeship', 'undergraduate university degree', 'postgraduate university degree' or 'don't know'. These were recoded to 'primary or secondary school', 'diploma or apprenticeship', 'undergraduate or postgraduate university qualification'. 'Don't know' responses were removed. Additional variables that required recoding included the number of household storage facilities available; food preparation/cooking facilities available; caregiver recall of a promotional vegetable message/slogan; the number of vegetable types consumed by children; and social support options. Original survey response options for three household storage facilities (refrigerator; freezer; cupboard/pantry) included 'Yes' or 'No' response options for each facility. These were recoded to 'less than three food storage options' or 'three food storage options'. Original food preparation/cooking facility response options included a 'Yes' or 'No' response to nine individual facilities (stove/cook top; oven; running water; electricity; utensils/cooking equipment; barbecue; microwave; bench top; open fire). 'Running water'; 'Electricity'; 'Utensils/cooking equipment'; and 'Bench top' were removed due to 100% 'Yes' responses. The remaining variables were recoded to 'Access to gas/electrical appliances only' and 'Access to fire and gas/electrical appliances'. Caregivers were originally asked to recall a promotional health message or slogan relating to vegetables, via an open-ended

question. Responses were recoded to ‘Yes’ (‘Recalled a message/slogan’) or ‘No’ (‘Did not recall a message/slogan’). Caregivers were originally asked to respond ‘Yes’ or ‘No’ each to a list of five vegetable types (i.e. ‘Fresh’; ‘Frozen’; ‘Tinned’; ‘Dried’; ‘Juice’). To provide a measure of vegetable variety consumed by children (manuscript 6), this variable was summed and recoded into ‘Number of vegetable types consumed by child in past month’ categories. Access to social support networks originally included the response categories ‘No-one’; ‘Family member’; ‘Friend’; ‘Child’s school’; or ‘Other’ category, to which responses included the name of formal social support agencies. This variable was subsequently recoded to ‘No-one’, ‘Informal support’ (‘Family’; ‘Friend’); ‘Formal support’ (‘Child’s School’; ‘Agency’) / ‘both informal and formal support’. The last two categories (‘Formal support’; ’Both informal and formal support’) were combined due to low cell counts (n = 6, n = 3 respectively).

Analyses included:

1. Frequencies to examine household demographics and the proportion of children that consumed adequate F&V;
2. Chi-square tests to examine associations between adequate F&V consumption and:
    a. F&V types consumed by children;
    b. Remoteness.
3. Chi-square tests to examine:
    a. Associations between F&V types and remoteness;
4. Simple and multivariable logistic regression analyses to determine:
    a. The demographic factors that predicted child FI;
    b. The FSD that predicted adequate F&V intake (also adjusting for potential confounders/demographic factors).

Figure 14 (below) illustrates quantitative associations investigated in this study. Further detail regarding quantitative analyses can be found in chapters five, seven, eight and nine.

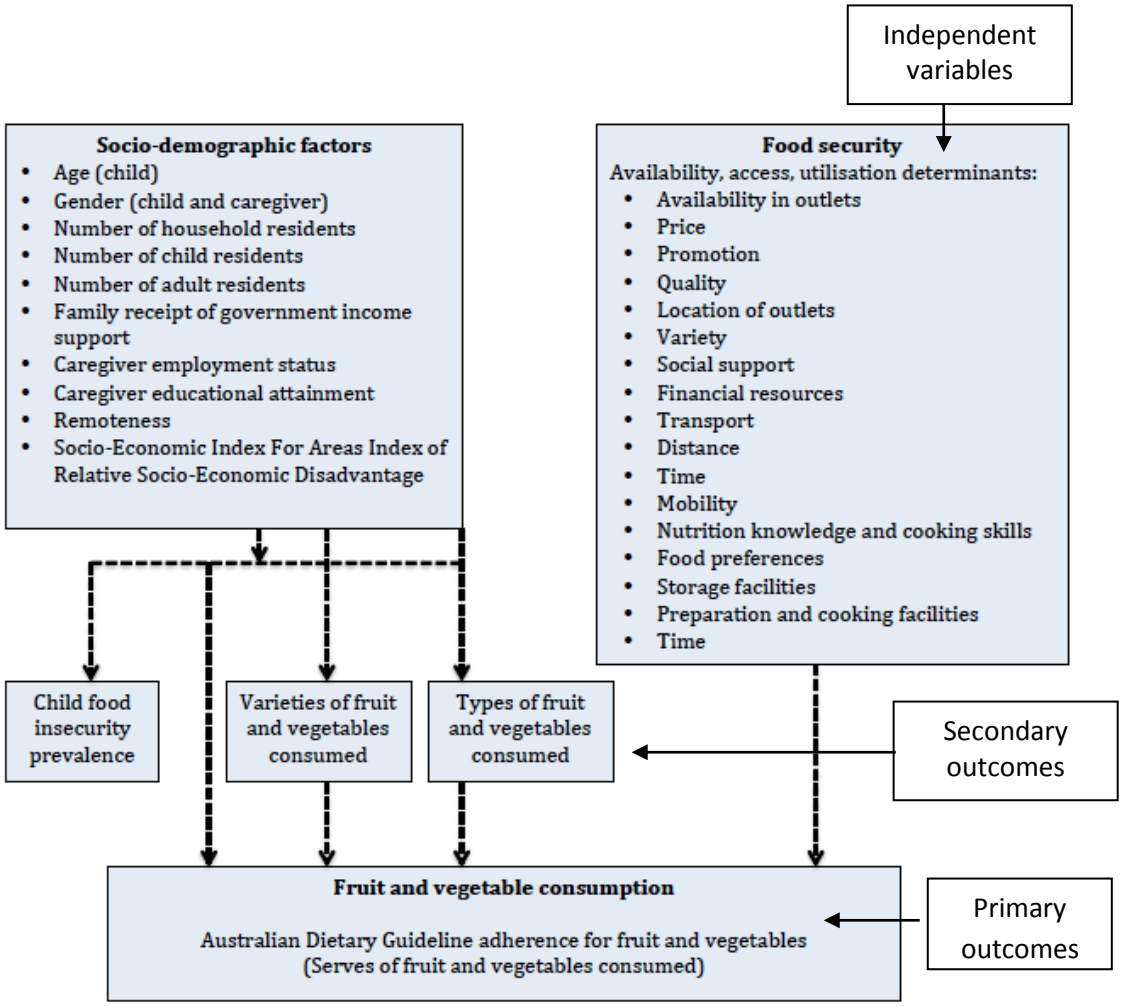


Figure 14: Quantitative data analysis framework: associations investigated (child survey, caregiver survey, child food diary)

3.3.5.4 Key informant interviews

All SSI were transcribed verbatim into Microsoft Word by the PhD candidate, rechecked for accuracy and imported into QSR Nvivo 10 (QSR International, 2014) for analysis. To ensure reliability, each transcript was twice checked to ensure accuracy of coding.

A coding frame was developed that included the topics (either F&V consumption or FSD or both). In addition, the code name, and description of the code were included. Exemplar quotes have been added to provide depth and understanding to the meaning of the code or theme (*Appendix E – Data analysis*).

In this study, an Ecological Model of Health Behaviour (McLeroy et al., 1988) was used to arrange nodes (codes) relating to F&V questions in the interview guide. These included the following theory-driven/deductive content (i.e. parent nodes used in the NVivo software):

- Intrapersonal factors;
- Interpersonal factors;
- Institutional factors;
- Community factors;
- Public policy factors.

Additional, separate parent nodes based on interview questions included:

- F&V quantities;
- F&V types and varieties;
- Strategies to increase F&V intake among children;
- Case nodes to categorise participants and enable matrix-coding queries, included:
    - Gender (child nodes of male and female);
    - Worker type (child nodes of school and youth, health, food supply);
    - WA region (child nodes of Kimberley, Pilbara, Goldfields, Midwest, Wheatbelt, Peel, South West, Great Southern);
    - Interview year (child nodes of 2013, 2014, 2015);
    - Interview method (child nodes of in-person, telephone);
    - ASGS RA category (child nodes of regional, remote).

FSD questions contained in the interview guide were based on the Determinants of Food Security framework (Rychetnik et al., 2003), and thus, template analysis of interviews occurred using these deductive nodes (King, 2004). Given that all of the deductive FSD nodes (except ‘mobility’) also related to F&V consumption, these were embedded as child nodes within the abovementioned overarching ecological themes. Mobility remained as a separate node. The embedded deductive FS child nodes included:

  - Location of food outlets;
  - Availability in outlets;
  - Price;
  - Quality;
  - Variety;
  - Promotion;
  - Financial resources;
  - Social support (recoded/split into ‘Informal social support’ and ‘Formal social support’ and embedded into ‘Interpersonal factors’ and ‘Institutional factors’ respectively);
  - Distance;
  - Transport (recoded/split into ‘Household transport to outlets’ and ‘Public transport’ and embedded into ‘Interpersonal factors’ and ‘Community factors’ respectively);
  - Nutrition knowledge and cooking skills (recoded/split into ‘Children’s food literacy’ and ‘Food literacy among parents’ and embedded into ‘Intrapersonal factors’ and ‘Interpersonal factors’ respectively);
  - Food preferences;
  - Food preparation and cooking facilities;
  - Food storage facilities;
  - Time;
- Mobility (remained as a separate node).

A thematic analysis was conducted, based on the process outlined by Braun and Clarke (Braun et al., 2006). As analyses continued, data-driven nodes (inductive codes) were created and added to the database under relevant deductive parent nodes. These included:

- School nutrition education and food skills programs;
- Health service provision;
- School governance and policy;
- Governance within food outlets;
- Health promoting spaces;
- Implementation of a store policy;
- Parental attitude towards F&V;
- Role modelling;
- Household provision of F&V; and
- Parental attitude to F&V.

A ‘summary of work’ detailed the date of coding and the work undertaken using the NVivo software (QSR International, 2014), while a personal reflective ‘research journal’ assisted the PhD candidate to identify and better understand patterns of data.

Manual analyses conducted in NVivo included word clouds to understand key aspects of themes and levels of influence (i.e. intrapersonal level influencers). In addition, matrix-coding queries were conducted by comparing sub-themes by demographic variables such as WA region.

To increase trustworthiness, a second member of the research team checked the themes/sub-themes coded by the lead author within QSR NVivo, by re-reading the quotes within a theme. A third team member listened to audio recordings of interviews to verify the accurate coding of themes and validate the essence of the thematic analyses that emerged (Godrich, 2016b).

Further information regarding qualitative analyses can be found in chapters four and six.

3.3.6 Phase 6: Research dissemination

3.3.6.1 Academic dissemination: conference presentations and journal articles

A Publication Plan was devised during Phase 1: Development and Study Approvals and updated throughout the PhD. As data analyses were undertaken, conference abstracts were submitted to, and subsequently accepted for, a number of local, national and international conferences. This was a strategy employed to disseminate the research findings and gain feedback from *researchers and practitioners* prior to development of full manuscripts.

Manuscripts that addressed each of the RQ were planned in consultation with the research supervisory team. Suitable journals were determined through research team discussions, impact factor searches, the Australian Research Council's Excellence in Research for Australia (ERA) list (Australian Research Council, 2016) and the Journal/Author Name Estimator website (The Biosemantics Group, 2016). Evidence demonstrating peer-review of each manuscript and accepted conference abstract has been included in *Appendix F – Evidence of peer review for journal articles and conference presentations*.

3.3.6.2 Dissemination to participants and wider community

Published manuscripts included within this Thesis with Publication have been promoted through social media (Twitter and Facebook). Other media forms (such as traditional print and radio) will be engaged via a specific media communication plan (currently in development under the guidance of Edith Cowan University's Corporate Communications team).

The DOE Evaluation and Accountability Directorate and participating *school principals* will receive an aggregated summary report of study findings; school principals will be encouraged to circulate this to the *class teachers* that consented for their class/classes to participate in this study.

Schools will be supplied with a pictorial school newsletter insert/infographic, should they wish to use it to showcase key study findings in their newsletter or on their school's website. This strategy will be used to report the study findings to *caregivers and children*.

In addition, a number of free, practical presentations based on published manuscripts will be offered to relevant staff from *government and non-government agencies* working in regional and remote WA (e.g. Foodbank WA, Cancer Council WA, Red Cross WA, Stephanie Alexander Kitchen Garden Foundation, EON Foundation, Diabetes WA etc.), with content tailored to increase the influence on practice. These presentations will be offered via face-to-face or videoconference delivery. Presentations will also be offered to interagency network groups. For example, one presentation is scheduled for the WA Health Promoting Schools Association's March 2017 committee meeting. Additional presentations will be offered to special working groups such as the proposed Charitable Food Sector Community of Practice WA Chapter (inaugural

meeting is scheduled for March 2017) and Charitable Food Sector Community of Practice National Forum (scheduled for April 2017). These interagency and working groups are comprised of agencies and individuals working with client groups that could be benefited by study findings. Short plain language summaries can also be provided to interested agencies for inclusion in their stakeholder newsletters (i.e. Public Health Advocacy Institute of WA, agencies listed above, community-based child health/family health services etc.). Further funding is also anticipated to be sought, to carry out regional/remote workshops/forums/presentations to discuss pertinent results for each region.

In addition, the research team compiled a Research Translation Reference Group (RTRG) Terms of Reference and proposed stakeholder list. The stakeholder list included *health, education, social work practitioners and food supply workers* from across WA. The purpose of this group is to act in an advisory role for the development of infographics, a translation strategy chosen to disseminate key findings to practitioners working within a range of sectors impacted by the topic areas. The RTRG will be provided with a copy of each draft infographic prepared (one per published manuscript) for comment and suggested use. Thereafter, the infographics will be finalised to ensure their relevance for the target group, before being circulated using social media and through the PhD candidate's and RTRG's professional networks. Infographics will also be circulated as a 'take-home' source of information after the agency presentations described above. Some of the infographics may also be appropriate for distribution through schools. Practitioners described above (RTRG members) will be encouraged to discuss the study outcomes with interested client groups.

3.4 Ethical considerations

A number of aspects of this study required due consideration of ethical issues, which have been summarised in Table 8 below:

Table 8: Ethical considerations addressed in this study

Consideration	How it was addressed in this study
Identification of appropriate research problem and research methods	• The PhD candidate's employment during the majority of the PhD required considerable travel across regional and remote WA. This afforded the physical opportunity to conduct numerous informal conversations with community members, workers and other key stakeholders over a number of years. This assisted with the identification of an appropriate research topic that would produce meaningful outcomes, in addition to development of methods and research-translation strategies. • The PhD candidate consulted a number of experienced school and health researchers during the study conceptualisation and data collection, to ensure methods were appropriate. Further, these researchers were also consulted to advise the research-translation phase that will extend beyond PhD candidature.
Ethics and Governance Approvals obtained	• The ECU Human Research Ethics Committee approved this study (project 8635). • The WA Department of Education (DOE) Evaluation and Accountability Directorate was consulted during the research conceptualisation phase and guided school-based processes. DOE provided approval for the study to be conducted in WA government schools. As a condition of approval, all site managers/principals will be provided with a summary report of research findings and the data cannot be used for any other purpose other than this research project. Consenting children went into a study-wide draw to receive a healthy eating fun pack (containing healthy cook books) and consenting caregivers received a healthy cookbook. • Catholic Education WA (CEWA) approval was sought and received after DOE approval was received. This enabled CEWA schools to be invited to join the study. • A significantly larger proportion of residents in the Kimberley region, compared to other WA regions, identify as Aboriginal or Torres Strait Islander. Therefore, the Kimberley Aboriginal Health Planning Forum (KAHPF) Research Sub-committee (inter-agency group) was consulted. Approval from the KAHPF committee, and stakeholder letters of support were received from various agencies/groups working in the Kimberley region and across WA. • Over the course of this study, a number of state government political discussions and potential policy changes across WA reportedly resulted in increased anxiety among regional and remote residents. In particular, among Aboriginal and Torres Strait Islander people in a particular region. During this time, one of the schools in this region agreed to participate in the study provided the study results were not compared between Aboriginal or Torres Strait Islander people and non-Aboriginal or Torres Strait Islander people. Another school recommended that their students not be asked to complete the child FS section of the child survey, due to the perceived underreporting that would occur. Informal discussions with other local stakeholders reinforced the sensitivity of the study topic at this point in time. Hence, the decision was made among the research team to analyse and report all study findings at the population level, without any comparisons between specific population groups.

Appropriate Consent Obtained	• As a requirement of study approvals from ECU and DOE, a number of layers of consent were required. These included: (1) School principal consent for their school's participation; (2) Class teacher consent for their class's participation; (3) Caregiver consent for their own participation; (4) Caregiver consent for their child's participation; (5) Children's consent for their own participation; (6) Key informant consent to participate in interviews. • As written consent was a requirement of participation, appropriate IL, explanations of study process and CF were developed for each participant group. • An on-site teacher and class briefing session was offered to schools, where possible, to further clarify study involvement, answer any questions about the study, and build rapport with schools and potential participants.
Avoid collecting harmful information	• Given some issues are sensitive, complex and involve interwoven factors, the PhD candidate was careful to stay to questions in the interview protocol (for key informant SSI). • Teachers were advised in their Teacher IL not to probe for any personal information, should they be required to assist children complete their child survey.
Data managed and analysed appropriately	• The non-digital data were kept in a locked filing cabinet in the PhD candidate's home office. • Digital data was stored on a password-protected computer and backed up to a USB device locked in the filing cabinet and password-protected DropBox folder. • Multiple perspectives were reported in the qualitative study.
Authorship of publications arising from this study	• As guided by the ECU Graduate Research School, the PhD Candidate used the Australian National University's Ready Reckoner to assist in deciding on co-authorship for each publication arising from this research. The tool facilitates a scoring system for each research activity conducted in the study relating to the publications, including research planning, execution, data analysis, interpretation and writing.
Data reported and shared	• A publication plan was devised to ensure the research findings were shared through appropriate peer-reviewed journals and conferences. A total of five manuscripts have either been published or are under review with national and international journals, with a sixth manuscript in preparation for submission. In addition, ten conference presentations have been delivered locally, nationally and internationally. • A communication plan has been developed, including research impact activities that extend beyond academia and PhD candidature. These include: o An aggregated summary of school-based results will provided to each participating school principal; o A school newsletter insert will be supplied to schools for use in their newsletter or online, to share key study findings; o Infographics and vignettes; o A series of free presentations, offered face-to-face or via videoconference, will be made available in 2017 to key stakeholders, interagency network groups and agencies working with regional and remote WA communities; o A specific media communication plan, including media releases, is currently being developed for dissemination of published results.

3.5 Summary

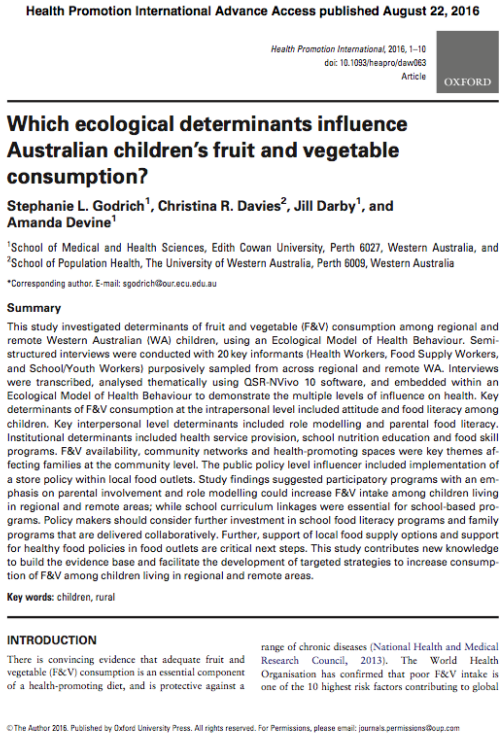
This chapter provided an overview of the mixed-methods approach used in this PhD study. The subsequent chapters include each of the manuscripts prepared for this Thesis with Publication. The next chapter (chapter 4) is the first chapter of concept 1 (fruit and vegetable consumption among regional and remote WA children) and provides a descriptive understanding of the determinants of F&V consumption among regional and remote WA children.

PART 1: FRUIT AND VEGETABLE CONSUMPTION AMONG REGIONAL AND REMOTE WESTERN AUSTRALIAN CHILDREN

CHAPTER 4: WHICH ECOLOGICAL DETERMINANTS INFLUENCE AUSTRALIAN CHILDREN'S FRUIT AND VEGETABLE CONSUMPTION?

4.0 Foreword

This chapter explores the ***first concept*** *outlined in this PhD,* ***F&V consumption among regional and remote WA children,*** *by utilising an Ecological Model of Health Behaviour to provide an understanding of the key determinants of children's F&V consumption in regional and remote WA. This chapter argues that in order to understand the complex determinants of F&V consumption, they must be examined across various levels of influence. This chapter answers* ***RQ 1: What are the determinants of F&V consumption among regional and remote WA children?*** *The chapter was submitted as a manuscript, and is published in Health Promotion International (Figure 15). The chapter commences with a brief abstract, followed by the introduction, overview of methods used, key results, discussion including recommendations, conclusions and a visual display of conference presentations, posters and the draft infographic to be used as a research translation strategy.*



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Article

OXFORD

Which ecological determinants influence Australian children's fruit and vegetable consumption?

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Summary

This study investigated determinants of fruit and vegetable (F&V) consumption among regional and remote Western Australian (WA) children, using an Ecological Model of Health Behaviour. Semi-structured interviews were conducted with 20 key informants (Health Workers, Food Supply Workers, and School/Youth Workers) purposively sampled from across regional and remote WA. Interviews were transcribed, analysed thematically using QSR-NVivo 10 software, and embedded within an Ecological Model of Health Behaviour to demonstrate the multiple levels of influence on health. Key determinants of F&V consumption at the intrapersonal level included attitude and food literacy among children. Key interpersonal level determinants included role modelling and parental food literacy. Institutional determinants included health service provision, school nutrition education and food skill programs. F&V availability, community networks and health-promoting spaces were key themes affecting families at the community level. The public policy level influencer included implementation of a store policy within local food outlets. Study findings suggested participatory programs with an emphasis on parental involvement and role modelling could increase F&V intake among children living in regional and remote areas; while school curriculum linkages were essential for school-based programs. Policy makers should consider further investment in school food literacy programs and family programs that are delivered collaboratively. Further, support of local food supply options and support for healthy food policies in food outlets are critical next steps. This study contributes new knowledge to build the evidence base and facilitate the development of targeted strategies to increase consumption of F&V among children living in regional and remote areas.

Key words: children, rural

INTRODUCTION

There is convincing evidence that adequate fruit and vegetable (F&V) consumption is an essential component of a health-promoting diet, and is protective against a range of chronic diseases (National Health and Medical Research Council, 2013). The World Health Organisation has confirmed that poor F&V intake is one of the 10 highest risk factors contributing to global

Figure 15: Godrich, S.L. Davies, C.R., Darby, J., Devine, A. (2016). Which ecological determinants influence Australian children's fruit and vegetable consumption? Health Promotion International doi 10.1093/heapro/daw063.
Link: https://academic.oup.com/heapro/article-abstract/doi/10.1093/heapro/daw063/2555422/Which-ecological-determinants-influence-Australian?papetoc

4.1 Abstract

Objective: This study investigated determinants of F&V consumption among regional and remote WA children, using an Ecological Model of Health Behaviour.

Methods: Semi-structured interviews were conducted with 20 key informants (Health Workers, Food Supply Workers, and School/Youth Workers) purposively sampled from across regional and remote WA. Interviews were transcribed, analysed thematically using QSR-NVivo 10 software, and embedded within an Ecological Model of Health Behaviour to demonstrate the multiple levels of influence on health.

Results: Key determinants of F&V consumption at the intrapersonal level included attitude and food literacy among children. Key interpersonal level determinants included role modelling and parental food literacy. Institutional determinants included health service provision, school nutrition education and food skill programs. F&V availability, community networks and health-promoting spaces were key themes affecting families at the community level. The public policy level influencer included implementation of a store policy within local food outlets.

Discussion: Study findings suggested participatory programs with an emphasis on parental involvement and role modelling could increase F&V intake among children living in regional and remote areas; while school curriculum linkages were essential for school-based programs. Policy makers should consider further investment in school food literacy programs and family programs that are delivered collaboratively. Further, support of local food supply options and support for healthy food policies in food outlets are critical next steps.

Conclusion: This study contributes new knowledge to build the evidence base and facilitate the development of targeted strategies to increase consumption of F&V among children living in regional and remote areas.

4.2 Introduction

There is convincing evidence that adequate F&V consumption is an essential component of a health-promoting diet, and is protective against a range of chronic diseases (National Health and Medical Research Council, 2013a). The World Health Organization has confirmed that poor F&V intake is one of the 10 highest risk factors contributing to global mortality (World Health Organization, n.d.-a). Despite this

evidence, many Australian children consume amounts of F&V below the recommendations set by the ADG of two serves of fruit and five serves of vegetables for children 9–11 years, while for children aged 12–13 years, the vegetable recommendation is 5 serves for girls and 5.5 serves for boys (National Health and Medical Research Council, 2013a). Surveys found almost one quarter (21.3%) of children consumed inadequate amounts of fruit and almost 90% consumed suboptimal amounts of vegetables (Tomlin et al., 2014). There is clear evidence to demonstrate that F&V intake among many WA children is suboptimal, yet the determinants of consumption remain unexplored.

One theoretical model of health behaviour useful in the exploration of these determinants is an Ecological Model of Health Behaviour, which investigates the interaction of factors across multiple 'levels of influence' (Glanz et al., 2008). The intrapersonal level relates to the biological or physical influences on health, such as knowledge and attitudes. Impacts at an interpersonal level include relationships between family members, peers and the influence of social culture on health (McLeroy et al., 1988). Institutional level impacts include school and social institution rules. The community level influences health behaviour through availability of healthy food in food outlets and also community-driven groups and power structures that allocate resources to improve health outcomes. Public policy includes overarching policies within the local, state or national context (Glanz et al., 2008; McLeroy et al., 1988). An understanding of specific factors occurring at various levels of influence is a vital link in the chain of strategies to increase children's F&V intake.

Not only is a better understanding of children's F&V drivers important for all children, it is particularly important among children living in regional and remote areas. These children have poorer health behaviours, including lower F&V consumption (Tomlin et al., 2014), than their metropolitan-dwelling counterparts (Australian Institute of Health and Welfare, 2014). However, the collection of information is challenging, given WA spans a vast 2 526 786 km^2 or 20 times the size of England (Butcher et al., 2014). The ASGS Remoteness Structure classifies a large majority of WA as Remote and Very remote with classifications determined by a location's access to services (Australian Bureau of Statistics, 2014b). This geographical isolation has typically resulted in these areas being beyond the scope of many major health surveys (Australian Bureau of

Statistics, 2011). With 23% of WA's population of 2.5 million people residing in regional or remote areas (Australian Bureau of Statistics, 2014b), and 27% of WA's children living in these areas (Commissioner for Children and Young People, 2015), research investigating the drivers of children's dietary intake is vital. The aim of this study was to investigate key informant perceptions of the determinants of F&V consumption among regional and remote WA children, using an Ecological Model of Health Behaviour.

4.3 Methods

4.3.1 Design and sampling

The present study forms part of a broader investigation into how children's F&V consumption is impacted by FI (Godrich, 2017). 'Key informants' such as dietitians, nutritionists and health promotion professionals facilitating food literacy programs (Health Workers), school principals, teachers or youth workers (School/Youth Workers) or people managing/working in local food outlets or farmers' markets (Food Supply Workers) comprised the sample. The use of these particular worker types provided broader insight into children's F&V consumption from a range of perspectives. These informant groups were believed to possess adequate knowledge on the topic given their role related to children's consumption (such as nutrition education or school F&V provision). Therefore, results provided by these insights would fall under multiple levels of influence (e.g. individual, organisational). Potential Health, and School/Youth Worker participants were identified via stratified purposive sampling (Patton, 1990) and were sourced from a stakeholder database comprising individuals sourced through professional networks across regional/remote WA. The third participant group, Food Supply Workers, were identified through internet (Google) search. Wherever possible, the proportion of individuals invited to participate from each WA region (e.g. Pilbara) represented the proportion of the WA non-metropolitan population in that region. This was determined by the Department of Regional Development's region profiles (Department of Regional Development, 2014). Participants reported on locations ranging in remoteness (Australian Bureau of Statistics, 2012a, 2014b) and SEIFA deciles, identified through the Australian Bureau of Statistics State Suburb Index of Relative Socio-economic Disadvantage 2011 data cube (Australian Bureau of Statistics, 2013f).

SSI were the chosen method to provide rich, detailed information regarding accessibility of services, health behaviours and how they were affected by various circumstances (Brikci et al., 2007). The study investigators constructed the SSI guide, which contained a list of questions that began with an informant depiction of the food environment in their town/region. The next set of questions was guided by the Determinants of Food Security model (Rychetnik et al., 2003) which underpinned the wider study. Succeeding questions were linked to the study's research questions and focussed on the: perceived amounts of F&V children were consuming from the informants' perspective; types of F&V commonly consumed by children; barriers and enablers of F&V consumption; strategies to increase consumption (existing or proposed) and to make F&V more appealing; motivators for children's F&V consumption; and children's perception of consequences associated with suboptimal F&V intake. The SSI guide was initially piloted in one interview, with amendments made prior to use in main data collection.

4.3.2 Data collection

Potential informants were invited to participate in the study using a method containing two communication points; firstly, an initial telephone call sought interest in study participation, while a follow up email further described the study in a written invitation letter and consent form. The information letter included an overview of the research topic, confidentiality information, ethics/governance approvals and use of results, etc. Of the 30 people invited, 20 provided written consent (67% participation rate) to participate in an interview of up to 60 minutes with the lead author. The three people who responded to but declined the invitation to participate indicated they were either not interested or didn't have time to participate. Seven people did not respond to the invitation. The lead author was trained in interview facilitation and qualitative data analysis and conducted all interviews for consistency. Interviews occurred between June 2013 and September 2015 as one component of a PhD. Given the geographic expanse between interviewer and interviewees, and therefore budget constraints, four interviews were conducted face-to-face and 16 via telephone. Interviews on average were 41 minutes (26 minutes for in-person and 44 minutes for telephone) and quality of contextual information did not differ by methodology. All participants provided permission for their interview to be recorded. Interview notes were taken in case of device failure, however the device did not fail for any interviews. After interviews were

conducted, the general themes arising were recorded in interview notes.

4.3.3 Data analysis

Data analysis occurred concurrently with data collection, to ascertain when saturation had been reached (Tong et al., 2007). The lead author transcribed interviews verbatim using Microsoft Word, and re-checked them for transcription accuracy. QSR-NVivo 10 software (QSR International Pty Ltd. Version 10, 2014) was used to manage the transcribed interviews and conduct interview coding. To increase trustworthiness, a second member of the research team checked the themes/sub-themes coded by the lead author within QSR NVivo, by re-reading the quotes within a theme. A third team member listened to audio recordings of interviews to verify the accurate coding of themes and validate the essence of the thematic analyses that emerged. All transcripts were de-identified and classified by year of interview, informant type, gender, remoteness, WA region, and interview method (e.g. in-person or telephone). Template analysis was one of the techniques used in the thematic analysis of this data, and is particularly useful when investigating the opinions of various worker types regarding an issue (King, 2004). This theoretical approach is often used with 20–30 participants, and is useful with large amounts of complex data (King, 2004), such as this study. The *a priori* codes created included the Ecological Model of Health Behaviour (McLeroy et al., 1988) levels of influence, which were the deductive overarching themes, e.g. 'intrapersonal factors'. These overarching themes were defined in the NVivo database as 'parent nodes' to demonstrate hierarchy in the coding frame (Braun et al., 2006). This hierarchical coding is particularly useful for understanding the relationship between themes and similarities and differences within and between themes (King, 2004). The deductive sub-themes ('child nodes' within the NVivo database) identified a priori were sourced from the Determinants of Food Security model (Rychetnik et al., 2003) which underpinned the wider study. These child node sub-themes were embedded within the parent node overarching themes they most closely related to, for example, the deductive child node sub-theme 'financial resources' was embedded within the deductive parent node overarching theme 'interpersonal factors'. Inductive, data-driven sub-themes (Braun et al., 2006) were also included as child nodes embedded within the overarching themes. Statements were coded into as many sub-themes as applicable (parallel coding) (King, 2004). Refinement included combining or separating sub-themes as required. A 'summary of work' documented data analyses undertaken by date, and a 'research

journal' contained memo summaries of interview transcripts, codes created and summaries of common themes in order to examine emerging patterns within these data. A comparison of interview transcripts, absence of new information and absence of new codes in the NVivo database was an additional measure undertaken to confirm that saturation had been reached. Analyses conducted manually included word frequencies and word clouds across each Ecological Model of Health Behaviour level of influence. Theoretically determined sub-themes relating to the Determinants of Food Security (Rychetnik et al., 2003) model were the focus of another paper. Therefore, these sub-themes were only included in the analyses for this paper where responses referred specifically to F&V consumption. Group-to-group validation was undertaken by exploring sub-themes by worker type, WA geographical region and regional vs. remote location, in addition to matrix-coding queries.

4.3.4 Ethical approvals

This study was approved by the Edith Cowan University Human Research Ethics Committee.

4.4 Results

Participants comprised 40% Health Workers (*n* = 8), 30% School and Youth Workers (*n* = 6) and 30% Food Supply Workers (*n* = 6). Twelve participants reported on regional WA while eight reported on remote WA. Eighty per cent of participants were female (*n* = 16). The 10 non- respondents' characteristics included 90% Food Supply Workers/10% Health Workers; nine regional/one remote WA resident; 60% males/40% females. All themes were incorporated into each Ecological Model of Health Behaviour level of influence; with specific sub-themes for each level of influence discussed in depth below.

4.4.1 Intrapersonal level influencers

The determinants of F&V intake among WA children identified in this study at the intrapersonal level are displayed in Figure 16, with two sub-themes described below:

4.4.1.1 Attitude (21 coded statements)

Attitudes were quite often linked with convenience. Children were perceived to consume F&V when it was conveniently located, such as on a kitchen bench top or pre-

chopped. Health Workers reported ready-to-eat fruit at school or part of community activities was quickly 'devoured', whereas if children had to prepare the items, or they were inconvenient, they were less likely to consume them, e.g.:

> *"I think some of the fruit in the school situation, like an orange is messy to eat… They like mandarins as they pop out of the skins easily. An orange is messy, watermelon is messy, melons are messy. I guess there aren't really good facilities to wash their hands once you have messy, sticky hands." (School/Youth Worker)*

4.4.1.2 Food literacy/nutrition knowledge among children (25 coded statements)

Children's knowledge and skills, specifically relating to F&V intake, was a facilitator and barrier to intake. Some children were believed to understand the diet-disease connection, but did not realise the enormity of the impact. Many informants believed that a lack of education within the home environment led to lower nutrition knowledge and skills among children, whereas some children taught their parents. Primary sources of nutrition information in some areas included television, school, magazines and online (e.g. social media). In other areas, service providers and schools were identified as the primary information sources. Participatory programs that either demonstrated that F&V preparation need not be difficult and/or encouraged children make the link between diet and health were highly regarded. Possession of knowledge and skills did not always translate into health-promoting behaviours, with the short-term reward of the convenience of unhealthy food often prevailing over the purchasing and preparation of F&V, e.g.:

> *"I think there is a strong awareness about healthy and un- healthy foods here. There is no doubt that the adults and the kids know about it and the kids are getting taught at school, what is healthy and unhealthy. People don't always practice what they preach." (School/Youth Worker)*

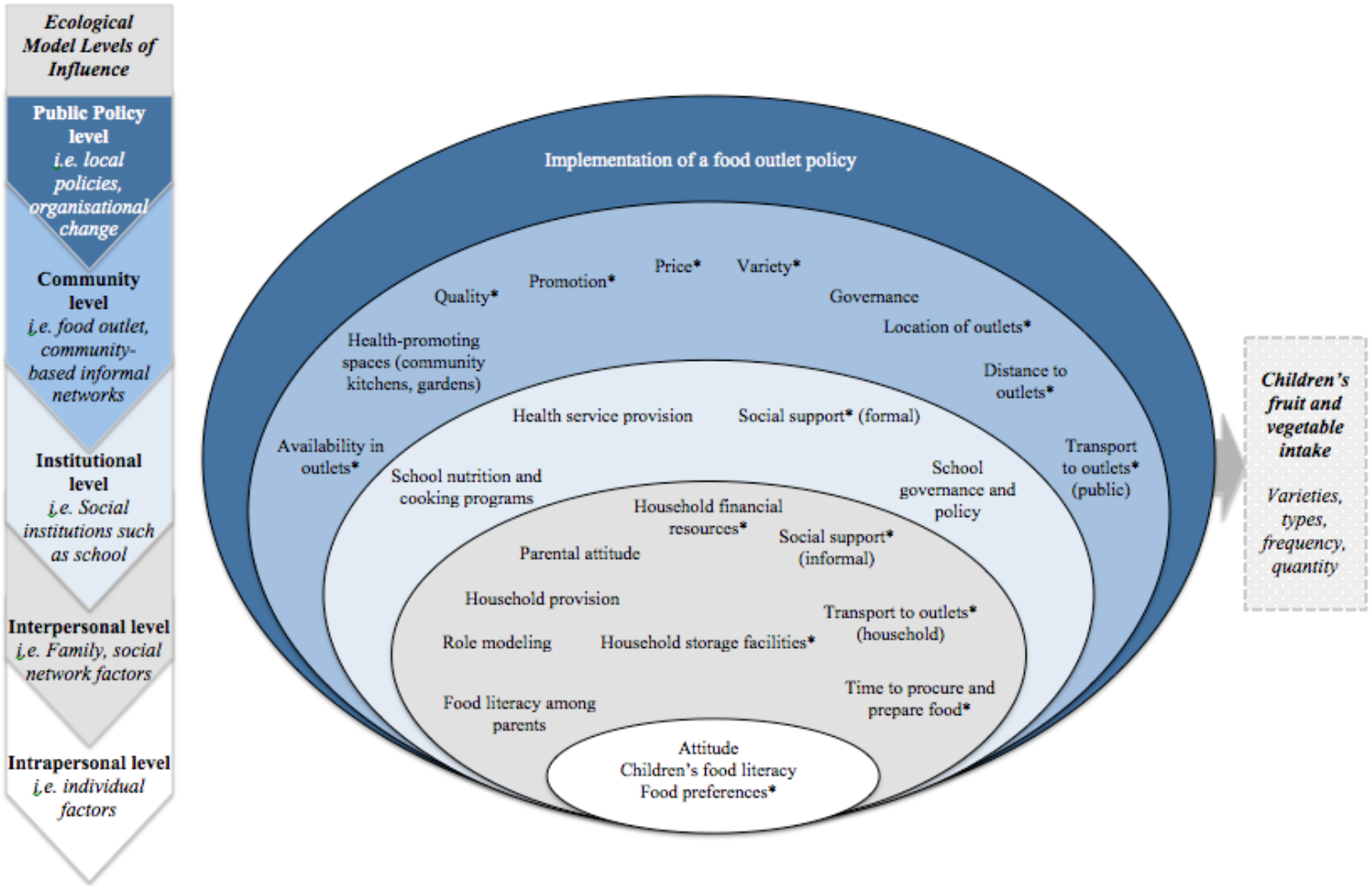

Figure 16: An ecological model of the determinants of fruit and vegetable consumption among regional and remote WA children (Adapted from the model described by McLeroy et al.).*Theoretical nodes (Godrich, 2017) based on the Determinants of Food Security model (Rychetnik et al., 2003) and only included where responses specifically related to children's F&V consumption.

4.4.2 Interpersonal level influencers

The determinants of F&V intake among regional and remote WA children identified in this study at the interpersonal level are displayed in Figure 16. Two prominent sub-themes discussed by informants were:

4.4.2.1 Food literacy among parents (52 coded statements)

Overall, informants discussed a wide spectrum of nutrition knowledge and skills relating to consumption of F&V. Health promotion messages such as 'Go for 2&5®' (http://www.gofor2and5.com.au) were perceived to be well known, despite the campaign being no longer funded in WA. A lack of awareness of cooking techniques were issues cited; there was a general belief that many parents didn't consider purchasing bulk produce at a reduced cost when in-season and freezing or preserving the produce. Further, limited recipe knowledge and skill sharing between generations were issues cited, e.g.:

> *"We have an example doing some food literacy stuff with some young mums. Just coming across the fact that they don't like fruit and veg, they don't feed it to their children. And don't necessarily have the skills to prepare it either. . . If you've got a generation of parents now. . . who might have grown up mostly on fast food and things like that. How do you persuade them that it would be wise for them to learn some cooking skills so they can feed their children more healthy stuff?" (Health Worker)*

In agricultural and farming towns, the level of nutrition knowledge and cooking skills were perceived as relatively high, with food preserving techniques and recipe sharing commonplace. Informants believed this was attributed to a closer connection to producers.

4.4.2.2 Role modelling (13 coded statements)

The demonstration of healthy eating behaviours, involving children in F&V preparation or passing down of knowledge to children from parents was discussed frequently. Role modelling was believed to start with parents, however parent's friends, close family, sporting stars and after-school program staff were believed to exert considerable influence over children's F&V intake, e.g.:

"The other thing was the role modelling thing. It might not be your parents eating the right thing; it might be uncle Stan or some other esteemed adult or something. The value of going to someone else's house is I think, being introduced to foods you might not have at home, just in different ways. . . Exposing kids to different foods where they might not have." (Health Worker)

4.4.3 Institutional level influencers

The determinants of F&V intake among regional and remote WA children identified in this study at the institutional level are displayed in Figure 16. Two most prominent sub-themes discussed by informants were:

4.4.3.1 School nutrition and cooking programs (43 coded statements)

Schools often acted as critical enablers of F&V consumption, providing F&V in the form of breakfast or lunch programs, or morning tea fruit platters. This was particularly the case in remote areas. Schools also facilitated nutrition education and food literacy initiatives, with informants positively discussing programs that incorporated hands-on cooking and nutrition across curriculum in fun, engaging and experiential ways. Education provided via kitchen garden programs was believed to filter through to the home environment through children educating their parents, however, children were believed to have difficulty in transferring learnt skills to real life situations, e.g.:

"Probably many have the knowledge but transferring that to buying and planning menus and so on, I think can be tricky.... They can recite what's good for you and what you shouldn't eat but actually cooking it and giving it to their family can sometimes get lost in their other needs I suppose of what else is happening in their lives." (School/Youth Worker)

Crunch&Sip® (http://www.crunchandsip.com.au) was the most frequently discussed school-based program facilitating childhood F&V consumption across WA. Crunch&Sip® is coordinated by the Cancer Council WA and involves a classroom break that enables students to consume water, fruit or salad vegetables they have brought to school (Cancer Council Western Australia, 2015). Key informants acknowledged the program as a useful reminder, encouraging parents to provide F&V to their children to take to school.

4.4.3.2 Health service provision (39 coded statements)

Some informants expressed frustration regarding unsustainability of health and education programs. Some programs were 'one-offs' and didn't consider the local community environment in which they were being delivered. Many service providers had a geographically expansive jurisdiction, such as delivery of health promotion programs across an entire WA region. This resulted in ad hoc delivery due to insufficient or recently withdrawn funding, e.g.:

> *"The Healthy Schools Project ran out of funding, so that meant that a lot of services targeted at schools were cut. So I feel a lot of services that are going on in schools at the moment, like Crunch&Sip® , like Food Sensations®, if we had more resources to put into those. Again, they're there, they just need to be delivered and promoted a lot more. I think education with parents and teachers as well, which is sometimes overlooked and it just compliments what is going on with kids." (Health Worker)*

Further compounding the issue, insufficient collaboration among service providers with 'different agendas' detracted from the potential effectiveness of behaviour change initiatives, due to competing message delivery. Informants reinforced the importance of focussing on community priorities, which would increase the sustainability of initiatives. Evident gaps in service provision resulted in age groups such as early childhood missing out. Positive attributes of successful programs included flexibility, exciting, hands on and use of colourful recipes. Most importantly, successful initiatives were depicted as community initiated, driven and considered the local community's environment.

4.4.4 Community level influencers

The determinants of F&V intake among regional and remote WA children identified in this study at the community level are displayed in Figure 16. Two sub-themes discussed by informants were:

4.4.4.1 Availability within food outlets (70 coded statements)

F&V availability was the most coded determinant across this level of influence. When described as a barrier, it was 'limited', 'reduced' and 'not really available'. Availability was generally discussed negatively in remote areas. Some shops were closed for periods

of the day, which resulted in community members purchasing takeaway food from stores that were open. Some towns only stocked small quantities of fresh produce; amounts were further reduced when there was an influx of contractors such as during times of mining exploration. Large community events or delivery issues such as unpredictable weather patterns further affected produce in some locations, e.g.:

> *"The roads are starting to deteriorate now, once it's wet, it's impassable. That shop owner has to fly stuff in...then planes get delayed or they have to carry people instead of food, then its delayed 3 weeks, it could be 4 weeks. That's everywhere." (Health Worker)*

Availability was also an enabler, positively described as 'fresh', 'local' and 'seasonal'. Some outlets received F&V deliveries two or three times weekly, and where possible, ordered from local producers. Farmers' markets were positively described, with seasonal produce, while market gardens and roadside stalls increased availability of locally produced F&V.

4.4.4.2 Community health-promoting spaces (14 coded statements)

Important discourse arose around the role of community spaces and activities promoting F&V consumption among children. These included communal cooking spaces for families to prepare food and community gardens open for anyone to source food. These spaces often increased exposure to a variety of F&V. Further, community sporting groups were seen as important avenues for promoting health messages to children, given the popularity of children's sport in rural areas. Some local food outlets sponsored local sporting events with F&V, as they felt it was their role to promote a healthy image within their community. One example of a community space promoting children's F&V intake included the town swimming pool, e.g.:

> *"When they do laps at the pool, they are swimming they are exercising, that physical exercise is great for them. They get fruit at the end of a certain number of laps, and that's available at the pool." (Health Worker)*

4.4.5 Public policy level influencers

Issues at the strategic public policy level were the least discussed by respondents in this study, with few statements coded. The determinant at this level is displayed in Figure 16, with the most prominent sub-theme discussed by informants including:

4.4.5.1 Implementation of a food outlet policy (6 coded statements)

Better education around bringing F&V into stores and increasing community advocacy for healthy options were key issues within this sub-theme. Many discussions focussed on the potential positive impact a reduction in availability of energy-dense, nutrient-poor options could have, e.g.:

> *"It would be great if there was a store policy because then more things could be regulated around access to food and, you know, having healthy foods more accessible and getting a better balance between junk and healthy options, or having the healthier options of the junky food available. There is no regulation around that." (Health Worker)*

Some informants witnessed the change in stores pre- to post- policy implementation, resulting from a new management model, describing how the healthier food was displayed in prominent positions. Others worked in towns where no policy existed; believing minimising choice of unhealthy items was imperative.

4.5 Discussion

This study aimed to explore ecological determinants of F&V consumption among regional and remote WA children. While other studies have relied on literature reviews to ascertain the key drivers to healthy eating among children (Jenkins et al., 2005; Krolner et al., 2011; Rasmussen et al., 2006; Shepherd et al., 2006; Thomas, 2003), the use of SSI with Health Workers, Food Supply Workers and School/Youth Workers elicited a deeper understanding of prominent issues (Brikci et al., 2007). An Ecological Model of Health Behaviour (Glanz et al., 2008) mapped resulting determinants at each level of influence. While findings from previous studies suggest single levels of influence contribute significant new knowledge to the literature (Haynes-Maslow et al., 2013; Wyse et al., 2011), this study explored the influence of complex, interwoven factors that drive F&V intake at multiple levels. In this study, a lack of nutrition knowledge and cooking skills further impacted value of F&V, with 'junk' food choices often prevailing over F&V. Research suggests children possess limited nutrition knowledge and skills (Goh et al., 2009) and are affected by social influences (Croll et al., 2001), which also supports our finding of poor food literacy among parents acting as a barrier to consumption. This finding was consistent with other studies (Goh et al., 2009; Niklas et al., 2013) that found adults lacked knowledge about various ways to

prepare F&V, therefore reducing children's consumption (Goh et al., 2009; Niklas et al., 2013). MacLellan concluded that while parents wanted to utilise new F&V, they lacked an ability to use them in the home environment (MacLellan et al., 2004). On the contrary, in this study, some parents were described as having excellent knowledge around F&V purchasing and preparation, particularly when they lived in agricultural areas. This supports other research that found parental knowledge of the positive benefits that F&V can have on health, and knowledge of healthy preparation methods, were key drivers to consumption (Yeh et al., 2008). Role modelling was a key determinant in this study, which corroborates previous work that found that role modelling by influential people influences healthy eating behaviours of children's and adolescent's (O'Dea, 2003). Institutional level influencers included the disadvantage of ad hoc health service provision that lacked follow up. School nutrition education and food skills programs were praised, however, funding to enhance these efforts was discussed as imperative. Reduced access to service provision makes adherence to a nutritious diet challenging (Barnidge et al., 2013; Pollard, Nyaradi, et al., 2014), contributing to the higher chronic disease risk factors, poorer health outcomes and shorter lifespan of people living in regional and remote areas (Australian Institute of Health and Welfare, 2008b). At the community level, F&V availability was very inconsistent across WA. Sporadic delivery due to food supply issues and limited availability of basic necessities including F&V (Australian Institute of Health and Welfare, 2008a, 2013(Boyington et al., 2009) and high costs (Boyington et al., 2009; MacLellan et al., 2004; Yeh et al., 2008) were obstacles cited by previous research and supported by our findings. Implementation of a store policy in food outlets was believed to result in positive change. The current absence of Government nutrition policies has been criticised, with calls for improved policy around product placement, labelling and incentive systems (Pollard et al., 2013; Sacks et al., 2008), as well as increased efficiency in the food supply chain (Pollard, Nyaradi, et al., 2014).

4.5.1 Strengths and limitations

The diversity of experience among key informants, purposively sampled to provide a range of perspectives across settings was a key strength of this study, as was the inclusion of participants from the majority of WA regions and across regional/remote areas. Further, the validation strategy using a 'rich, thick description' of themes provides a detailed overview of key issues (Creswell, 2014). In addition, the integration

of study findings within an Ecological Model of Health Behaviour depicts the comprehensive and interconnected determinants of F&V consumption, noted as a particularly important perspective in F&V research with rural communities (Dean et al., 2011). One limitation is that permissions precluded the investigation of how the themes presented in this study may be similar or different between population groups such as Culturally and Linguistically Diverse people or Aboriginal and Torres Strait Islander people. Although the two-year data collection timeframe is a limitation, the absence of significant nutrition policy changes during the data collection period suggests results would not have been substantially impacted.

4.5.2 Implications

This research contributes significant new knowledge to the currently sparse evidence base pertaining to determinants of F&V consumption among children. Potential grass-roots strategies to prioritise include participatory, family-focused programs with an emphasis on parental involvement (New South Wales Department of Education and Communities, 2015) and role modelling to increase F&V intake among children; an emphasis on school curriculum linkages (New South Wales Department of Education and Communities, 2015) and a focus on 'fun' in school-based program components. In order to have a significant impact on F&V intake, public policy needs to be implemented that considers an ecological framework and incorporates the numerous factors that impact health (Moore et al., 2011). One issue requiring political prioritisation includes continued investment in school food literacy programs, which have been included in both WA and national health strategies (Department of Health, 2012; National Preventative Health Taskforce, 2009). Secondly, investment in family programs that are delivered collaboratively with education and health workers and focus on local priorities are imperative to enable parental skill-building. Thirdly, and a critical next step is the increased support for food outlets/ stores to implement healthy eating policies, source local food supply options and thus create strategies promoting healthy food choices in communities (Story et al., 2008).

4.6 Conclusion

This research adds important new information to the scant literature around regional and remote WA. It also provides greater understanding about how children's F&V consumption is impacted across multiple conduits. Increasing F&V intake among

children could contribute to a reduction in chronic disease risk factors (National Health and Medical Research Council, 2013b). Given that dietary risk factors contribute the highest disease burden in Australia (Institute for Health Metrics and Evaluation, 2014), removing barriers and increasing facilitators of F&V intake for children in regional and remote areas is likely to increase consumption, resulting in a healthier nation with a lower burden of disease.

4.7 Summary

This chapter provided an overview of the key drivers of regional and remote WA children's F&V consumption, from the perspectives of key stakeholders. Figures 17-22 below include the infographic and snapshots of the conference presentations delivered relating to this chapter. The next chapter (Chapter 5) will examine WA children's F&V consumption. Specifically, the quantities, types and varieties consumed by WA children.

4.8 Research impact activities arising from Chapter 4

The following includes the draft infographic that was based on this chapter's findings, in addition to related conference presentations delivered locally and nationally.

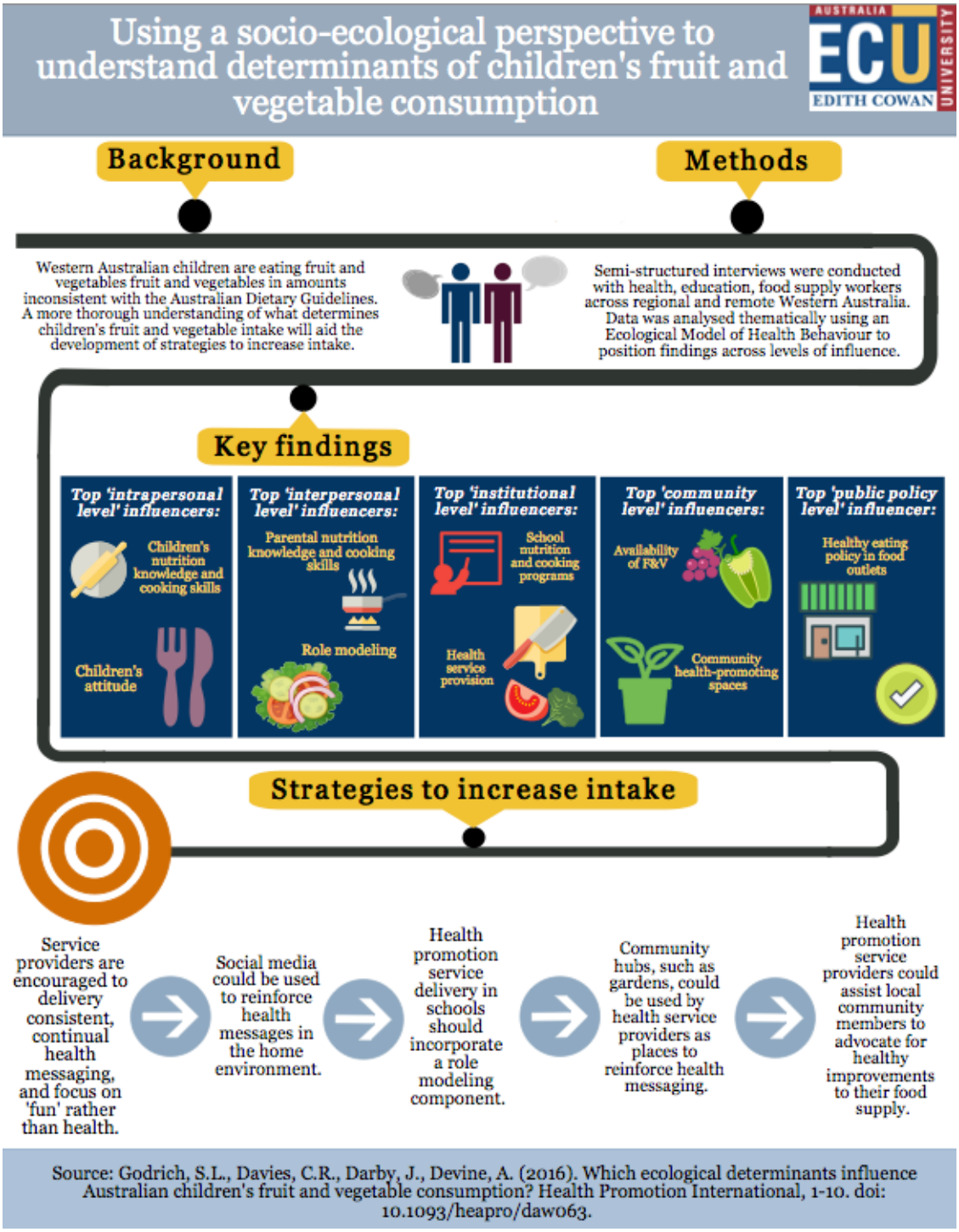

Figure 17: Paper 1 draft infographic for stakeholder review.

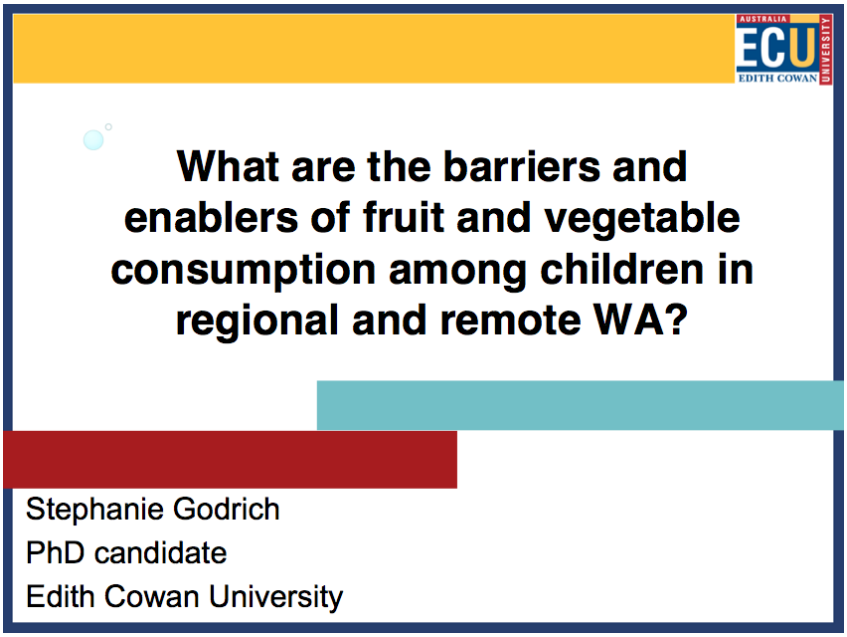

Figure 18: Godrich, S., Darby, J., Davies, C., Devine, A. (2014, July). What are the barriers and enablers to fruit and vegetable consumption among children in regional and remote Western Australia? Paper accepted for oral presentation at the Aboriginal Health Conference, Perth, Western Australia.

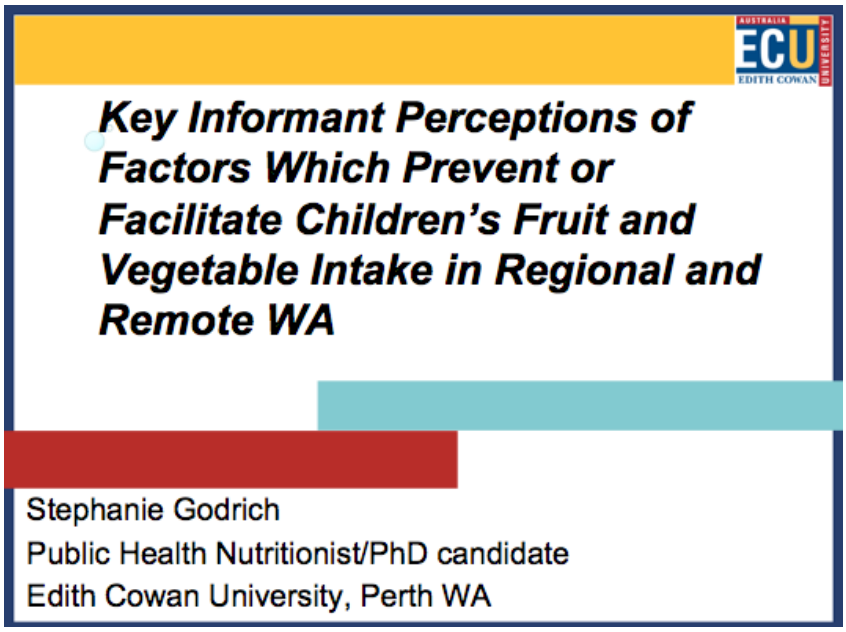

Figure 19: Godrich, S., Darby, J., Davies, C., Devine, A. (2015, May). Key informant perceptions of factors that prevent or facilitate children's fruit and vegetable intake in regional and remote Western Australia. *Paper accepted for oral* ***presentation at the 13th National Rural Health Conference, Darwin, Northern Territory.***

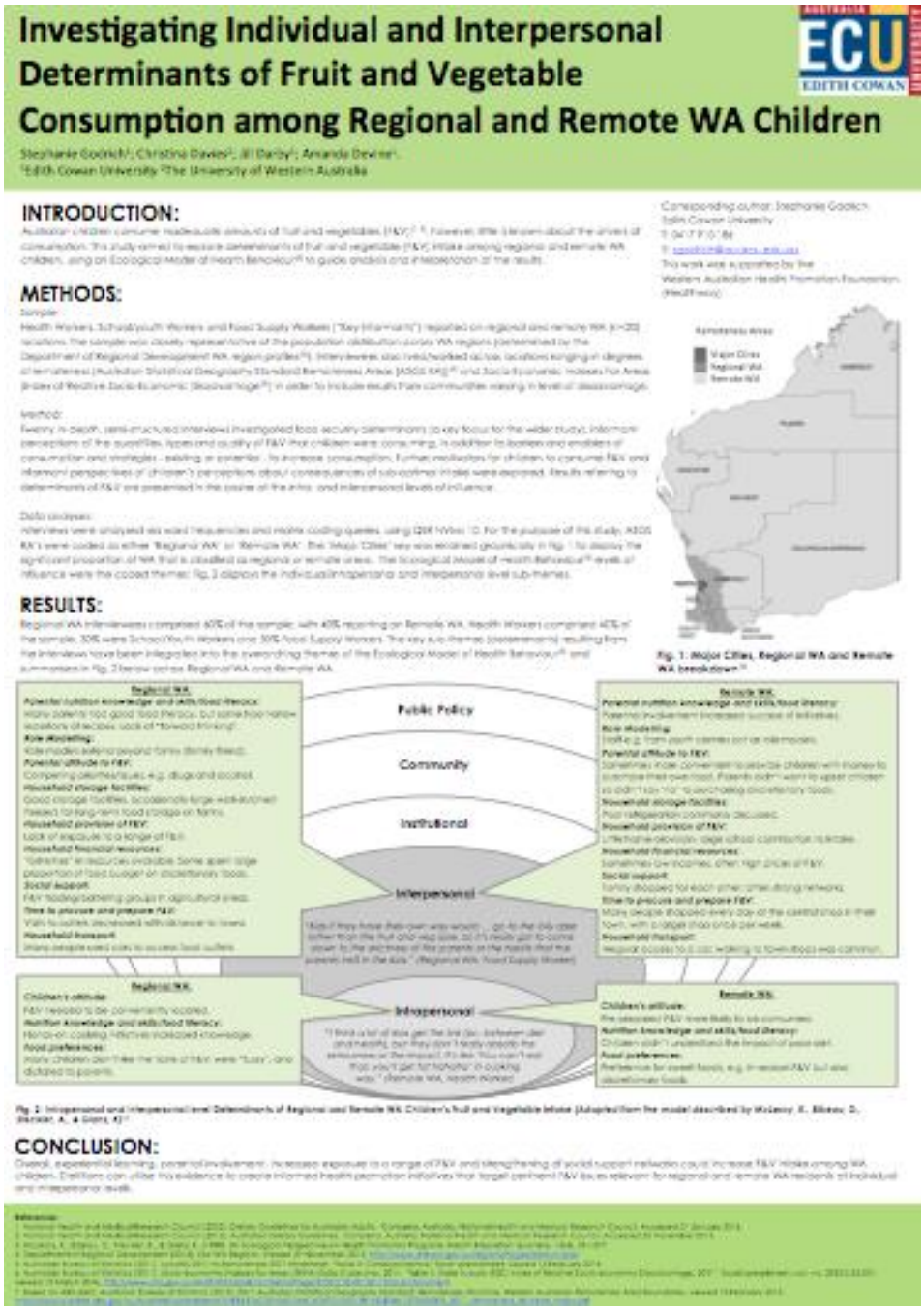

Figure 20: Godrich, S., Davies, C., Darby, J., Devine, A. (2016, May). Investigating individual and interpersonal determinants of fruit and vegetable consumption among regional and remote WA children. Paper accepted for poster presentation at the Dietitians Association of Australia 33rd National Conference, Melbourne, Victoria.

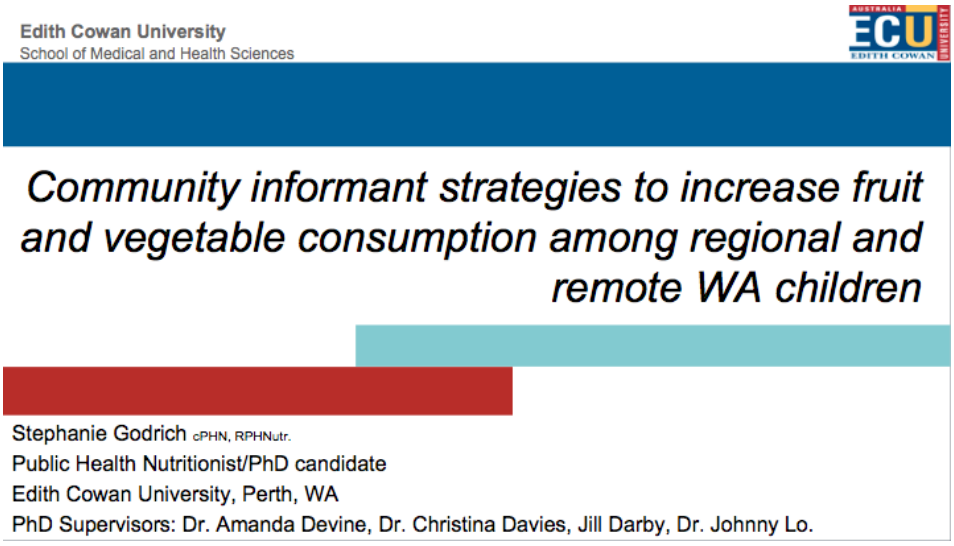

Figure 21: Godrich, S., Davies, C., Darby, J., Devine, A. (2016, June). Community informant strategies to increase fruit and vegetable consumption among regional and remote WA children. Paper accepted for oral presentation at the 23rd National Australian Health Promotion Association Conference, Perth, Western Australia.

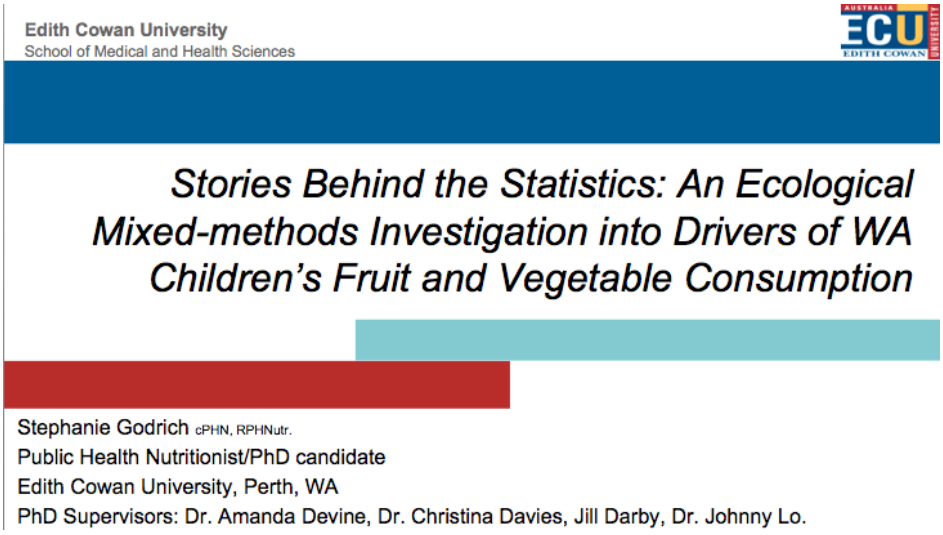

Figure 22: Godrich, S., Davies, C., Darby, J., Lo, J., Devine, A. (2016, June). Stories behind the statistics: An ecological mixed-methods investigation into drivers of WA children's fruit and vegetable consumption. Paper accepted for oral presentation at the 23rd National Australian Health Promotion Association Conference, Perth, Western Australia.

CHAPTER 5: ARE REGIONAL AND REMOTE WESTERN AUSTRALIAN CHILDREN EATING FOR GOOD HEALTH? AN INVESTIGATION INTO FRUIT AND VEGETABLE CONSUMPTION

5.0 Foreword

This chapter completes the ***first concept*** *explored within this PhD,* ***F&V consumption among regional and remote WA children.*** *The chapter provides a quantification of regional and remote children's consumption of F&V, the types and varieties they consumed. Data are sourced from caregiver surveys and 24-hour FD. Overall findings for regional and remote WA children are discussed. Comparison between regional and remote WA is also presented. This chapter argues that closer scrutiny of children's consumption needs to occur in order to develop tailored strategies to increase consumption in regional and remote areas. This chapter answers* ***RQ 2: What quantities, varieties and types of fruit and vegetables do children living in regional and remote WA consume and how do these compare to the serves recommended by the ADG?*** *This chapter is published in the Health Promotion Journal of Australia (Figure 23). The manuscript commences with a brief abstract, followed by an introduction, an outline of methods used, key results, discussion, conclusion and an infographic developed based on this chapter's findings.*

Health Promotion Journal of Australia
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Brief Report

Are regional and remote Western Australian children eating for good health? An investigation into fruit and vegetable consumption

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Abstract

Issue addressed: Little is known about the fruit and vegetable (F&V) habits of regional and remote Western Australian (WA) children beyond quantities consumed. This study aimed to ascertain the proportion of regional and remote WA children who met the Australian Dietary Guidelines (ADG) for F&V, the types and varieties of F&V consumed, and whether consumption behaviour was associated with remoteness.

Methods: Caregiver and child dyads (n = 256 dyads) completed similar paper-based surveys, 196 of these children completed 24-h dietary records. Statistical analyses were conducted using IBM SPSS (version 23).

Results: Overall, children were less likely to adhere to vegetables (15.4%) than fruit (65.8%) guidelines. Adherence to the ADG did not significantly differ between regional and remote locations. However, a higher proportion of remote children consumed dried fruit compared with regional children, while significantly more regional children compared with remote children consumed from the "pome, tropical and stone fruit" group and the "starchy vegetables", "red/orange vegetables" and "dark green leafy vegetables" groups.

Conclusions: Many regional and remote WA children consumed F&V in suboptimal amounts. Further research should aim to ascertain factors that increase or decrease the likelihood of ADG adherence across regional and remote WA and determine why certain F&V variety groups and types differed in consumption across Remoteness Areas.

So what: This study provided closer scrutiny of WA children's F&V consumption habits, highlighting the differences in consumption behaviours due to remoteness and identifying specific areas that require further investigation.

Key words: diet, nutrition, rural and regional health.

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Introduction

In 2013, the World Health Organization declared 5.2 million deaths worldwide were attributed to low fruit and vegetable (F&V) consumption.[1] Low consumption, particularly in childhood, is concerning given lifelong dietary behaviours are developed and established during these years.[2]

Australian children's fruit consumption is relatively high; from 2014–2015, almost 70% of children aged 9–13 years consumed adequate amounts of fruit, according to the 2013 Australian Dietary Guidelines (ADG).[3,4] However, vegetable consumption was largely suboptimal; only 2.8% consumed adequate vegetables.[5] In Western Australia (WA), almost two-thirds of children aged 9–15 years consumed the recommended two serves of fruit,[5] while almost one in 10 consumed five or more vegetable serves per day.[5]

Data on F&V consumption in regional and remote WA is currently combined[6] either as "non-metropolitan"[7] or "country"[8] data, which precludes closer scrutiny of regional versus remote consumption. In addition, some reports do not provide regional and remote data. This study aimed to ascertain the proportion of regional and remote WA children who met the ADG for F&V, the types and varieties of F&V consumed, and whether consumption behaviour was associated with remoteness.

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Figure 23: Godrich, S.L., Lo, J., Davies, C.R., Darby, J., Devine, A. (2016). Are regional and remote Western Australian children eating for good health? An investigation into fruit and vegetable consumption. Health Promotion Journal of Australia. Advance Online Access, doi 10.1071/HE16090. Online link: http://www.publish.csiro.au/HE/HE16090

5.1 Abstract

Objective: Little is known about the F&V habits of regional and remote WA children beyond quantities consumed. This study aimed to ascertain the proportion of regional and remote WA children who met the ADG for F&V; the types and varieties of F&V consumed; and whether consumption behaviour was associated with remoteness.

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Results: Overall, children were less likely to adhere to vegetables (15.4%) than fruit (65.8%) guidelines. Adherence to the ADG did not significantly differ between regional and remote locations. However, a higher proportion of remote children consumed dried fruit compared with regional children, while significantly more regional children compared with remote children consumed from the 'pome, tropical and stone fruit' group and the 'starchy vegetables', 'red/orange vegetables' and 'dark green leafy vegetables' groups.

Conclusions: Many regional and remote WA children consumed F&V in suboptimal amounts. Further research should aim to ascertain factors that increase or decrease the likelihood of ADG adherence across regional and remote WA and determine why certain F&V variety groups and types differed in consumption across Remoteness Areas. This study provided closer scrutiny of WA children's F&V consumption habits, highlighting the differences in consumption behaviours due to remoteness and identifying specific areas that require further investigation.

5.2 Introduction

In 2013, the World Health Organization declared 5.2 million deaths worldwide were attributed to low F&V consumption (World Health Organization, 2016). Low consumption, particularly in childhood, is concerning given lifelong dietary behaviours are developed and established during these years (Kelder et al., 1994).

Australian children's fruit consumption is relatively high; from 2014–2015, almost 70% of children aged 9–13 years consumed adequate amounts of fruit, according to the 2013 ADG (Australian Bureau of Statistics, 2015b; National Health and Medical Research Council, 2013a) However, vegetable consumption was largely suboptimal; only 2.6%

consumed adequate vegetables (Australian Bureau of Statistics, 2015b) In WA, almost two-thirds of children aged 9–15 years consumed the recommended two serves of fruit (Tomlin et al., 2014), while almost one in 10 consumed five or more vegetable serves per day (Tomlin et al., 2014).

Data on F&V consumption in regional and remote WA is currently combined (Australian Institute of Health and Welfare, 2014), either as 'non-metropolitan' (Martin et al., 2008) or 'country' data (Tomlin et al., 2014), which precludes closer scrutiny of regional versus remote consumption. In addition, some reports do not provide regional and remote data. This study aimed to ascertain the proportion of regional and remote WA children who met the ADG for F&V; the types and varieties of F&V consumed; and whether consumption behaviour was associated with remoteness.

5.3 Methods

5.3.1 Sampling

Children aged 9–13 years and their caregivers (caregiver–child dyad) were recruited using non-random sampling at schools. This age range facilitated comparison with the ADG (National Health and Medical Research Council, 2013a). A database including WA non-metropolitan schools was created, containing contact information sourced from authority websites (Association of Independent Schools of Western Australia (Inc). 2012; Catholic Education WA, 2012; Department of Education WA, 2012a). Sample size calculations were performed prior to recruitment. A sample of 245 children and 245 of their caregivers was deemed required.

Schools listed on the database were categorised by WA region (i.e. Pilbara) (Department of Regional Development, 2014) and Remoteness Area (Australian Bureau of Statistics, 2014b). Where possible, school sampling reflected the proportion of schools from regions, Remoteness Areas and spanned levels of disadvantage (Australian Bureau of Statistics, 2013f). Rapport-building techniques were incorporated to increase participation rates (Martin et al., 2008; Trapp et al., 2011). Schools eligible to participate in the Foodbank WA *Food Sensations*® program were invited to participate in the present study. The lead researcher was an employee or consultant of Foodbank WA during the data collection period and statewide travel for employment provided an opportunity for rapport-building during recruitment (i.e. teacher and class briefing sessions) (Trapp et al., 2011).

5.3.2 Survey tools

Child surveys, caregiver surveys and FD were used. Child and caregiver surveys included similar questions to verify results gained from each participant group, and were pictorial to account for literacy issues. Questions asking about 'usual' number of F&V serves consumed by children and the 24-hour dietary diary from the Child and Adolescent Physical Activity and Nutrition Survey (Martin et al., 2008) were used with permission. Investigator-initiated questions included demographics (i.e. age) and types of F&V consumed in the previous month.

5.3.3 Recruitment

As this study was conducted in schools, written consent from principals, class teachers, caregivers and children was required. An IL was developed for each participant group that included a study overview, approvals, data use, an outline of study processes and a CF.

Thirty-two schools were invited to participate via an initial telephone call, followed by an email. The email included a principal IL, a CF and a DOE WA approval letter. Twenty-three school principals (71.8%) consented to participate. Principals nominated classes of children aged 9–13 years to participate. Of the 71 teachers invited, 69 (97.2%) consented, which resulted in 74 classes participating.

All 1,814 students and their caregivers in consenting classes were invited. Whenever possible, a teacher and class briefing session was conducted (68.9%, n = 51 classes) as a rapport-building technique and to disseminate study packs that included caregiver/child IL's and CF's, surveys and food diaries. Where a briefing session was not possible/declined (31.1%, n = 23 classes), study packs were mailed to class teachers.

A total of 347 caregivers (19.1%) and 340 children (18.7%) consented to participate. Out of these, a total of 256 dyads completed both the child and caregiver surveys, and thus were included in the sample.

5.3.4 Data collection

5.3.4.1 Caregiver and child Surveys

Data collection occurred between March 2013 and December 2015. During this period, 26 caregiver–child dyads were included in validity and reliability testing to ensure survey tools and methods were appropriate. The caregiver survey was completed at

home and the child survey completed in class. Stickers and sealable envelopes were provided to ensure privacy.

5.3.4.2 Twenty-four-hour food diary

Children and teachers viewed a FD instructional DVD prepared by the lead author. A class pack containing photographs of portion guides (Cancer Council Victoria, 1994) was provided, to assist children to correctly complete their FD. Class teachers and caregivers were asked to assist children with entries as required.

Each class's labelled envelopes containing CF, completed surveys and FD were posted to the study centre in pre-paid postal envelopes.

5.3.5 Data analysis

Returned surveys and FD were matched, identification numbers allocated and de-identified. Unmatched surveys were excluded. Caregiver and child data were entered into separate Microsoft Excel databases and imported into IBM SPSS (IBM Corp, 2015). Caregivers reported the number of F&V serves that their child usually consumed each day, in addition to F&V types consumed by children in the previous month. These data determined ADG adherence and F&V types consumed. To ascertain F&V variety groups, FD data were entered into Xyris FoodWorks version 8 Professional (Xyris Software Australia Pty Ltd, 2012) by a single trained nutritionist. Ten per cent of the sample was rechecked for coding accuracy. FoodWorks automatically quantified and assigned F&V serves from F&V variety groups. Analyses conducted in SPSS included descriptive statistics. Chi-square tests were used to conduct cross-tabulations (e.g. between fruit types consumed and remoteness).

The Edith Cowan University Human Research Ethics Committee (project 8635) provided approval for this study.

5.4. Results

5.4.1 Demographics

Compared with the WA population, a significantly larger proportion of this sample was from remote WA, female, aged between 25–54 years and had a higher mean number of children and total people per household (all $p < 0.001$) (Table 9).

Table 9: Demographics of study sample respondents

Demographics	Sample	Proportion of the WA Population (Australian Bureau of Statistics, 2013a) (n=2,239,170)
Percentage from Regional and Remote WA (n=253)		
Regional WA	56.1%	71.9%*
Remote WA	43.9%	28.1%*
Caregiver Gender (n=252)		
Female	84.9%	49.7%
Male	15.1%	50.3%
Caregiver age (years) (n=248)		
25-34	16.5%	23.7%
35-44	58.1%	24.0%
45-54	23.7%	22.7%
55-64	1.2%	18.6%
65-74	0.4%	11.1%
Residents living in the household (n=252)		
Mean number of people per household	4.6	2.6
Mean number of children per household	2.5	1.9

*Proportion of total regional and remote WA population of 594,957 people.

5.4.2 Fruit and vegetable dietary guideline adherence among regional and remote Western Australian children

Approximately two-thirds (65.8%, n = 158) of caregivers reported their child met/exceeded the 2013 ADG for fruit (≥ 2 serves of fruit daily). Only 15.4% (n = 37) of caregivers reported their child consumed ≥ 5 serves of vegetables daily. Children's ADG adherence for F&V (total respondents and by remoteness) has been included in Figure 24.

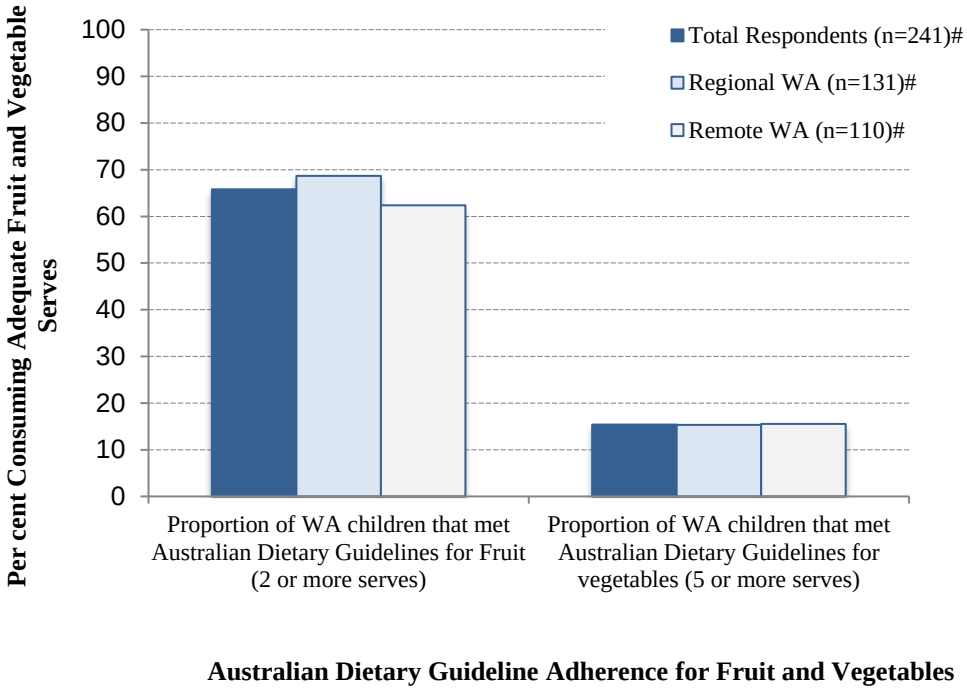

Figure 24: The proportion of regional and remote Western Australian children that met the Australian Dietary Guidelines for fruit and vegetables. Results are presented for total respondents and examined by regional and remote location.

No significant differences between regional WA and remote WA children's adherence to ADG for fruit (68.7% vs. 62.4% adherence) or vegetables (15.3% vs. 15.5% adherence). #Due to missing values, responses for the total sample ranged from *n* = 240-241; regional WA responses were *n* = 131; remote WA responses ranged from *n* = 109-110.

5.4.3 Fruit and vegetable types consumed by regional and remote Western Australian children

Fresh fruit and fresh vegetables were the most common types consumed. Almost all children who consumed adequate fruit consumed fresh fruit (98.7%, *n* = 155); all children who consumed adequate vegetables consumed fresh vegetables (100%, *n* = 37) in the last month. Children's consumption of F&V types (total respondents and by remoteness) has been included in Figure 25.

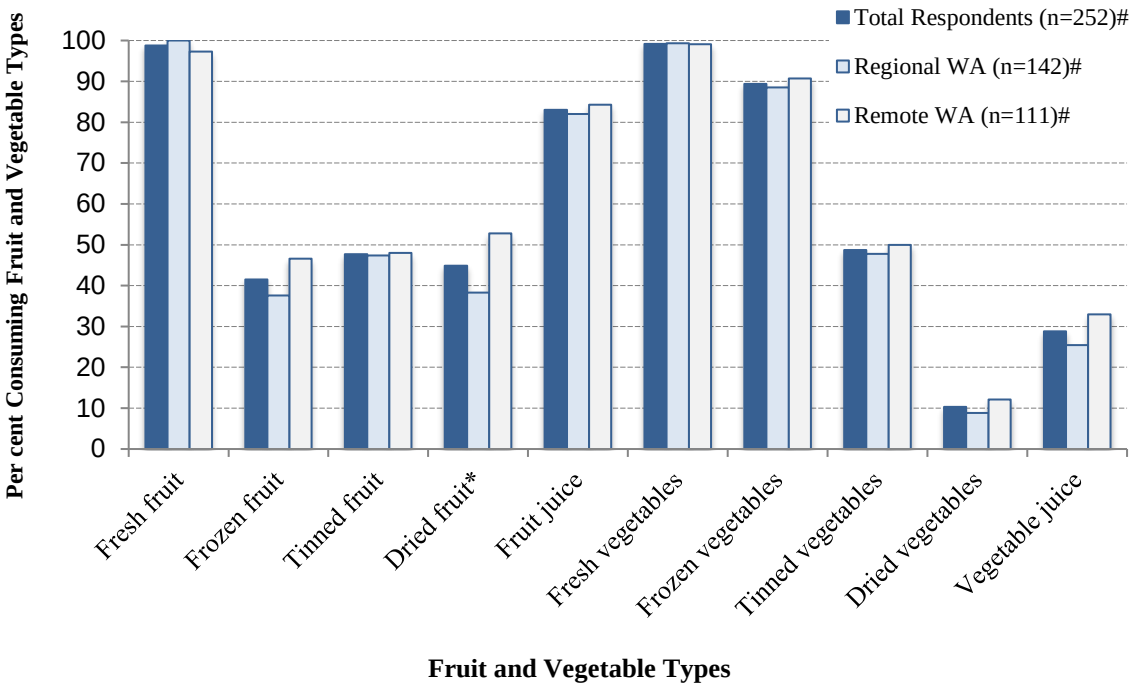

Figure 25: The proportion of regional and remote Western Australian children that consumed fruit and vegetable types in the previous month. Results are presented for total respondents and examined by regional and remote location.

*Significantly higher consumption of 'Dried fruit' type in remote WA compared with regional WA (52.8% vs. 38.3%, $p = 0.026$). #Due to missing values, responses for the total sample ranged from n = 224-252; regional WA responses ranged from n = 125-142; remote WA responses ranged from n = 99-111.

5.4.4 Fruit and vegetable variety groups consumed by regional and remote Western Australian children

'Pome, tropical and stone fruit' was the most consumed fruit group, while almost one-third of children consumed vegetables from the 'zucchini, eggplant and pumpkin' group. No association was found between consumption of F&V varieties and F&V guideline adherence. Children's consumption of F&V varieties (total respondents and by remoteness) has been included in Figure 26.

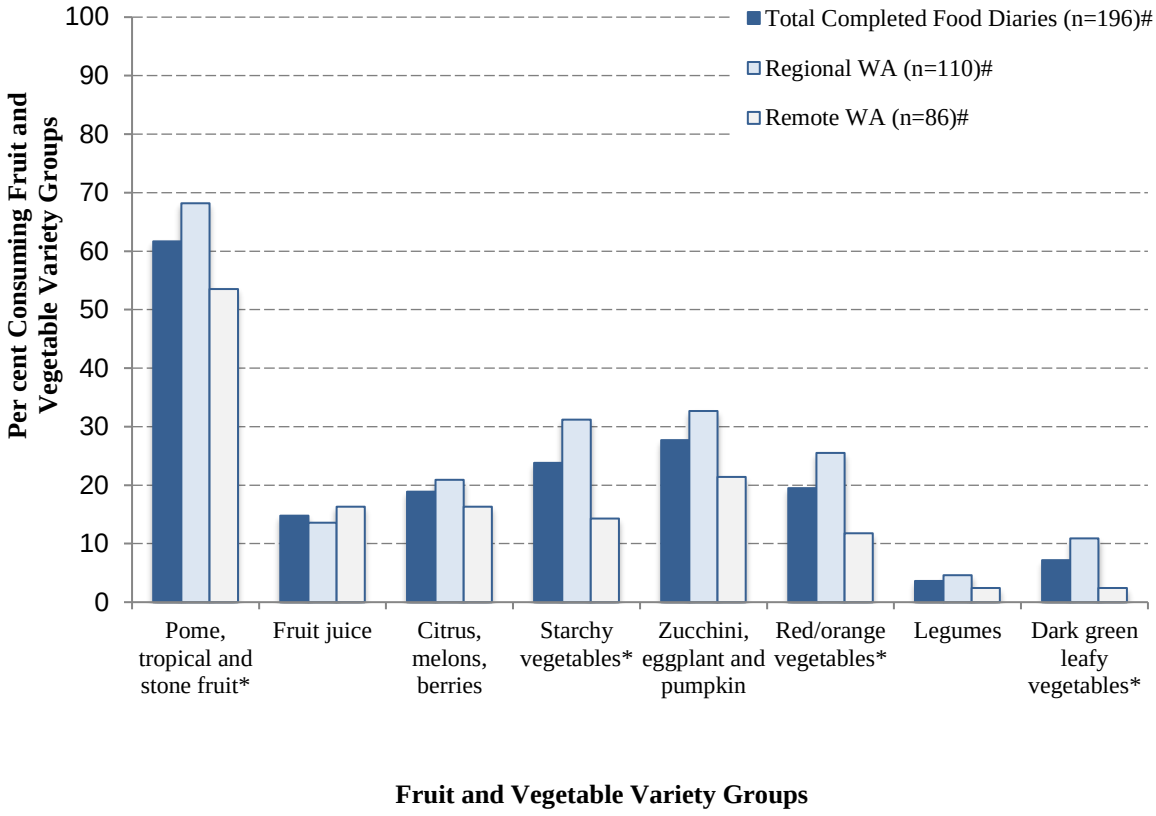

Figure 26: The proportion of regional and remote Western Australian children consuming fruit and vegetable varieties, according to a 24-hour food diary. Results are presented for total respondents and examined by regional and remote location.

*Significantly higher consumption in regional WA vs. remote WA of 'pome, tropical and stone fruit' (68.2% vs. 53.5%, $p = 0.036$); 'starchy vegetables' (31.2% vs. 14.3%, $p = 0.006$); 'red/orange vegetables' (25.5% vs. 11.8%,$p = 0.017$); and 'dark green leafy vegetables' (10.9% vs. 2.4%, $p = 0.022$). #Due to missing values, responses for the total sample ranged from n = 191-196; regional WA responses ranged from n = 107-110; remote WA responses ranged from n = 84-86.

5.5 Discussion

Key findings included that 65.8% of children met the ADG recommendation for fruit; 15.4% met ADG vegetable recommendations. No significant associations existed between ADG adherence and remoteness. Fresh fruit and fresh vegetables were the most commonly consumed F&V types. A higher proportion of remote children consumed dried fruit compared with regional children, while significantly more regional children compared with remote children consumed from the 'pome, tropical and stone fruit' group and the 'starchy vegetables', 'red/orange vegetables' and 'dark green leafy vegetables' groups.

The percentage of children in this study who met the fruit ADG (65.8%, n = 158) and vegetables (15.4%, n = 37) was higher than in previous WA surveillance data. Previous data indicated that 64.0% of children met fruit guidelines and 8.8% met vegetable guidelines (Tomlin et al., 2014). Our finding that remoteness was not significantly associated with fruit or vegetable ADG adherence supported major Australian surveys (Australian Institute of Health and Welfare, 2012, 2014). Our previous research suggested this was, in part, due to the contribution many remote schools made to children's F&V intake through breakfast or lunch programs (Godrich, 2016b). The differences in F&V types and varieties consumed by regional and remote children participating in this study could result from higher availability, affordability and quality produce in some locations (Godrich, 2016b).

Strengths of this study included using a caregiver–child dyad to provide an understanding of F&V consumption from two perspectives. Children completed the 24-hour FD, which measured children's consumption of F&V varieties. Caregivers completed the caregiver survey, which included questions about children's 'usual' F&V serves and F&V types consumed. Additional strengths included that children and caregivers were sampled in both regional and remote WA and across various levels of disadvantage.

Limitations included the significantly higher proportion of remote residents, females, caregivers aged 25–74, child residents and total number of household residents, compared with the WA population ($p < 0.001$). This resulted in a non-representative sample. The requirements for written consent and the completion of surveys by both caregivers and children are likely to have contributed to the lower sample size and lengthy data-collection timeframe. Surveys used in this study were developed before the release of the 2013 ADG. The 2013 ADG recommend 5.5 serves of vegetables for boys aged ≥ 12 years. Consequently, information about half-serves of vegetables was not collected; serves of vegetables > 5 serves were rounded down for this age group (8.6%, n = 22). F&V serve size prompts provided in this study's surveys were based on the 2003 ADG. Therefore, one example of a vegetable serve was '1 medium potato'. In contrast, the 2013 ADG refers to 'half a medium potato' as one vegetable serve (National Health and Medical Research Council, 2013b). Therefore, it is possible the vegetable serves for some participants may have been underestimated, based on this

particular prompt. This impacted other studies conducted before and during the new ADG release (Australian Bureau of Statistics, 2014a).

5.6 Conclusion

Almost two-thirds of the children surveyed consumed fruit in adequate amounts for good health; however, the majority of children consumed suboptimal vegetable amounts. Further research in regional and remote WA should (1) ascertain which factors increase or decrease the likelihood of ADG adherence among children, particularly for vegetables; and (2) explore which factors contribute to children's significantly higher consumption of F&V groups and types in particular regional and remote WA locations.

5.7 Summary

This chapter provided a closer examination of regional and remote WA children's F&V consumption in relation to adequate quantities, types and varieties consumed. Figure 27 (below) contains the infographic developed with this chapter's results. The next chapter will introduce the second concept explored in this PhD, ***FS among regional and remote WA children,*** *through a qualitative investigation of the FSD among regional and remote WA children.*

5.8 Research impact activities arising from Chapter 5

The following includes the draft infographic that was based on this chapter's findings.

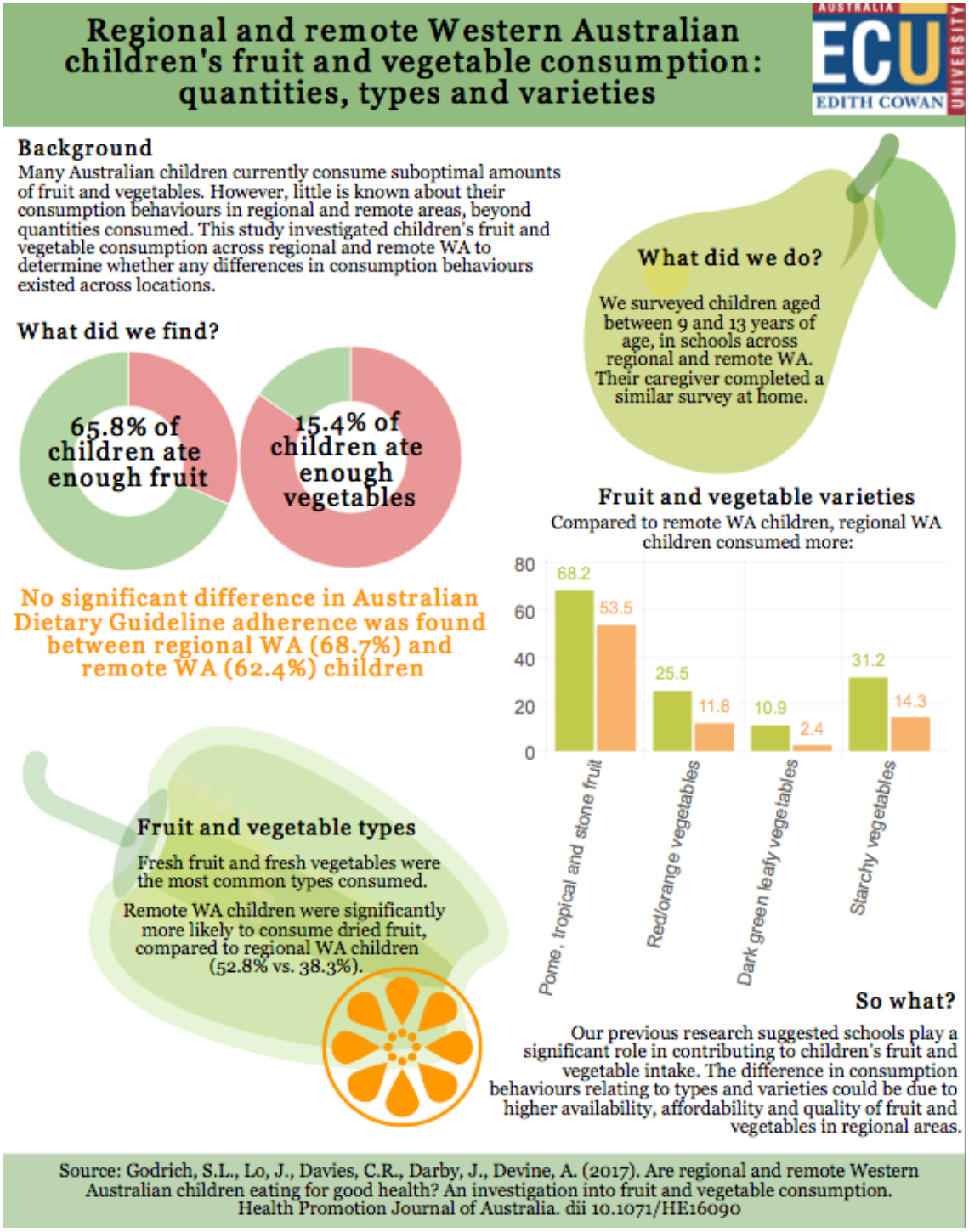

Figure 27: Paper 3 draft infographic for stakeholder review.

PART 2: FOOD SECURITY AMONG REGIONAL AND REMOTE WESTERN AUSTRALIAN CHILDREN

CHAPTER 6: WHAT ARE THE DETERMINANTS OF FOOD SECURITY AMONG REGIONAL AND REMOTE WESTERN AUSTRALIAN CHILDREN?

6.0 Foreword

This is first chapter presented within the ***second concept*** *explored in this PhD,* ***FS among regional and remote WA children.*** *This chapter provides a qualitative investigation of the key FSD among regional and remote WA children from the perspective of health, school/youth, and food supply workers. Through the examination of FSD across 'food availability', 'food access' and 'food utilisation' dimensions, the chapter argues that clear inequities exist across WA in regards to availability and access to affordable, good quality food. In addition, adequate formal social support options are unavailable in many locations. Further, food literacy skills are often suboptimal and require further support to strengthen. This chapter is published in Australian and New Zealand Journal of Public Health (Figure 28). This chapter answers* ***RQ 3: What are the determinants of FS among regional and remote WA children?*** *The chapter commences with a brief abstract, followed by the introduction, overview of methods used, key results, discussion including recommendations, conclusions and associated infographic.*

What are the determinants of food security among regional and remote Western Australian children?

Stephanie Godrich,[1] Christina Davies,[2] Jill Darby,[1] Amanda Devine[1]

Food security is a complex, multifactorial[1] issue referring to reliable access of sufficient food,[2] incorporating food availability, access, utilisation and stability dimensions.[3-5] Food insecurity arises when access is restricted or uncertain.[2] Resulting personal and societal costs are *"felt as reduced physical, mental, spiritual and social health, and wellbeing."*[6] The issue is underestimated in high-income countries including Australia,[7] with slow political prioritisation,[7-9] largely due to a lack of understanding around its determinants.

Given Australia's vast geography, important food security determinants include reduced availability, especially of healthy food, in regional and remote areas. Freight costs[1,7-11] result in food being up to 200% more expensive than metropolitan areas.[9] Poor nutrition knowledge and skills[1,9-16] are additional issues. Unique concerns for Western Australia (WA) relate to a high population density in metropolitan areas[17] compared to the rest of the state, which is regional and remote. Limited food processing results in large reliance on food supplied from interstate,[17] transported via road or rail[18] and delivered infrequently.[17,19] Environmental issues further disrupt deliveries and reduce availability.[17] Moreover, food outlets experience infrastructure failures, including power outages, decreasing food quality.[17] The small public health nutrition workforce prohibits substantial advocacy to improve food supply.[17] Households in the most socioeconomically disadvantaged areas are particularly impacted by higher food costs.[1,9,17] This is yet another barrier for low-income households,[17] especially welfare recipients,[16] to buy foods essential for their family's health.[20,21]

In Australia, children from low-income families are vulnerable to food insecurity,[1,22,23] especially in remote areas.[22] Childhood is a critical period in which foundations for health are established.[22] Negative health impacts in childhood, including poor development, decreased academic performance, reduced social skills and weight gain[24] potentially affect adult health status.[22] While consequences of food insecurity are known, research in regional and remote WA has largely focused on food supply, community infrastructure and financial issues.[11,17] Key gaps in the current evidence include (i) an investigation of community-level food security determinants in regional and remote WA extending beyond availability, cost, quality, infrastructure and workforce barriers; (ii) an understanding of household-level food security determinants in regional and remote WA; and (iii) how these determinants affect regional and remote WA children.

Abstract

Objective: To explore how determinants of food security affect children in regional and remote Western Australia (WA), across food availability, access and utilisation dimensions.

Methods: The Determinants of Food Security framework guided the thematic analysis (using NVivo 10) of semi-structured interviews with 20 key informants.

Results: Food availability factors included availability, price, promotion, quality, location of outlets and variety. Food access factors included social support, financial resources, transport to food outlets, distance to food outlets and mobility. Food utilisation factors included nutrition knowledge and skills, children's food preferences, household storage facilities, household preparation and cooking facilities and time to purchase food.

Conclusions: Key food availability recommendations include increasing local food supply options. Access recommendations include ensuring equitable formal social support and empowering informal support options. Utilisation recommendations include prioritising food literacy programs focusing on quick, healthy food preparation and budgeting skills.

Implications for public health: Policymakers should invest in local food supply options, equitable social support services and experiential food literacy programs. Practitioners should focus child/parent programs on improving attitude, knowledge and skills.

Key words: food security, regional, remote, children

Objective

This research aimed to explore the impact of food security determinants[1] on children in regional and remote WA, across food availability, access and utilisation dimensions.

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The authors have stated the following conflict of interest: SG is a consultant of Foodbank WA, a food relief charity that delivers nutrition education and cooking sessions with WA schools and communities.

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Figure 28: What are the determinants of food security among regional and remote Western Australian children? Godrich, S.L., Davies, C.R., Darby, J., Devine, A. Australian and New Zealand Journal of Public Health. Early View. Copyright © 2017, Public Health Association of Australia, Wiley. Online link: http://onlinelibrary.wiley.com/doi/10.1111/1753-6405.12636/full

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Implications for public health: Policymakers should invest in local food supply options, equitable social support services and experiential food literacy programs. Practitioners should focus child/parent programs on improving attitude, knowledge and skills.

6.2 Introduction

FS is a complex, multifactorial (Food and Agriculture Organization, 2006) issue referring to reliable access to sufficient food (Nord, 2007), incorporating food availability, access, utilisation and stability of the first three dimensions (Food and Agriculture Organization, 2008; Innes-Hughes et al., 2010; Rychetnik et al., 2003; United Nations Food and Agriculture Organisation, 1998). FI ensues when access is restricted or uncertain (Food and Agriculture Organization, 2003). Resulting personal and societal costs are *"felt as reduced physical, mental, spiritual and social health, and wellbeing."* (Booth et al., 2001) The issue is underestimated in high-income countries including Australia (Prime Minister's Science, 2010) with slow political prioritisation (Foley et al., 2009), largely due to a lack of understanding around its interrelated determinants.

Given Australia's vast geography, important FSD include reduced availability, especially of healthy food, in regional and remote areas. Excessive food freight costs (Pollard, Nyaradi, et al., 2014) result in food being sold up to 200% more expensive than metropolitan areas (Booth et al., 2001; Ferguson et al., 2016). Poor nutrition knowledge and skills (Australian Institute of Health and Welfare et al., 1997; Browne et al., 2009; Burns, 2004; Wardle et al., 2000) are additional issues. Unique concerns for WA relate to a high population density in metropolitan areas (Pollard, Landrigan, et al., 2014) compared to the rest of the state, which is regional and remote. Limited food processing results in large reliance on interstate food supply (Pollard, Landrigan, et al., 2014), transported via road or rail (Australian Government, 2012) and delivered infrequently (Pollard, Nyaradi, et al., 2014; Pollard et al., 2015). Environmental issues further disrupt deliveries and reduce availability (Pollard, Nyaradi, et al., 2014). Moreover, food outlets experience infrastructure failures, including power outages, decreasing food quality (Pollard, Landrigan, et al., 2014). The small public health nutrition workforce prohibits substantial advocacy to improve food supply (Pollard, Nyaradi, et al., 2014). Households in the most socioeconomically disadvantaged areas are particularly impacted by higher food costs (Ferguson et al., 2016; Pollard, Landrigan, et al., 2014). This is yet another barrier for low-income households (Pollard, Nyaradi, et al., 2014), especially welfare recipients (Pollard et al., 2015), to purchase foods essential for their family's health (Beaulac et al., 2009; National Health and Medical Research Council, 2013a).

In Australia, children from low-income families are vulnerable to FI (Foley et al., 2009; Ramsey et al., 2011), especially in remote areas (Rosier, 2011). Childhood is a critical period where foundations for health are established (Ramsey et al., 2011). Negative health impacts in childhood, including poor development, decreased academic performance, reduced social skills and weight gain (Jyoti DF et al., 2005) potentially affect adult health status (Nord, 2009). While consequences of FI are known, research in regional and remote WA has largely focused on food supply, community infrastructure and financial issues (Pollard, Landrigan, et al., 2014; Pollard, Nyaradi, et al., 2014). Key gaps in the current evidence include (i) an investigation of community-level FSD in regional and remote WA extending beyond availability, cost, quality, infrastructure and workforce barriers; (ii) an understanding of household-level FSD in regional and remote WA; (iii) how these determinants affect regional and remote WA

children. The aim of this research was to explore how FSD (Rychetnik et al., 2003) impact children in regional and remote WA, across food availability, access and utilisation dimensions.

6.3 Methods

6.3.1 Sample

'Key informants' were interviewed as 'expert sources of information' (Marshall, 1996). Three groups were selected; 'Health Workers' (e.g. dietitians, health promotion practitioners), 'School/Youth Workers' (e.g. principals, youth program coordinators) and 'Food Supply Workers' (e.g. independent food outlet managers). These groups were selected given their roles related to FSD (Rychetnik et al., 2003) across *food availability* (e.g. food supply workers managed/worked in food outlets), *food access* (e.g. youth workers provided food to children in afterschool programs) and *food utilisation* (e.g. some health workers facilitated food literacy programs) dimensions. Given the sensitive nature of the topic and the possibility of social-desirability biased responses, parents were not specifically targeted in this research (Krumpal I, 2011). Participants were purposively sampled via a stakeholder database containing contacts sourced from professional networks (i.e. interagency health network groups and school/youth workers). Food supply informants' workplaces were identified via an online (Google) search using the related town and *"supermarket"* as keywords. Participants reported on areas ranging in disadvantage (Australian Bureau of Statistics, 2013e) and remoteness (Australian Bureau of Statistics, 2012a, 2014b, 2016a). The sample from each WA region was closely representative of the population distribution (Department of Regional Development, 2014). Due to small sample sizes for some WA regions, results will be discussed within an overall regional/remote WA context to provide a meaningful understanding of child FSD in WA.

6.3.2 Instrument and data collection

SSI were conducted. SSI facilitate in-depth conversation from participants around the study topic (Galletta et al., 2013) and are appropriate for sensitive topics, such as FI (Harrell MC et al., 2009). The SSI utilised an interview guide developed by the research team, comprising nutrition, public health and health promotion evaluation experts. The SSI guide was piloted with a health worker prior to data collection. The same SSI guide was used for all key informants. Questions were open-ended and commenced with

informants' descriptions of the local food environment where they worked/lived, to gain an unprompted picture. For example, *"Tell me a bit about the town/s you work/live in; what is the food situation like?"* Subsequent questions prompted discussion around Determinants of Food Security (Rychetnik et al., 2003) framework constructs.

Thirty people were invited to partake in an interview through an initial telephone call garnering interest and follow-up email containing an IL and CF indicating study aims, approvals, anticipated interview length (60-minutes), example topics for discussion, use of data. Twenty out of the 30 invited participants provided written consent to participate in this research. Of the 10 people who were invited but did not participate, seven did not respond to the minimum of three follow-up attempts. The remaining three non-respondents declined to participate, citing a lack of time or interest. Table 1 displays the demographics of respondents and non-respondents. Twenty interviews were conducted in person (n = 4) or via telephone (n = 16) between June 2013 and September 2015, by the lead author. All interviews were recorded with participant permission.

6.3.3 Data analysis

Key points or themes were noted after each interview. Interviews were transcribed verbatim into Microsoft Word, de-identified, checked for transcription accuracy and imported into QSR NVivo software, QSR International Pty Ltd, Version 10 2014 (QSR International, 2014). A thematic analysis was the strategy employed to analyse themes. The initial coding framework was based on the Determinants of Food Security (Rychetnik et al., 2003) framework and research questions. Inductive codes (not reported on in this paper) were created when new themes were identified, codes were combined if they were similar. A research journal included a summary of codes, containing example concepts. This assisted to identify when no new information was being added to codes (Guest et al., 2006). Saturation was confirmed at 20 interviews when no more pertinent themes or concepts were identified (Guest et al., 2006) and when creation of new codes had ceased. Data analyses included word frequencies, word clouds and matrix-coding queries. To ensure quality of coding, codes were thoroughly checked: three authors corroborated the coding by reviewing the coding framework, matrix-coding queries and checking audio recordings to determine key themes. The Edith Cowan University Human Research Ethics Committee (Project 8635) approved this study.

6.4 Results

Twenty key informants (eight "Health Workers", six "Food Supply Workers", six "School/Youth Workers") participated in this study (response = 67%). Sixty per cent of interviewees discussed regional WA (n = 12) and 40% remote WA (n = 8). The majority (80%) of interviewees were female (n = 16) (Table 10). An in-depth analysis of the FS dimension themes investigated in this study, i.e. *food availability, food access* and *food utilisation* (Innes-Hughes et al., 2010; Rychetnik et al., 2003), and their sixteen sub-themes (determinants), are presented below. Figure 29 provides a graphical illustration of these FS dimension themes and sub-themes, while Table 11 illustrates the relative importance of each sub-theme based on the number of coded statements.

Table 10: Respondent and non-respondent demographics

Respondents			
Demographics	**Key Informant Types included**		
	Health Workers	*School/Youth Workers*	*Food Supply Workers*
Remoteness			
Regional WA	4	2	6
Remote WA	4	4	
Gender			
Female	6	6	4
Male	2		2
Non-respondents			
Demographics	**Key Informant Types included**		
	Health Workers	*School/Youth Workers*	*Food Supply Workers*
Remoteness			
Regional WA	1		8
Remote WA			1
Gender			
Female	1		3
Male			6

Figure 29: Determinants of food security among regional and remote Western Australian children, within food availability, access and utilisation dimension themes. Sub-themes listed in descending order of coded statements and adapted from frameworks developed by Rychetnik, L, Webb, K, Story, L. et al (2003) and Innes-Hughes C, Bowers K, King L. et al (2010).

6.4.1 Food security determinants – Food availability

Six 'Food availability' sub-themes are described below.

6.4.1.1 Availability in food outlets

Clear paradoxes existed between locations for food availability, with the volatility of WA's food supply chain highlighted. Some areas were well stocked with a wide range, including locally grown fruit, vegetables and fresh meat. Others lasted delivery-to-delivery on basic necessities. Tourism-focussed towns sold 'ready-made packs' including salads and pre-cooked items. Children consumed convenient healthy food when available, e.g. seasonal fruits. Farmers' markets sold locally grown food, which was limited in larger supermarkets. 'Takeaway-food' was often readily available. In other locations, food availability became scarce before the next delivery was received (e.g. weekly, fortnightly). In particular, fresh produce was *"Down to the dregs in the last two to four days"* and comprised *"basic"* produce including pumpkin, onions and oranges. Food supply chain issues - including flooding due to inclement weather - resulted in disrupted food deliveries, decreasing food availability. As did small population sizes, e.g.:

> *"The nature of what we buy, the quantity is directly related to the foot traffic... Anything that you've got to buy in large quantities that we can't sell reasonably quickly."* (Food Supply Worker)

6.4.1.2 Price

Multiple, independent food outlets and farmers' markets selling local produce just above wholesale price increased affordability, enabled competitive pricing and *"value-buy in"* products (i.e. second quality produce). Other locations relied on a single food outlet, with food prices described as *"inflated"*, impacted by store decisions and transport costs. While some managers discounted fresh produce prices for children, it was unaffordable in some locations, e.g.:

> *"Look, the freight's just enormous …I feel it's just wrong that the people who can least afford it but most need it are charged so much for it… There's a fruit pack with 5 or 6 pieces of fruit maximum, and that's $13.80."* (School/Youth Worker)

6.4.1.3 Promotion

Ten respondents described stores promoting locally-sourced food and weekly specials. Promotional strategies included recipe cards at point-of-sale, F&V posters, snack and salad packs. One farmers' market used social media to promote cooking demonstrations using stallholders' produce. Local promotion included school children or women's groups displaying healthy eating posters they had created in outlets. Occasionally, managers were cited as conscientious in their healthy food promotion, e.g.:

> *"Although there's still the unhealthy options on the shelves, the store managers are very health conscious in terms of having the boiled eggs and bananas at the front counter for kids to choose instead of lollies and chocolates."* (Health Worker)

Five key informants believed local food outlets promoted discretionary foods, e.g. sugary drinks, more heavily than healthy foods. The discretionary foods were placed in *"high view"* at the front of the store or on check-out counters, in contrast to healthy foods placed towards the back of the store.

6.4.1.4 Quality

In this study, local food supply options, small grocery stores with high produce turnover and farmers' markets increased food quality. Outlets were praised for strategic purchasing of products that would *"survive the journey"* where long-distance freight was required. In other locations, lengthy food transport decreased quality, resulting in *"tasteless"* and *"unappealing"* produce. Additional perspectives highlighting food supply chain inefficiencies included produce grown in rural areas being sent to a depot in the city before being redistributed back to areas of origin for sale. Poor-quality produce reduced appeal among children but was occasionally the only option, e.g.:

> *"I mentioned the carrots growing or a bit of mould, but here there is no choice and you buy it because you need it and you cut off the mouldy bit."* (School/Youth Worker)

6.4.1.5 Location of food outlets

Small towns usually had a main supermarket and 'peripheral' food outlet/s, e.g. roadhouses where snacks were purchased. However, low viability of outlets resulted in increased centralisation of large supermarkets. This facilitated wider food variety for

some families while presenting challenges for others in outlying areas with limited transport. Larger towns had a number of supermarkets that were centrally located and accessible by major roads, e.g.:

> *"…Both the grocery stores are in the middle of town, which isn't difficult as it's not that big… You can actually park in one place and walk to all the food outlets."* (Health Worker)

6.4.1.6 Variety

There was often good diversity in food products with some stores catering for a range of dietary requirements (e.g. Gluten-free). Informants suggested consumer demand resulted in *"No such thing as in-season"*. Contradictorily, variety in some locations was reduced to generic staples (i.e. apples) and 'hardy' products, frozen or tinned food. Some store managers were hesitant to order a large range, citing lack of community support, e.g.:

> *"Ours is a numbers game. We have insufficient throughput here to provide significant diversity of food. We have the very basic staples."* (Food Supply Worker)

6.4.2 Food security determinants – access to food

Five sub-themes relating to household 'Access to food' are described below:

6.4.2.1 Social support

Clear inequities in formal social support existed across WA. Schools played substantial roles in mediating the effects of FI among children through emergency food relief. Informal social support was strong, particularly when there were limited formal options. Some areas provided numerous formal social support options, including agencies (such as St. Vincent de Paul Society) and the local Council who supplied soup kitchens, food boxes or emergency relief vouchers. Informal social support networks included community driven food-trading groups that exchanged home-grown produce. These groups were promoted via social media and enabled families to source additional food. Other informal support included families *"meal sharing"* and *"chipping in"* to support each other. There was the general sense that when people needed help, particularly those relying on food vouchers, that community assistance was provided.

6.4.2.2 Financial resources

Household finances varied across WA, with social issues resulting in less money for food. Difficulties were caused by low-income, unexpected unemployment, debt, or drug/alcohol issues, high housing costs and poor budgeting skills. Often foods perceived as cheap and would *"go a long way"* (e.g. pasta), were purchased. The reliance on food vouchers and the prevalence of hunger among schoolchildren was indicated. Two distinct financial groups were commonly discussed, e.g.:

> *"The top tier of economy is the farmers and business owners and the people who work in fly in fly out roles that have higher disposable incomes... The other sector of the community, the majority of these people are on benefits or are working and on lower level incomes."* (Health Worker)

6.4.2.3 Transport to food outlets

Smaller, centralised towns facilitated active transport e.g. children walking and cycling to purchase food. Families in outer suburbs or farming communities most often used cars. Some towns offered public transport that ran at inconvenient times, or no public transport at all, e.g.:

> *"If you're unable to drive, it might be a bit of a problem because we don't have public transport. I drive, I am located too far from the local shop to walk."* (Health Worker)

6.4.2.4 Distance to food outlets

Disparities in distance to outlets were apparent. Some families travelled to other towns to purchase food due to a limited range in their own town. Families in close proximity to town centres easily accessed food from centrally located outlets; families located further away struggled, e.g.:

> *"The least affluent area of town is the longest distance from the shops… The people with the least amount of money have the greatest distance to go."* (School/Youth Worker)

6.4.2.5 Mobility

Mobility was a minor sub-theme in this study. Two informants discussed the built environment as a barrier to mobility, such as a lack of footpaths preventing active

transport.

6.4.3 Food security determinants – food utilisation

Five 'Food utilisation' sub-themes are described below:

6.4.3.1 Nutrition knowledge and cooking skills

Parental knowledge and skills was a polarising issue and is important to discuss within the context of children's FS. Seven informants indicated that many parents possessed sufficient nutrition and cooking skills, with peer-to-peer knowledge and recipe sharing occurring. However, this did not necessarily result in healthy food provision at home. Barriers to food literacy cited included: low valuing of healthy food, competing priorities, fatigue and a lack of time. Some participants reported low-socioeconomic groups were less likely to possess adequate nutrition knowledge and cooking skills, with heavy purchasing of takeaway foods.

Children's understanding of diet-related health outcomes varied; the schooling environment contributed significantly to nutrition knowledge and skills. Some informants suggested that possession of nutrition knowledge often didn't result in practical application, e.g.:

> *"They know it at school but internalising it and reproducing it outside of school is perhaps our biggest challenge at the moment." (School/Youth Worker)*

6.4.3.2 Children's food preferences

Children's amenability to healthy food was increased by convenience and experiential learning; particularly regarding food selection, propagation and preparation. However, many children were *"fussy"*, preferred takeaway foods and were successful in dictating the purchase of these foods to their parents, e.g.:

> *"The children are actually dictating to the parents what they will and won't eat... I find the parents actually succumb to a lot of that. A lady comes in and says, 'I have to get him a specific sausage roll, he won't eat anything else'."* (Food Supply Worker)

6.4.3.3 Storage facilities

Household storage facilities varied; some families bought and stored food in bulk, others regularly visited food outlets due to inadequate storage facilities. In agricultural

areas, household food storage options included walk-in cool rooms or chest freezers. In contrast, some residents owned small fridges or had intermittently working facilities. These residents used the local food outlet as their 'storeroom', shopping daily or multiple times daily. Frequent power outages and financial problems further impacted food storage, e.g.:

> *"… [they] have had their power cut off because they haven't paid their bills. So in terms of refrigeration, that can be quite tricky."* (School/Youth Worker)

A barrier to provision of perishable food for children's lunchboxes included no storage facilities at school. This led to non-perishable options often supplied for lunches because of food safety concerns.

6.4.3.4 Preparation and cooking facilities

Many families possessed adequate cooking facilities, while inadequate facilities resulted in children purchasing pre-cooked options. Frequent power outages impacted food preparation, e.g.:

> *"I am aware of a number of families that basically live off takeaways. They would have maybe a kettle, a stockpot, a saucepan and that's about it. We do have reticulated gas in town and electricity… but we do have a lot of outages."* (School/Youth Worker)

6.4.3.5 Time to purchase and prepare food

Some families allocated little time for food purchasing and preparation, others shopped daily. Interviewees indicated that some food outlets closed periodically, limiting shopping hours. Shopping was not a priority for some families; people were reportedly *"disorganised"* and were reminded about food when children arrived home from school. Discourse suggested school-based nutrition education was diluted by a lack of home follow-up, e.g.:

> *"While it's good at school, they go home and mum says 'We don't have time for that, whack this is in the microwave, you'll be right.'"* (Food Supply Worker)

6.5 Discussion

This research explored factors influencing WA children's FS, guided by the Determinants of Food Security framework (Rychetnik et al., 2003). Key *food*

availability determinants included inequities in availability, price, promotion and quality of healthy food, revealing the existence of 'food deserts'. These issues were mediated by prioritising local food supply options. *Food access* factors included unequal distribution of formal social support services; informal support mediated food insecurity. Families with limited finances often relied on emergency relief and welfare and therefore had difficulty providing nutritious food for their children. *Food utilisation* determinants included low food literacy and reliance on takeaway foods, particularly among disadvantaged families. However, local skill sharing among peers mediated this. Many children preferred and successfully dictated parents' purchasing of 'junk food', though experiential learning improved attitude towards healthy food.

Consistent with other studies, inequitable food availability resulted from unfavourable weather, supply chain issues, food travel distance and small populations (Beaulac et al., 2009; Evans et al., 2015; Le et al., 2015; Pollard, Landrigan, et al., 2014; Pollard, Nyaradi, et al., 2014; Pollard et al., 2015). Elevated cost in towns due to low competition, increasing remoteness and food freight costs supported previous research (Beaulac et al., 2009; Pollard, Landrigan, et al., 2014; Turrell et al., 2002). The importance of informal support networks where insufficient formal options existed has also been previously reported (Pollard, Nyaradi, et al., 2014; Swanson et al., 2008). Limited food literacy, particularly among disadvantaged groups, reduced purchasing of nutritious foods like F&V. This finding supports the literature that suggests lower socio-economic groups possessing lower food literacy are less likely to purchase foods that align with dietary recommendations (Blisard, 2004; National Health and Medical Research Council, 2013a; Pollard, Nyaradi, et al., 2014). Many children preferred energy-dense nutrient poor options. Other studies have highlighted children's refusal to try healthy food and preferences for sugary, *"less healthful"* foods (MacLellan et al., 2004; O'Dea, 2003).

Strengths of this study included the range of perspectives; that sampling/data collection occurred across WA regions, locations ranging in disadvantage and remoteness and a broad investigation of FSD. Limitations include a lack of parent and child perspectives. This study presents an overall perspective of FS issues across WA; insufficient sample sizes for some WA regions prevented examination of issues between regions and permissions precluded investigation of how themes may differ between specific

community groups, e.g. Culturally and Linguistically Diverse people and Aboriginal and Torres Strait Islander people.

This study forms a basis for action to improve FS in WA and answers the call of previous research to investigate how FI may impact WA children (Pollard, Nyaradi, et al., 2014). Key recommendations based on prominent themes discussed in this study are summarised in Table 11. At a *food availability* level, recommendations include (i) increased support for local food supply options (Bastian et al., 2011; Browne et al., 2009; Sacks et al., 2008; Tasmanian Food Security Council, 2012). For example, land use management that facilitates locally-controlled food production (Tasmanian Food Security Council, 2012), markets and/or community-driven gardens (Innes-Hughes et al., 2010; Tasmanian Food Security Council, 2012). Where this is impractical, state and local government facilitation of core-food freight subsidies (Innes-Hughes et al., 2010; Lee et al., 2009; Pollard, Landrigan, et al., 2014; Sacks et al., 2008) or discounts at the store level (Bastian et al., 2011; Browne et al., 2009; Ferguson et al., 2016; Innes-Hughes et al., 2010). Recommendations at a *food access* level include (i) equitable distribution of and support for agencies to work in partnership (Bastian et al., 2011; Tasmanian Food Security Council, 2012), such as conducting *"FS assessments"* and implementing programs including *"giving and receiving"* to increase valuing of support and retain dignity (Browne et al., 2009; Innes-Hughes et al., 2010; Tasmanian Food Security Council, 2012); and (ii) support for social networks (i.e. food growing/trading groups) to develop additional community-based FS options (Bastian et al., 2011; Tasmanian Food Security Council, 2012), particularly in 'food deserts' (Tasmanian Food Security Council, 2012) where food availability, access, cost and quality are issues. This may increase community empowerment, which can improve financial and social development and health outcomes (Marmot, 2006). Key *food utilisation* dimension recommendations include (i) increased funding for and focus of experiential food literacy programs (Innes-Hughes et al., 2010; Tasmanian Food Security Council, 2012) on quick, healthy food preparation (MacLellan et al., 2004), budgeting skills targeting disadvantaged families (Bastian et al., 2011; Lee et al., 2009); and (ii) experiential food literacy education programs that increase children's nutrition knowledge, preferences and requests for healthy food (Bastian et al., 2011; Innes-Hughes et al., 2010). Key program components should include growing and tasting food

(Tasmanian Food Security Council, 2012), quick recipe ideas and be delivered in school and community settings (Bastian et al., 2011).

Table 11: Key recommendations to improve regional and remote children's food security across food availability, access and utilsation dimensions. Recommendations and implementation strategies are based on major sub-themes determined in this study and support previous research.

FS dimension themes and sub-themes (determinants) explored	Number of coded statements	Key recommendations and example implementation strategies
Food Availability		
Availability in outlets	96	**Support the development and promotion of local food supply options to increase food availability, quality and reduce cost.** Examples: • Strengthen reliance on a local food supply using direct retail options, i.e. farmers' markets. • Where sourcing local produce is impractical, state and local government facilitation of core food freight subsidies. • Healthy food discounts in-store to increase purchasing of nutrient-dense options.
Price	56	
Promotion	52	
Quality	51	
Location of food outlets	28	
Variety	28	
Food Access		
Social support	76	**Ensure availability of equitable social support options, with a particular focus on empowerment of community initiatives.** Examples: • Promote collaboration between social support agencies to ensure efficient and effective service provision. • Support the development of community-based social network groups including local food growing and trading groups.
Financial resources	46	
Transport	26	
Distance	11	
Mobility	5	
Food Utilisation		
Nutrition knowledge and cooking skills	137	**Prioritise experiential food literacy programs that focus on improving attitude towards nutritious food, increase nutrition knowledge and cooking skills.** Examples: • Fund and focus parental literacy programs on quick, healthy food preparation and budgeting skills. • Fund and focus children's food literacy programs on increasing the palatability and desire for healthy food such as through growing and tasting of produce.
Children's food preferences	60	
Storage facilities	35	
Cooking and food preparation facilities	34	
Time	13	

6.6 Conclusion

Policy makers should consider further investment in locally-sourced food options, experiential food literacy programs and social support services. Health practitioners should incorporate practical food attitude, knowledge and skills strategies into community-based initiatives. Further quantitative research should aim to determine which key FSD are most influential on FS status and its resulting dietary outcomes. In a

high-income country like Australia, child FI is inexcusable and could be appeased if stakeholders collaborate to implement key recommendations such as those highlighted in this study.

6.7 Summary

This chapter provided key insights into regional and remote WA children's FS across 'food availability', 'food access' and 'food utilisation' dimensions, with a range of potential intervention strategies highlighted for each dimension. The chapter provided a useful basis for policy and practice actions and further research to improve FS among children. Figure 30 (below) contains the infographic developed with the research findings arising from this chapter. The next chapter, 7, will quantify the prevalence of FI among children living in regional and remote WA.

6.8 Research impact activities arising from Chapter 6

The following includes the draft infographic that was based on this chapter's findings.

Figure 30: Paper 2 draft infographic for stakeholder review.

CHAPTER 7: PREVALENCE AND SOCIO-DEMOGRAPHIC PREDICTORS OF FOOD INSECURITY AMONG REGIONAL AND REMOTE WESTERN AUSTRALIAN CHILDREN

7.0 Foreword

This chapter completes the ***second concept*** *explored in this PhD,* ***FS among regional and remote WA children.*** *The chapter quantifies child FI in regional and remote WA and examines the socio-demographic factors that increase the likelihood that a child is FI. Child surveys and caregiver surveys were conducted to source child FS information and household socio-demographic data. To our knowledge, this chapter provides the first published prevalence of child FI in Australia from a child's perspective and answers* ***RQ 4: What is the proportion of children in regional and remote WA that are FI?*** *This chapter was submitted as a manuscript and is currently under review. The chapter commences with a brief abstract, followed by the introduction, overview of methods used, key results, discussion including recommendations, conclusions and draft infographic developed as a research translation strategy.*

7.1 Abstract

Objective: Inequalities can negatively impact the health outcomes of children. The aims of this study were to: (i) ascertain the prevalence of FI among regional and remote WA children and (ii) determine which socio-demographic factors predicted child FI.

Methods: Caregiver-child dyads (n = 219) completed cross-sectional surveys. Descriptive statistics and logistic regression analyses were conducted using IBM SPSS version 23.

Results: Overall, 20.1% of children were classified as FI. Children whose family received government income support were more likely to be FI (OR 2.60; CI 1.15, 5.91; p = 0.022), as were children living in a Medium disadvantage area (OR 2.60; CI 1.18, 5.72; p = 0.023), compared to High or Low SEIFA ratings.

Conclusions: Recommendations include: incorporating strategies to improve FS in government plans; ensuring government welfare policies adequately support disadvantaged families; increasing local employment opportunities in regional and remote areas; investment in school and adult education and training programs;

delivering free or subsidised food literacy initiatives; establishing evidence on the causes of FI, and the potential impact of FI on children's health behaviours.

Implications for public health: One in five children were classified as FI, demonstrating that FI is an issue in WA.

7.2 Introduction

Health inequalities are influenced by a number of factors, including socio-demographic conditions which are among the SDH (World Health Organization, n.d.-b). These determinants are categorised into *"structural determinants"* such as gender, education, employment and income, while *"intermediary determinants"* include material conditions such as the ability to source healthy food and access to transport; psychosocial conditions including availability of social support; and behavioural conditions such as health behaviours (Social Determinants of Health Alliance, n.d.; Solar et al., 2010; World Health Organization, 2003b). Avoidable, unequal spread of these SDH results in health inequities among populations (Solar et al., 2010; World Health Organization, 2003b). People living in regional and remote areas are particularly susceptible to health inequities given the social and economic disadvantage associated with living in these areas (Australian Institute of Health and Welfare, 2008b, 2014, 2016a). A key issue resulting from these health inequities and requiring urgent action, particularly among vulnerable populations such as families receiving government income support and children, is FS (Pollard, Nyaradi, et al., 2014; Tasmanian Food Security Council, 2012).

Food security has been defined as *"When all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, access, utilization and stability. The nutritional dimension is integral to the concept of food security"* (Food and Agriculture Organization of the United Nations, 2009). Conversely, FI results from reduced, restricted or uncertain physical and economic access to sufficient, safe, nutritious and appropriate food (Food and Agriculture Organization, 2003). Despite the importance of the issue, and given access to food is a basic human right (World Health Organization, 2007), there is still no single agreed method to measure FI prevalence among populations. Measurement tools range from individual questions in self-completed surveys (Nolan et al., 2006) to multi-item

questionnaires that are delivered via trained interviewers (Bickel et al., 2000). The CFSSM is the most widely used tool to assess FI in children and has been assessed for validity and reliability in the USA (Connell et al., 2004). The CFSSM is considered an excellent indicator of FI experienced by children, particularly among children ≥ 12 years of age, where responses were found to be more consistent among the small samples used in validation tests, compared to younger age groups (Connell et al., 2004; Nord, 2007). However, other research has demonstrated this tool was appropriate for children as young as six years of age (Nalty et al., 2013) and studies have verified children's capacity as reliable reporters (Herjanic et al., 1975). Further, Connell et al (2005) conducted qualitative research that revealed children's descriptions of FI strongly resembled those of adults (Connell et al., 2005). This suggests children are capable of understanding and reporting on their own FI experiences. Australia, however, lags behind in the accurate measurement of FI among its population, especially children. Previous FI studies in Australia (Gallegos et al., 2008; Pollard, Nyaradi, et al., 2014; Ramsey et al., 2011; Temple, 2008) attempted to measure FI using a single question, or a few broad questions, which may not adequately establish the extent of the issue. Furthermore, the reported figures from these studies were household FI or FI among child residents, but as reported by adults and by and large are on the urban population (Gallegos et al., 2008; Pollard, Nyaradi, et al., 2014; Ramsey et al., 2011; Temple, 2008).

FI individuals may undertake coping behaviours such as reducing the quality of food consumed (Tasmanian Food Security Council, 2012), meal size or meal omission which leads to severe hunger among household residents (Burns, 2004). The consequent reduced diet diversity, low consumption of core food groups (Nord, 2007) and poor nutrient intake has been associated with poor scholastic achievement (Mechanic et al., 2007), behavioural and emotional issues and absenteeism (Ramsey et al., 2011), nutrient deficiencies (Mechanic et al., 2007) and poor general health (Ramsey et al., 2011). The resultant diet-related health impacts include risk of unhealthy weight gain resulting in obesity (Burns, 2004), reduced productivity and wellbeing (Tasmanian Food Security Council, 2012) and, in the long term, numerous NCD (Vozoris et al., 2003). The need to address mortality resulting from NCD has recently been reinforced through the inclusion as one of 17 global Sustainable Development Goals, with the aim of a 30% reduction in premature death by 2030 (United Nations, 2016). Further, NCD risk factors

such as poor nutrition and obesity have been included as a Public Health Priority by the Centers for Disease Control and Prevention in the USA (Centers for Disease Control and Prevention, 2011a). In Australia, many of these diseases, including obesity, have also been classified as NHPA (Australian Institute of Health and Welfare et al., 1997) and make a significant contribution to the Burden of Disease (Australian Institute of Health and Welfare, 2016b; Institute for Health Metrics and Evaluation, 2014). Therefore, the health inequities underpinning these adverse health outcomes need to be mediated through points of intervention, such as the implementation of government policy (Solar et al., 2010) that focus on the SDH in regional and remote areas.

Despite government reports and strategic frameworks emphasising the importance of improving health inequalities (Australian Institute of Health and Welfare, 2016a), particularly FI (Department of Health, 2012; National Preventative Health Taskforce, 2009; Pollard et al., 2015; Prime Minister's Science, 2010; South Metropolitan Population Health Unit, 2014; Tasmanian Food Security Council, 2012), there is a lack of evidence regarding child FI prevalence from the child's perspective and the underlying SDH that are instrumental in predisposing children to FI. An additional current evidence gap includes a focus on regional and remote areas, given these residents face higher levels of disadvantage (Australian Institute of Health and Welfare, 2014, 2016a). There are clear gaps in the availability of health data from these areas that need to be filled, in order to improve health inequality (Australian Institute of Health and Welfare, 2016a). The aims of this research were therefore to (i) ascertain the prevalence of FI among regional and remote WA children; and (ii) determine which socio-demographic factors increased the likelihood of child FI.

7.3 Methods

7.3.1 Sampling and consent

The study samples included school children (9-13 years) and their caregivers living in regional and remote WA. The age range was selected to facilitate comparison of children's dietary intake with the ADG (a focus of the wider study). Sample size calculations were conducted and $n = 245$ caregiver-child dyads was deemed required. This was based on the total number of students attending schools within the desired age range (58,962), included in the 'population' line of the calculator. This was drawn from the Department of Education's annual census (Department of Education WA, 2012b).

For precision purposes, the minimum sample size was determined with an effect size of 0.15, 80% power at the 5% level of significance. A master database including all non-metropolitan schools was compiled, using websites from each school governance structure (Association of Independent Schools of Western Australia (Inc). 2012; Catholic Education WA, 2012; Department of Education WA, 2012a). Schools were categorised by WA region, as defined by their listed location in each of the Department of Regional Development's *Region in Profile* (Department of Regional Development, 2014). The ASGS (Australian Bureau of Statistics, 2012a) was used to categorise schools by RA. Schools were also based in towns ranging in SEIFA IRSD (Australian Bureau of Statistics, 2013e), which classifies locations into index scores from one (most disadvantaged) to 10 (least disadvantaged). The concept of 'disadvantage' is defined by the Australian Bureau of Statistics in relation to *"people's access to material and social resources, and their ability to participate in society"* (Pink, 2013). This variable includes elements such as low household income, and low household rent (Australian Bureau of Statistics, 2013e). Non-probability sampling was undertaken; schools that were due to participate in the Foodbank WA *Food Sensations*® program were invited to participate in this study.

School principals (n = 32) were telephoned and provided with a study overview to determine interest in receiving a follow up email containing DOE approval letter, principal invitation letter and consent form. A total of 23 school principals provided written consent for their school to participate in the study (71.8% participation rate). Schools declining to participate cited a lack of time or interest in the study by their teachers or the existence of FI in their community, which they did not want highlighted. A total of 76 classes (71 teachers) were invited to participate by provision of a teacher IL and CF. Each willing class teacher was required to provide written consent for their class's involvement; a total of 97.2% of teachers did so (n = 69 teachers, 74 classes). Classes were offered an on-site teacher and class briefing session (n = 51) where possible, as an engagement strategy and to facilitate a clear understanding of the research processes (Trapp et al., 2011). The session was used to explain the study, discuss the timeline and answer any questions teachers or children had. The remaining classes (n = 23) either declined a briefing session or budgetary constraints prevented delivery. These classes received mailed study packs, which included an identical teacher

IL and detailed study procedures. Participating teachers and classes resulted in a total of 1,814 children and 1,814 of their caregivers being invited to participate in the study.

As a requirement of study approval, and in addition to written principal and teacher consent, written informed consent was required from (1) caregiver participants for their own participation, (2) caregiver participants for their child's participation, and (3) child participants for their own participation. The take-home sealable caregiver/child CF envelope was either disseminated in the teacher and class briefing session, or via class teachers. The form included a three-part CF attached for caregivers and children to indicate consent. A tailored list of mental health, food relief and support services available in the family's town/region were also included, as a precautionary measure in case any of the survey questions caused distress among caregivers.

A total of 347 caregivers and 340 children indicated their consent to participate by returning signed caregiver and child CF. A caregiver-child dyad was the chosen method, and given matched caregiver and child surveys were a requirement for inclusion, 256 dyads were included in the sample. Due to missing data for some of the questions, a total of 219 dyads were included in analyses.

7.3.2 Instrument development

The caregiver survey comprised socio-demographic questions including gender, age, number of adults and children living in the household, caregiver educational attainment and caregiver employment status. A number of variables were used to indicate financial resources, including SEIFA IRSD (Australian Bureau of Statistics, 2013f) and household receipt of government income support. The child survey included socio-demographic questions comprising self-reported gender, age, number of household residents and the CFSSM (Connell et al., 2004) (Table 12), used with permission.

7.3.3 Data collection

Data collection occurred between March 2013 and December 2015. This timeframe included pilot testing with 26 caregiver-child dyads. Face validity was conducted through the provision of written feedback from teachers and caregivers regarding study processes and question understanding among themselves and their students/children. Caregiver surveys were completed at home and returned to the class teacher via their child in the sealable CF envelope. Class teachers disseminated surveys to consenting students, who used a privacy sticker to close their survey upon completion. All child

and caregiver surveys and CF envelopes were collected by class teachers and posted to the study centre in a pre-paid envelope.

7.3.4 Data analysis

Reliability of the survey instruments was assessed through test-retest during the pilot study, with analyses including WSRT. No significant differences were found for variables included in this paper. Due to low cell counts, the response categories for a number of variables (i.e. caregiver educational attainment, number of household residents, caregiver employment status, SEIFA IRSD decile) were recoded using IBM SPSS Statistics version 23 (IBM Corp, 2015). For example, caregiver educational attainment was recoded to 'Primary School or Secondary School', 'Diploma or Apprenticeship' or 'Undergraduate/Postgraduate University Degree' (Table 13). All recoded variables were manually checked to ensure correct recoding.

7.3.4.1 Prevalence of child food insecurity

Child FS status was determined using the CFSSM scoring criteria (Connell et al., 2004). Respondents' affirmative responses to the nine items included in the CFSSM questionnaire are tallied to form a raw score. (Connell et al., 2004). The raw score then determines the FS classification. Respondents are deemed 'High FS, 'Marginal FS', 'Low FS' or 'Very low FS'. These CFSSM categories were subsequently recoded into either FS (High FS and Marginal FS) or FI (Low FS and Very low FS) categories, guided by recommendations for reporting (Connell et al., 2004), and to enable logistic regression analyses.

7.3.4.2 Socio-demographic predictors of child food insecurity

The relationship between FI (outcome variable) and each of the socio-demographic factors (independent variables) was initially examined using simple logistic regression models. A list of these factors, suggested to influence FI (Foley et al., 2009; Ramsey et al., 2011) are given in Table 13. All independent variables were entered as categorical covariates, except for caregiver age and number of resident children in the household, which were entered as continuous variables. Child age was entered as an ordinal variable to further confirm that the CFSSM was appropriate to use with our whole sample. A conservative significance of $p \leq 0.20$ was set for inclusion in subsequent multivariable analyses (Bursac et al., 2008; Mills et al., 2009).

A data-driven model was initially conducted, based on significant variables identified in simple logistic regression models. However, given the number of household residents and employment status have been shown in the literature to be associated with FI (Foley et al., 2009; Nord, 2009; Ramsey et al., 2011; Temple, 2008), these variables were additionally included in a subsequent data-plus-theory-driven model. Reference categories determined for both data-driven and data-plus-theory-driven approaches were based on those with high frequencies, and/or hypothesised or demonstrated to exacerbate FI (Ramsey et al., 2011). For instance, literature suggests younger children are most protected from FI (Nord, 2009, 2007), hence, the youngest child age category was selected as the reference category for the 'child age' variable. The level of significance was set at $p < 0.05$ (Table 14).

7.3.5 Ethics approvals

The Edith Cowan University Human Research Ethics Committee (Project 8635) provided ethical approval for this study.

7.4 Results

7.4.1 Demographics

The mean age of caregivers included in this study was 40.7 ± 6.2 years (n = 219), while child participants were on average 10.9 ± 1.1 years (n = 219). The majority of caregivers were female (84.9%, n = 186), while girls comprised 67.6% (n = 148) of the child sample. Approximately two-thirds (60.7%, n = 133) of the sample lived in regional WA.

7.4.2 Prevalence of child food insecurity

A total of 20.1% of children were classified as FI (16.9% Low FS and 3.2% Very low FS combined), while 79.9% of children were food secure (66.7% High FS and 13.2% Marginal FS). The proportion of FI children did not significantly differ between ages (p = 0.333). Child responses to individual CFSSM questions included more than one in five children were concerned that food would run out before their family could afford to buy more, while 14.6% were concerned that their meals contained cheap (i.e. low quality) foods because their family was running out of money (Table 12).

Table 12: Child Food Security Survey Module results, adapted from Connell, Nord et al., J Nutr (2004; 134; 10; 2566-2572).

CFSSM Questions	*n*	CFSSM Responses of "A lot" or "Sometimes" Combined
*Did you **worry** that food at home would run out before your family got money to buy more?*	217	21.2%
*Did the food that your family had **run out** and you didn't have money to get more?*	219	6.4%
*How often were you not able to eat a **balanced meal** because your family didn't have enough money?*	218	7.8%
*Did your meals only include a few kinds of **cheap foods** because your family was running out of money to buy food?*	219	14.6%
*Has the size of your meals **been cut** because your family didn't have enough money for food?*	219	5.0%
*Did you have to **eat less** because your family didn't have enough money to buy food?*	219	9.6%
*Did you have to **skip a meal** because your family didn't have enough money for food?*	218	3.3%
*Were you **hungry** but didn't eat because your family didn't have enough food?*	219	6.8%
*Did you ever not eat for the **whole day** because your family didn't have enough money for food?*	219	1.8%

Table 13: Simple logistic regression models for socio-demographic factors and child food security (n = 219)

Socio-demographic variables	Description	Total n (%)	OR[#] (95% CI^)	*p*-value
Caregiver Age	26-66 years	219[♮]	0.98 (0.93, 1.03)	0.490
Caregiver gender	Male	33 (15.1)	1.33 (0.55, 3.19)	0.519
	Female	186 (84.9)	1.00 (ref)	
Caregiver Employment Status	Overall			0.323
	Unemployed/volunteer	34 (15.5)	1.73 (0.71, 4.22)	0.227
	Part time	87 (39.7)	0.86 (0.41, 1.83)	0.707
	Full time	98 (44.7)	1.00 (ref)	
Caregiver Educational Attainment	Overall			**0.151**[+]
	Primary school/Secondary school	96 (43.8)	2.11 (0.88, 5.07)	0.094
	Diploma/Apprenticeship	67 (30.6)	1.17 (0.43, 3.16)	0.745
	Undergraduate University degree/ Post-graduate University degree	56 (25.6)	1.00 (ref)	
Family Receipt of Financial Assistance	Yes	54 (24.7)	2.34 (1.15, 4.76)	**0.018**[+]
	No	165 (75.3)	1.00 (ref)	
SEIFA IRSD decile range	Overall			**0.061**[+]
	Low score, high disadvantage	127 (58.0)	1.00 (ref)	
	Medium score, medium disadvantage	64 (29.2)	2.01 (0.99, 4.08)	0.052
	High score, low disadvantage	28 (12.8)	0.57 (0.15, 2.06)	0.394
Remote Location	Regional	133 (60.7)	1.00 (ref)	
	Remote	86 (39.3)	1.37 (0.70, 2.68)	0.348
Number of residents	Overall			**0.186**[+]
	2-3	28 (12.8)	1.00 (ref)	
	4	94 (42.9)	0.94 (0.31, 2.85)	0.918
	5	65 (29.7)	1.04 (0.32, 3.29)	0.945
	6	22 (10.0)	1.72 (0.44, 6.63)	0.428
	7 or more	10 (4.6)	4.60 (0.95, 22.16)	0.057
Number of resident children	Overall			0.298
	1	22 (10.0)	1.00 (ref)	
	2	106 (48.4)	0.50 (0.17, 1.48)	0.217
	3	63 (28.8)	0.62 (0.20, 1.94)	0.419
	4	24 (11.0)	1.09 (0.30, 3.97)	0.887
	5	4 (1.8)	2.66 (0.30, 23.42)	0.376
Child gender	Male	71 (32.4)	1.41 (0.71, 2.8)	0.326
	Female	148 (67.6)	1.00 (ref)	
Child Age	Overall			0.333
	9	20 (9.1)	1.00 (ref)	
	10	60 (27.4)	1.09 (0.34, 3.48)	0.883
	11	78 (35.6)	0.77 (0.24, 2.44)	0.663
	12	46 (21.0)	0.36 (0.09, 1.44)	0.151
	13	15 (6.8)	0.46 (0.07, 2.79)	0.400

[♮] Mean; [#] Odds Ratio; ^ Confidence Interval; 1.00 (ref) = Reference category; SEIFA indicates Socio-Economic Indexes for Areas Index of Relative Socio-Economic Disadvantage; [+]significant at $p < 0.20$.

7.4.3 Socio-demographic predictors of child food insecurity

Variables that met the single association criteria ($p < 0.20$) for inclusion into the multivariable logistic regression model were caregiver educational attainment, number of household residents, SEIFA IRSD category and family receipt of government income support (Table 13). These variables are indicated with bolding. Both the data-driven and data-plus-theory-driven models concurred (with minimal difference in the estimates) that family receipt of government income support and SEIFA IRSD category were significant predictors of child FI; children from families that received government income support were approximately twice as likely to be FI than those who did not ($p = 0.022$). Children residing in locations in the Medium SEIFA IRSD category were more than twice as likely to be FI than children from the Low SEIFA IRSD category (high level of disadvantage) ($p = 0.023$) (Table 14). Closer investigation of the data found that among families *not* receiving government income support, children living in a location classified as Medium SEIFA IRSD had the highest FI prevalence (30.2%). This was in comparison to 11.4% from the Low SEIFA IRSD category and 4.2% in the High SEIFA IRSD category (data not shown). No significant interaction was found between SEIFA IRSD category and receipt of government income support.

Table 14: Multivariable logistic regression analyses for socio-demographic factors and child food insecurity; data-driven and data-plus-theory-driven models (n = 219)

Socio-demographic vaeriables	Description			Data Driven		Data plus Theory	
		Total n	Total %	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
Caregiver Educational Attainment	Overall				0.266		0.260
	Primary school/Secondary school	96	43.8	2.09 (0.83, 5.27)	0.120	2.23 (0.85, 5.85)	0.104
	Diploma/Apprenticeship	67	30.6	1.41 (0.50, 3.98)	0.518	1.64 (0.56, 4.83)	0.369
	University degree	56	25.6	1.00 (ref)		1.00 (ref)	
Family receipt of government income support	Yes	54	24.7	2.39 (1.09, 5.25)	**0.030****	2.60 (1.15, 5.91)	**0.022****
	No	165	75.3	1.00 (ref)		1.00 (ref)	
SEIFA IRSD	Overall				**0.024****		**0.023****
	Low score, high disadvantage	127	58.0	1.00 (ref)		1.00 (ref)	
	Medium score, medium disadvantage	64	29.2	2.59 (1.20, 5.57)	0.015	2.60 (1.18, 5.72)	0.017
	High score, low disadvantage	28	12.8	0.64 (0.16, 2.54)	0.529	0.57 (0.14, 2.32)	0.433
Total Number of Household Residents	Overall				0.256		0.554
	2-3	28	12.8	1.00 (ref)		1.00 (ref)	
	4	94	42.9	0.93 (0.28, 3.08)	0.903	1.89 (0.42, 8.43)	0.404
	5	65	29.7	0.89 (0.26, 3.09)	0.858	1.25 (0.22, 7.14)	0.801
	6	22	10.0	1.30 (0.31, 5.41)	0.720	1.78 (0.19, 16.95)	0.615
	7 or more	10	4.6	4.49 (0.86, 23.48)	0.075	5.98 (0.58, 61.39)	0.132
Number of Resident Children	Overall						0.538
	1	22	10.0			1.00 (ref)	
	2	106	48.4		-	0.28 (0.07, 1.18)	0.083
	3	63	28.8			0.42 (0.08, 2.17)	0.298
	4	24	11.0			0.44 (0.05, 3.97)	0.465
	5	4	1.8			0.56 (0.02, 12.60)	0.712
Caregiver Employment	Overall						0.886
	Unemployed	34	15.5		-	0.93 (0.34, 2.59)	0.893
	Part-time	87	39.7			0.81 (0.35, 1.88)	0.624
	Full-time	98	44.7			1.00 (ref)	

1.00 (ref) = Reference category; SEIFA indicates Socio-Economic Indexes for Areas Index of Relative Socio-Economic Disadvantage; **Significant at $p \leq 0.05$

7.5 Discussion

The aims of this research were to (i) ascertain the prevalence of FI among regional and remote WA children; and (ii) determine which socio-demographic factors predicted child FI. Key findings included that one in five children were classified as FI. Results from regression analyses established that household receipt of government income support and Medium SEIFA IRSD category were significant predictors of child FI.

Given one study had previously found inconsistent results among younger children when using the CFSSM (Connell et al., 2004), we conducted further investigation of FS status among children in our sample. Our finding that FS status did not differ significantly between age groups and our face validity and reliability testing suggested it was appropriate to use this tool with our full child sample. This supports other research that suggests younger children are capable of reporting on their FI experiences (Connell et al., 2005; Nalty et al., 2013). We found that receipt of government income support increased FI which concurs with previous evidence (Burns, 2004; South Metropolitan Population Health Unit, 2014). International and national research highlighted the vulnerability of welfare-dependent families to FI, whereby they needed to spend up to almost half of their available weekly income on food (Kettings et al., 2009; Pollard et al., 2015; Rosier, 2011; Tasmanian Food Security Council, 2012). Furthermore, this study reports a greater likelihood of child FI among families living in areas of Medium levels of disadvantage which aligns with previous Australian evidence of prevalent FI in the three highest socio-economic disadvantage quintiles (Booth et al., 2001). In addition, we were able to report a higher prevalence of FI among these children whose families were not receiving government income support, which suggests that families may not be eligible for income support, or may not believe that they need it. However, the higher FI prevalence among their children indicates more support for these families is required.

The strengths of this study included, to our knowledge, the first published prevalence of child FI in Australia from the child's perspective. Therefore, this study responded to the call of previous research to obtain children's perspectives of FS (Connell et al., 2005; Connell et al., 2004; Pollard, Nyaradi, et al., 2014). Additional strengths included representation from most WA regions, all ASGS RA's and representation of participants from across SEIFA IRSD scores. A limitation includes the use of non-

probability sampling; inclusion of only schools registered with Foodbank WA's *Food Sensations*® initiative could have impacted the prevalence rate of FI. The disparity in the ratio of regional to remote participants in the sample (60.7% regional WA and 39.3% remote WA) versus the WA non-metropolitan population distribution (71.8% regional WA and 28.2% remote WA) (Australian Bureau of Statistics, 2013a) also suggests the reported prevalence may be biased. An additional limitation is non-respondent bias; one school declined participation in this voluntary study because of a perceived high prevalence of FI in their town. Therefore, the towns that participated in this study may have had differing levels of child FI, which may have resulted in more conservative estimates; despite the prevalence we reported already being high. Further, this study had low caregiver/child consent rates; a key reason for this reported by schoolteachers was due to the consent process required in order to conduct this study. An additional reason is suggested to be the sensitive nature of the issue, which potentially deterred caregiver consent and therefore participation among both caregivers and children. Underreporting among participants may also have occurred, as reported by others (Ramsey et al., 2011), despite surveys being suggested by children as a preferred method to measure FI among children (Connell et al., 2004). One participating school recommended that their students should not be asked to complete the CFSSM section of our child survey, due to concerns the stigma that may be associated with these FI questions would result in deliberate underreporting.

This research highlights the considerable challenges associated with valid and reliable assessments of child FI, a stigmatised and sensitive issue. It is evident that FI is a significant public health issue for WA children, albeit the suggested conservative estimate of 20.1% found among this sample. Given childhood is a critical time for development; the importance of increasing FS and consumption of nutritious food to maximise health outcomes among children must be prioritised. Therefore, strategies to mediate the effects of the key underlying socio-demographic determinants preventing adherence to a nutritious diet need to be developed. Recommendations for key government levers include (i) incorporating goals and strategies to improve FS into public health plans or develop stand-alone FS policies (Bastian et al., 2011; Le et al., 2015; National Rural Health Alliance Inc., 2016; South Metropolitan Population Health Unit, 2014). In particular, a focus on increasing equitable access to affordable, nutritious food options, especially for vulnerable groups, should be made a priority

(Department of Health, 2012; Gallegos et al., 2008; Le et al., 2015; Nolan et al., 2006; Pollard, Landrigan, et al., 2014; School of Public Health and Social Work and School of Exercise and Nutrition Sciences, 2013; South Metropolitan Population Health Unit, 2014; World Health Organization, 2003b). Example strategies include food subsidies or incentive schemes (National Rural Health Alliance Inc., 2016; Rychetnik et al., 2003); (ii) ensuring that government welfare policies act as both adequate 'safety nets' and 'springboards' out of disadvantage (World Health Organization, 2003b); (iii) supporting the establishment of local employment opportunities in regional and remote areas, such as through local food production/supply (Bastian et al., 2011), to increase financial security (World Health Organization, 2003b), particularly among those who are *"falling through the net"* of social security (Booth et al., 2001; Nnakwe, 2008); (iv) investing in quality school and adult education/training, focusing on coping skills (World Health Organization, 2003b) and food literacy programs to increase opportunities for community members to gain meaningful, stable employment providing an adequate wage and develop food literacy skills (Australian Institute of Health and Welfare, 2016a; Bastian et al., 2011; Booth et al., 2001; Gallegos et al., 2008; Nolan et al., 2006; Sanders et al., 2009; Temple, 2008). Recommendations for practice include (i) delivery of experiential, targeted food literacy programs (Nolan et al., 2006; Rychetnik et al., 2003) based on FI determinants such as financial resources; and (ii) where possible, offering these free of charge or subsidised for vulnerable groups (Temple, 2008). Specific population groups include low income regional and remote residents (National Preventative Health Taskforce, 2009) (Department of Health, 2012) and large families. Recommendations for future research include (i) further investigation and monitoring of FI and its determinants, from multiple perspectives, in Australia (Booth et al., 2001; Foley et al., 2009; Kettings et al., 2009; Pollard, Nyaradi, et al., 2014), especially among children, regional and remote residents (National Rural Health Alliance Inc., 2016); and (ii) longitudinal research to investigate the impact of FI on children's behaviours and resulting health outcomes (National Rural Health Alliance Inc., 2016).

7.6 Conclusion

To our knowledge, this study provided the first published prevalence of child FI in Australia from the child's perspective. Child FI is likely to be reduced if measures are implemented to reduce health inequities relating to social and economic determinants across regional and remote areas.

7.7 Summary

This chapter provided a quantification of child FI among regional and remote WA children and determined the socio-demographic factors that increase the likelihood that a child is FI. Figures 31-33 include the infographics and refer to the conference presentations developed with this chapter's results. The next chapter, Chapter 8, will introduce the third and final concept examined in this study, ***the relationship between FS and F&V consumption among regional and remote WA children.*** *Chapter 8 will investigate whether FS determinants significantly predict adequate fruit consumption among regional and remote WA children.*

7.8 Research Impact activities arising from Chapter 7

The following includes the draft infographic that was based on this chapter's findings, in addition to related conference presentations delivered internationally.

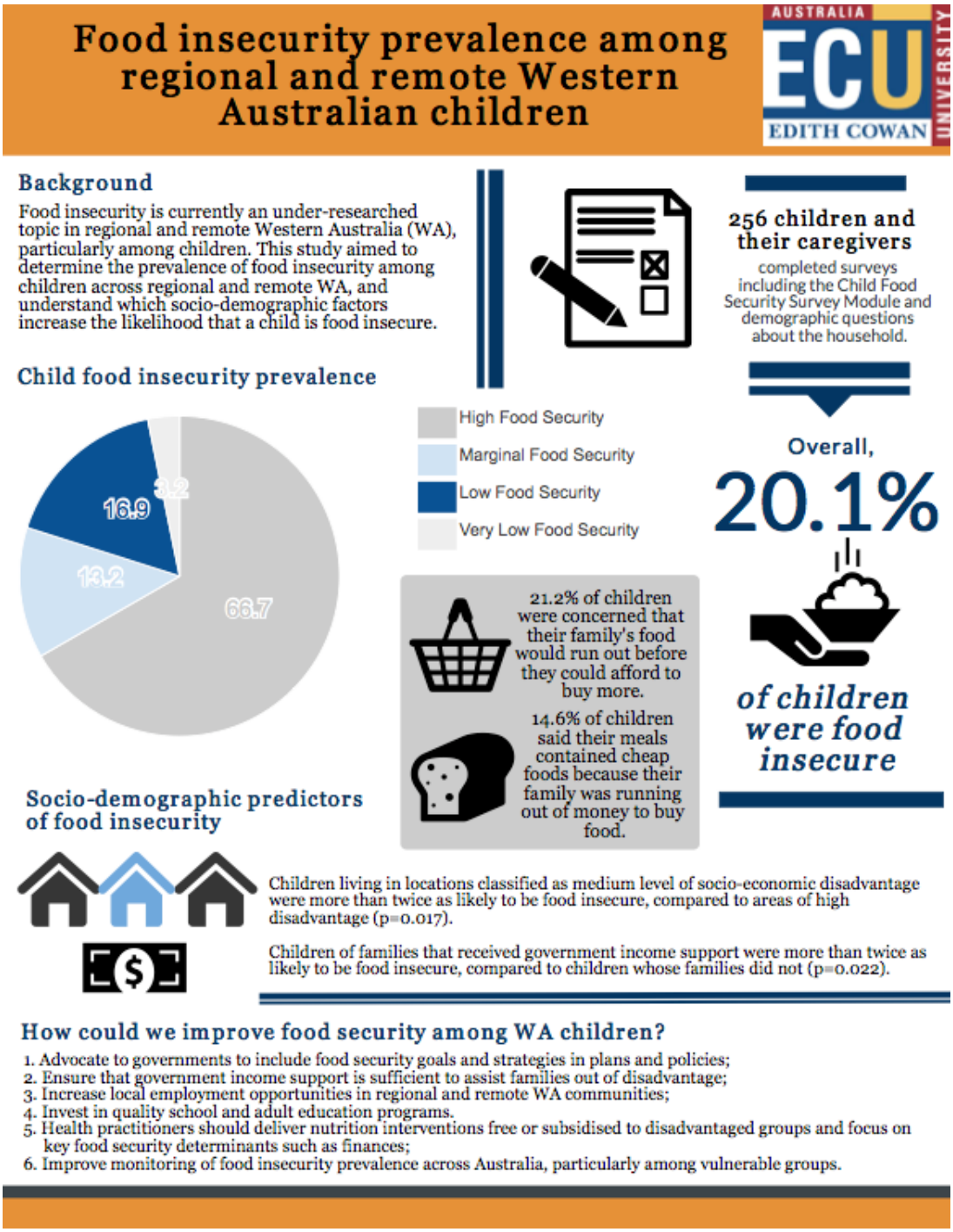

Figure 31: Paper 4 draft infographic for stakeholder review.

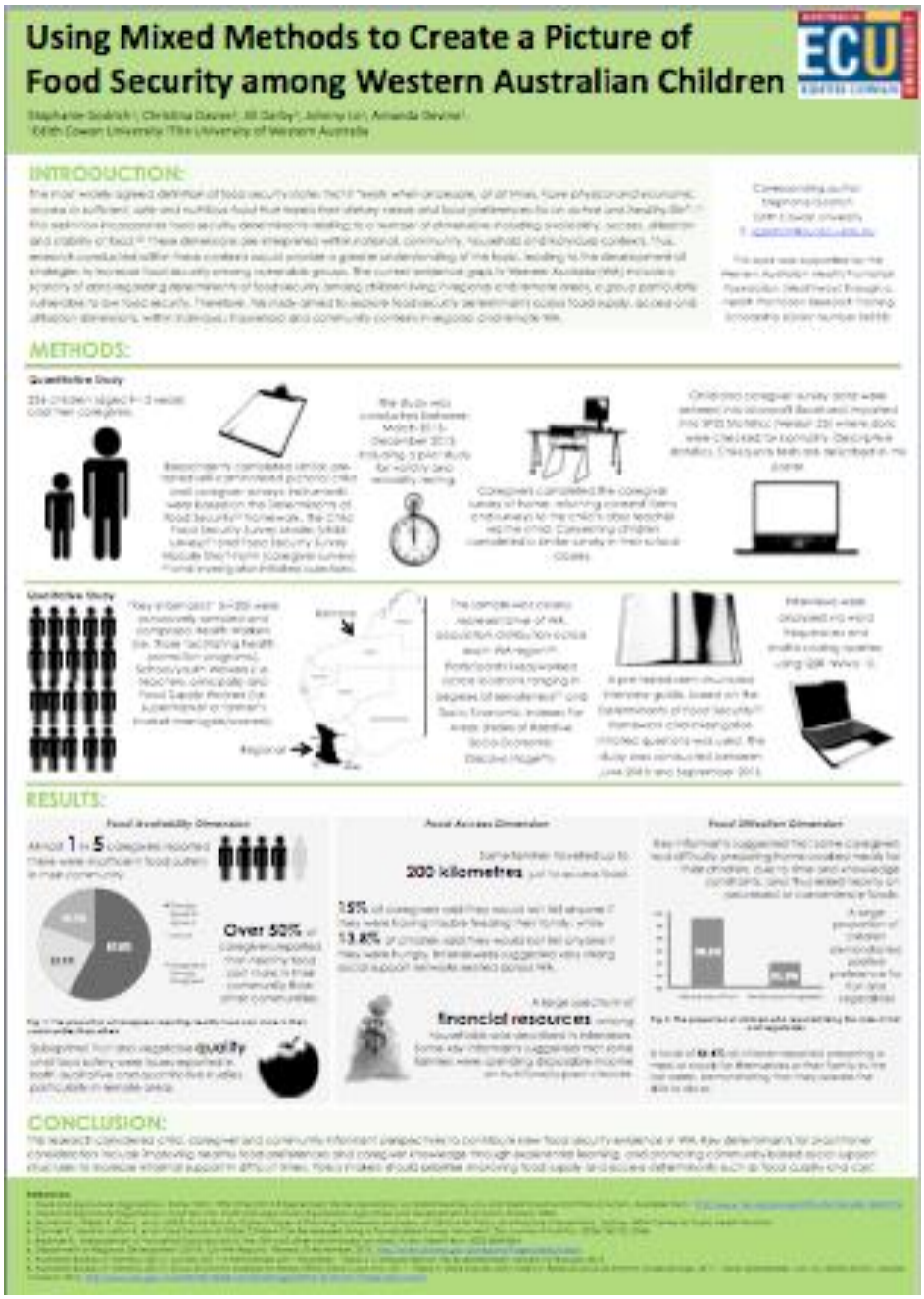

Figure 32: Godrich, S., Davies, C., Darby, J., Lo, J., Devine, A. (2016, September). Using mixed-methods to create a picture of food security among Western Australian children. Paper accepted for poster presentation, World Nutrition Congress, Cape Town, South Africa.

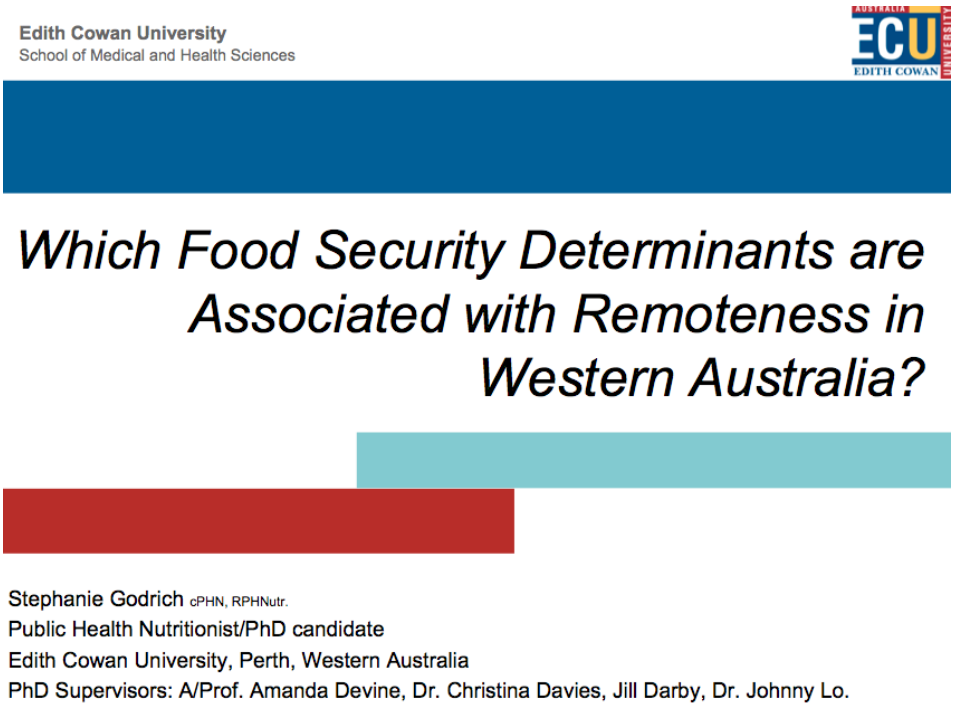

Figure 33: Godrich, S., Lo, J., Davies, C., Darby, J., Devine, A. (2016, July). Which food security determinants are associated with remoteness in Western Australia? Paper accepted for oral presentation at the International Conference on Public Health, Colombo, Sri Lanka.

PART 3: THE RELATIONSHIP BETWEEN FOOD SECURITY DETERMINANTS AND FRUIT AND VEGETABLE CONSUMPTION AMONG REGIONAL AND REMOTE WESTERN AUSTRALIAN CHILDREN

CHAPTER 8: DO FOOD SECURITY DETERMINANTS PREDICT ADEQUATE FRUIT CONSUMPTION AMONG REGIONAL AND REMOTE WESTERN AUSTRALIAN CHILDREN?

8.0 Foreword

This chapter relates to the ***third concept*** *investigated in this study,* ***the relationship between FSD and F&V consumption among regional and remote WA children****. The chapter explores whether FSD across 'food availability', 'food access' and 'food utilisation' dimensions significantly predict adequate fruit consumption among regional and remote WA children. This chapter contributes to answering* ***RQ 5: Are FSD related to F&V consumption and which determinant has the greatest influence on consumption among children in regional and remote WA?*** *This chapter is in preparation for submission. The chapter commences with a brief abstract, followed by the introduction, overview of methods used, key results, discussion including recommendation and conclusion. It also provides a visual representation of the conference presentations delivered, relating to this chapter.*

8.1 Abstract

Objective: FI results in adverse dietary impacts including reduced intake of foods recommended by the ADG. The objective of this research was to determine whether FSD were associated with adequate fruit consumption among children.

Methods: Cross-sectional surveys were completed by caregiver-child dyads (n = 256). Surveys included questions relating to socio-demographic factors, FSD and usual fruit intake. A total of 186 dyads were included in analyses. Descriptive and logistic regression analyses were conducted using IBM SPSS (version 23).

Results: A total of 67.7% of children in this sample met the ADG for fruit consumption. FSD of 'price' and 'social support' met inclusion criteria ($p \leq 0.20$) for multivariable analyses. In an unadjusted multivariable model, price was a significant predictor of children's fruit consumption (p = 0.047), while no relationship was found for social support (p = 0.153). After adjusting for child age, child gender, caregiver age, caregiver gender, caregiver educational attainment, remoteness and SEIFA, price no longer remained significant. Overall, social support was not significantly associated with fruit intake in either the unadjusted or adjusted models.

Conclusion: These findings support the call for fruit subsidies in regional and remote areas to reduce cost. This could increase equitable opportunities for children to access fruit.

8.2 Introduction

FS was defined at the 1996 World Food Summit as *"when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life"* (Food and Agriculture Organization, 1996). This definition was further expanded with the addition of dimensions; 'food availability', 'food access', 'food utilisation'; and stability of the first three dimensions. FI occurs when a person does not have adequate availability of and access to food, or the ability to utilise it. There are numerous poor health outcomes relating to FI, including dietary changes resulting in nutrient deficiencies (Nord, 2007), school absenteeism (Ramsey et al., 2011), lower academic performance (Mechanic et al., 2007) and behavioural issues (Ramsey et al., 2011). Therefore, a better understanding of the key FSD is imperative in order to ensure negative health effects are mediated.

Adequate fruit consumption among children aged 9-13 years is considered by the 2013 ADG to be 2 serves per day. One serve is equivalent to 1 cup of diced fruit or 1 medium piece such as an apple (National Health and Medical Research Council, 2013a). Currently in Australia, fruit consumption among children is moderate, with almost 70% of children adhering to dietary recommendations. WA children consume slightly less than the national average, with almost two-thirds meeting fruit guidelines (Tomlin et al., 2014). While this evidence demonstrates consumption of fruit is inadequate for around one-third of WA children, the evidence base is limited in regards to the influence of FSD on adequate fruit consumption.

In Australia, cost is a key driver of healthy food consumption (Kettings et al., 2009; Pollard et al., 2015; Rosier, 2011), especially for disadvantaged families. Other barriers include a lack of social support (Di Noia, 2013; National Rural Health Alliance Inc. and Australian Council of Social Services, 2013) and community connectedness (National Rural Health Alliance Inc. and Australian Council of Social Services, 2013), inconsistent availability of processed fruit (i.e. tinned fruit) in lower-income communities (Jetter, 2006) and suboptimal fruit quality and variety (Haynes-Maslow et

al., 2013). Variable transportation to access nutritious food (Jetter, 2006) has been reported as a barrier for families that did not own a car, or relied on public transport (Haynes-Maslow et al., 2013). Enablers have included sufficient density of food outlets; previous research demonstrated an increase in fruit intake with each additional supermarket located in the local community (Morland, 2002). Social support was also an enabler, with stronger social networks increasing fruit consumption (Sorensen et al., 2007). In regards to barriers to fruit consumption specifically, a systematic review determined that sensory characteristics appeared to dominate children's negative views (Krolner et al., 2011). For example, taste has been cited as a deterrent to fruit consumption, particularly in comparison to foods high in fat, sugar and salt. Further, 'mushy' textures and 'soggy' attributes were found to impede consumption. In addition, children perceived fruit to be less filling than energy-dense foods (Krolner et al., 2011).

In order to contribute to the sparse evidence base, this study responded to the call of previous research (Department of Health, 2010) and aimed to determine whether FSD were associated with adequate fruit consumption among regional and remote WA children.

8.3 Methods

8.3.1 Sample

A required sample of n = 160 child-caregiver dyads was determined via sample size calculations. This was based on the total number of students attending schools within the desired age range (58,962), included in the 'population' line of the calculator. This was drawn from the Department of Education's annual census (Department of Education WA, 2012b). For precision purposes, the minimum sample size was determined with an effect size of 0.15, 80% power at the 5% level of significance. Study participants were sampled from regional and remote WA schools. Schools participating in the Foodbank WA *Food Sensations*® program were invited to participate in the study. These schools were eligible given the lead author was travelling to these schools for employment. Thus, recruitment using rapport building processes including on site teacher and class briefing sessions (Trapp et al., 2011) was made possible. Contact details for schools located across WA regions (Department of Regional Development, 2014). RA (Australian Bureau of Statistics, 2014b) and SEIFA IRSD (Australian Bureau of Statistics, 2013f) were obtained from school authority websites

(Association of Independent Schools of Western Australia (Inc). 2012; Catholic Education WA, 2012; Department of Education WA, 2012a). These details were used to compile a master database so sampling could reflect school distribution across these factors as closely as possible.

A large majority of the 32 principals of schools invited to participate returned a signed principal CF (71.8%, *n* = 23). Most teachers of classes invited to participate in the study also provided written consent for their class's participation (97.2%, *n* = 69 teachers of 74 classes). A teacher and class briefing session to outline study requirements and distribute study packs was a strategy used to increase rapport and understanding of study requirements (Trapp et al., 2011). This approach was used with almost three-quarters of classes (68.9%, *n* = 51), with the remaining classes that declined the session or was not possible due to budgetary constraints, receiving packs in the mail. All children in consenting classes (*n* = 1814) and their caregivers were invited to participate. A total of 347 caregivers and 340 children provided written consent to participate in this study. Given this study's design included a caregiver-child dyad only matched caregiver-child respondents could be included in the sample (*n* = 256). Missing data for some questions resulted in a sample of *n* = 186 dyads.

8.3.2 Surveys

Paper-based surveys were developed. A number of demographic questions (Table 15) and fruit consumption questions were asked, based on previous literature (Martin et al., 2008) and investigator-initiated questions. For example, caregivers reported their child's usual consumption of fruit through the question: "*How many serves of fruit does your child usually eat each day?*" Response options included: 'My child doesn't eat fruit'; 'one serve of fruit or less each day'; '2 serves of fruit each day'; '3 serves of fruit each day'; '4 serves of fruit or more each day'; 'don't know'. In addition, FSD questions that were underpinned by the Determinants of Food Security framework (Rychetnik et al., 2003) and based on previous literature (Hendrickson et al., 2006) were included (Table 16).

Table 15: Simple logistic regression models for confounding variables/socio-demographic factors and adequate fruit consumption, among regional and remote Western Australian children (n = 186).

Confounding variables/socio-demographic factors		Total n (%)	OR# (95% CI^)	*p*-value
Caregiver age (years)	26-63 years	40.74♮	1.00 (0.95, 1.05)	0.837
Caregiver gender	Male	27 (14.5)	1.80 (0.68, 4.72)	0.232
	Female	159 (85.5)	1.00 (ref)	
Caregiver Educational Attainment	Overall			0.240
	Primary school/Secondary school	59 (31.7)	1.00 (ref)	
	Diploma/Apprenticeship	81 (43.5)	1.79 (0.84, 3.80)	0.128
	Undergraduate University degree/Post-graduate University degree	46 (24.7)	0.95 (0.44, 2.01)	0.897
Child age	9-13	10.86♮	1.08 (0.80, 1.45)	0.591
Child gender	Male	64 (34.4)	0.96 (0.50, 1.83)	0.907
	Female	122 (65.6)	1.00 (ref)	
SEIFA IRSD range[1]	Overall			**0.190**[+]
	Low score (High disadvantage)	119 (64.0)	1.00 (ref)	
	Medium score (Medium disadvantage)	50 (26.9)	0.53 (0.26, 1.05)	0.070
	High score (Low disadvantage)	17 (9.1)	0.70 (0.24, 2.05)	0.520
Geographical location[2]	Regional	108 (58.1)	1.33 (0.71, 2.47)	0.367
	Remote	78 (41.9)	1.00 (ref)	

OR [#] = Odds Ratio; CI [^] = Confidence Interval; [♮] Mean; 1.00 (ref) = reference category. [1] SEIFA Low score (High disadvantage) includes IRSD scores of 1-3; Medium score (Medium disadvantage) includes IRSD scores of 4-6; High score (Low disadvantage) includes IRSD scores of 7-10. [2]Geographical location 'regional' includes the Australian Statistical Geography Standard Remoteness Areas (ASGS RA) of 'Inner regional' and 'Outer regional'(Australian Bureau of Statistics, 2014b); geographical location of 'remote' includes the ASGS RA of 'Remote' and 'Very remote' (Australian Bureau of Statistics, 2014b).

8.3.3 Data collection

Data collection occurred between March 2013 and December 2015. Face validity and reliability testing occurred through a pilot study with one regional school (*n* = 26 dyads). Surveys were completed in school class (child survey) and at home (caregiver survey). Privacy was maintained through provision of a sealable A4 envelope for caregivers to return their surveys, and privacy stickers for children to seal completed surveys. Class teachers collected CF, completed surveys and posted them to the study centre in a pre-paid envelope.

8.3.4 Data analysis

Children and their caregivers were assigned ID numbers and entered into Microsoft Excel datasets, which were imported into IBM SPSS (version 23) (IBM Corp, 2015).

‘Adequate fruit consumption’ was the dependent variable included in regression analyses for this paper. Children’s usual fruit serves, as reported by their caregiver, were compared with the ADG recommendation of 2 serves of fruit to ascertain ‘adequate fruit consumption’ (National Health and Medical Research Council, 2013a). Survey questions that addressed each FS dimension and construct of the Determinants of Food Security (Rychetnik et al., 2003) framework (independent variables) are listed in Table 16. Any cases with missing data were excluded; only complete cases remained (n = 186).

8.3.4.1 Simple regression analyses

The relationship between FSD and adequate fruit consumption were initially explored via simple logistic regression analyses. Continuous independent variables included number of residents in the household, distance to food outlet and time required to travel to food outlets. Caregiver age and child age were potential confounding variables that were entered as continuous variables. The remaining confounding and independent variables were entered into analyses as categorical variables (Table 15 and Table 16).

8.3.4.2 Multivariable regression analyses

Variables significant at $p \leq 0.20$ in simple regression analyses were entered into a multivariable model (Table 17). Both unadjusted and adjusted models were created, the latter of which controlled for socio-demographic factors as confounders for children’s fruit intake. These included child age (Neumark-Sztainer et al., 1996), child gender (Jones et al., 2010; Neumark-Sztainer et al., 1996), caregiver educational attainment (Jones et al., 2010), SEIFA (Giskes et al., 2002; Neumark-Sztainer et al., 1996), caregiver age (Trapp, 2015b), caregiver gender (Trapp, 2015b) and remoteness (Ding Ding., 2012; McNaughton, n.d.). The level of significance was set at $p \leq 0.05$.

8.3.5 Ethical approval

Ethics was obtained from the Edith Cowan University Human Research Ethics Committee (Project 8635).

8.4 Results

8.4.1 Sample demographics

A total of 85.5% of caregiver respondents in this study were females, with the mean age of respondents 40.7 years ± 6.3. Over half (58.1%) of the sample was from regional WA

("Inner regional" and "Outer regional"); 41.9% were from remote WA ("Remote" and "Very remote"). Over one-third of caregiver respondents (31.7%) indicated their highest level of educational attainment was primary or secondary school (Table 15).

8.4.2 Food security determinants

Almost half (49.5%) of caregivers reported that they would eat healthier food if it was more available in their local community, while 79.0% reported that healthy food cost more in their town than elsewhere. The key people 79.0% of caregivers would turn to if they were having trouble feeding their family included family or friends, demonstrating the importance of informal social support. Over two-thirds (68.3%) of families used only one transport mode to access and purchase fruit. The large majority reported knowing how to use fruit in meals and that their child liked the taste of fruit (both 98.4%) (Table 16).

Table 16: Simple logistic regression models for food security determinants and adequate fruit consumption, among regional and remote Western Australian children (n = 186).

FS dimension	FSD	Description	Response	Total n (%)	OR# (95% CI^)	*p*-value
FOOD AVAILABILITY	**Availability in Outlets**	Caregiver reported agreement that they would eat healthier food if more healthy options were available in their community's stores[3]	Disagree	94 (50.5)	1.38 (0.74, 2.57)	0.298
			Agree/Unsure	92 (49.5)	1.00 (ref)	
	Price	Caregiver reported agreement that the cost of healthy eating is higher in their community than other places[3]	Disagree	39 (21.0)	2.57 (1.06, 6.24)	**0.036**[+]
			Agree/Unsure	147 (79.0)	1.00 (ref)	
	Promotion	Caregiver recall of a promotional health slogan/message relating to fruit	No	40 (21.5)	1.00 (ref)	
			Yes	146 (78.5)	0.87 (0.40, 1.87)	0.730
	Quality	Caregiver reported agreement that they would eat more fruit if it didn't spoil so often[3]	Disagree	115 (61.8)	1.37 (0.73, 2.57)	0.318
			Agree/Unsure	71 (38.2)	1.00 (ref)	
	Location of Food Outlets	Caregiver reported agreement that there are enough food stores in their community[3]	Unsure/Disagree	42 (22.6)	1.00 (ref)	
			Agree	144 (77.4)	1.22 (0.59, 2.51)	0.586
	Variety	Number of fruit types consumed by child in past month[4]	Overall			0.479
			1-2	49 (26.3)	1.00 (ref)	
			3	83 (44.6)	1.38 (0.66, 2.90)	0.384
			4-5	54 (29.0)	1.64 (0.72, 3.76)	0.238
FOOD ACCESS	**Social Support**	Who caregiver would tell if they were finding it difficult to feed their family	Overall			**0.115**[+]
			No-one	29 (15.6)	1.00 (ref)	
			Informal Support (Family/friend)	147 (79.0)	2.03 (0.89, 4.58)	0.088
			Formal Support (School/Agency) / both Informal and Formal social support	10 (5.4)	0.81 (0.19, 3.42)	0.777
	Financial Resources	Family receipt of government income support	No	143 (76.9)	0.65 (0.30, 1.42)	0.287
			Yes	43 (23.1)	1.00 (ref)	
		Caregiver employment status	Overall			0.519
			Unemployed/Volunteer	30 (16.1)	1.00 (ref)	
			Part time	78 (41.9)	0.60 (0.23, 1.60)	0.315
			Full time	78 (41.9)	0.57 (0.21, 1.51)	0.261
		Number of household residents	2-14	4.54[¤]	0.97 (0.76, 1.22)	0.798
	Transport to Food Outlets	Number of transport modes used to purchase fruit[5]	Overall			0.477
			1	127 (68.3)	1.00 (ref)	

			2	40 (21.5)	1.23 (0.57, 2.66)	0.588
			3	19 (10.2)	1.98 (0.62, 6.35)	0.246
	Distance to Food Outlets	Distance to food outlet to purchase fruit (Km)	0-200 km	11.0[♮]	0.99 (0.98, 1.00)	0.584
FOOD UTILISATION	**Nutrition Knowledge and Cooking Skills**	Caregiver reported agreement that they don't know how to use fruit in meals	Disagree	183 (98.4)	4.31 (0.38, 48.50)	0.237
			Agree/Unsure	3 (1.6)	1.00 (ref)	
	Food Preferences	Caregiver reported agreement that their children don't like the taste of fruit	Disagree	183 (98.4)	N/A	0.999
			Agree/Unsure	3 (1.6)	1.00 (ref)	
	Storage Facilities	Household storage facilities available[6]	Less than three food storage options	3 (1.6)	1.00 (ref)	
			Three food storage options	183 (98.4)	N/A	0.999
	Food Preparation and Cooking Facilities	Household food preparation and cooking facilities available[7]	Access to gas/electrical appliances only	150 (80.6)	1.00 (ref)	
			Access to fire and gas/electrical appliances	36 (19.4)	0.94 (0.43, 2.03)	0.878
	Time	Time required to travel to food outlets (Minutes)	0-120 minutes	7.87[♮]	0.99 (0.96, 1.01)	0.421

OR [#] = Odds Ratio; CI [^] = Confidence Interval; [♮] Mean; 1.00 (ref) = reference category; N/A = Estimates unavailable due to low counts of SA/A/Unsure
[1] SEIFA Low score (High disadvantage) includes IRSD scores of 1-3; Medium score (Medium disadvantage) includes IRSD scores of 4-6; High score (Low disadvantage) includes IRSD scores of 7-10.
[2] Geographical location 'regional' includes the Australian Statistical Geography Standard Remoteness Areas (ASGS RA) of 'Inner regional' and 'Outer regional'(Australian Bureau of Statistics, 2014b); geographical location of 'remote' includes the ASGS RA of 'Remote' and 'Very remote'(Australian Bureau of Statistics, 2014b).
[3] Questions sourced from Hendrickson, D., Smith, C., Eikenberry, N. (Hendrickson et al., 2006)
[4] Fruit types included 'Fresh'; 'Frozen'; 'Tinned'; 'Dried'; 'Juice'.
[5] Number of transport modes includes the sum of 'Car'; 'Bus'; 'Bicycle'; and 'Walk' options. NB: no respondents reported using all four transport modes.
[6] Household storage facilities includes the sum of 'Refrigerator'; 'Freezer'; 'Cupboard/pantry' options (either all three options or less than three options).
[7] Housheold food preparation and cooking facilities includes the options sum of gas/electrical appliances: 'Stove/cook top'; 'Oven'; 'Barbecue'; 'Microwave'; and sum of gas/electrical appliance plus 'Open fire' [+]Significant at $p \leq 0.20$. Included in multivariate model.

8.4.3 The relationship between food security determinants and adequate fruit consumption

In this sample (n = 186), a total of 67.7% of children met the ADG for fruit consumption. Independent variables that met inclusion criteria for multivariable regression analyses ($p \leq 0.20$) included caregiver reported level of agreement/disagreement that healthy food cost more in their location (Price) and social support networks (Social Support) (Table 16). The unadjusted multivariable model results indicated that price was a significant predictor of children's fruit intake (p = 0.047). Children whose caregiver indicated that healthy food did not cost more in their community compared to other locations were approximately twice as likely to consume adequate fruit. This was in comparison to children whose caregiver indicated that price was barrier. After adjusting for potential confounding variables, price no longer remained significantly associated with fruit intake. Overall, access to social support was not significantly associated with adequate fruit intake among children in either the unadjusted (p = 0.153) or adjusted models (p = 0.108).

Table 17: Multivariable logistic regression model for food security determinants and adequate fruit consumption, among regional and remote Western Australian children (n = 186).

FS Dimension	FSD	Description	Response	1. Adequate Fruit Consumption (unadjusted model)		2. Adequate Fruit Consumption (adjusted for socio-demographic factors)	
				OR # (95% CI^)	*p*-value	OR# (95% CI^)	*p*-value
FOOD AVAILABILITY	**Price**	Caregiver reported agreement that the cost of healthy eating is higher in their community than other places[1]	Disagree	2.47 (1.01, 6.02)	**0.047****	2.05 (0.79, 5.30)	0.138
			Agree/Unsure	1.00 (ref)		1.00 (ref)	
FOOD ACCESS	**Social Support**	Who caregiver would tell if they were finding it difficult to feed their family	Overall		0.153		0.108
			No-one	1.00 (ref)		1.00 (ref)	
			Informal Support (Family/friend)	1.97 (0.86, 4.51)	0.105	2.35 (0.97, 5.67)	**0.056***
			Formal Support (School/Agency)/ both Informal and Formal social support	0.86 (0.20, 3.68)	0.841	1.11 (0.22, 5.42)	0.896

OR # = Odds Ratio; CI ^ = Confidence Interval; 1.00 (ref) = reference category
[1] Question sourced from Hendrickson, D., Smith, C., Eikenberry, N. (Hendrickson et al., 2006)
**Significant at $p \leq 0.05$; *Significant at $p \leq 0.10$
Nagelkerke R Square statistic was 0.061; the *p*-value of the Hosmer and Lemeshow Goodness of Fit Test was 0.894.

8.5 Discussion

The aim of this research was to determine whether FSD were associated with adequate fruit consumption among regional and remote WA children. In simple regression analyses, price of healthy food (‘food availability’ dimension) and social support (‘food access’ dimension) were significant predictors of children’s fruit intake. After inclusion in an unadjusted multivariable model, price of healthy food significantly predicted adequate fruit consumption. However, after adjustment for potential confounders, price no longer remained significant. Social support was not a significant predictor of fruit intake in neither unadjusted nor adjusted multivariable models.

Our finding that cost was associated with adequate fruit intake in the unadjusted multivariable model builds on existing literature. In previous qualitative research, the cost of fruit was extensively described as a barrier to purchasing fruit, with participants expressing their concern about not being able to provide fruit for their family (Haynes-Maslow et al., 2013). Further, previous quantitative research suggests cost was a major barrier for dietary guideline adherence (Jetter, 2006).

Strengths of this study included participants from locations ranging in remoteness, from across WA regions and IRSD scores. This study also contributes new evidence to a scarce WA evidence base, in relation to FSD and fruit consumption across regional and remote areas. Limitations include low response rates and the exclusion of unmatched dyads. The sample size, however, did meet the requirements to answer the objective. In order to be included in the study, child and caregiver participants were required to both consent and complete their respective survey. This further reduced the sample. Incomplete data for some questions resulted in the exclusion of participants, which further reduced the sample.

The price of healthy food significantly predicted fruit intake in simple regression analyses and unadjusted multivariable analyses, however, was no longer significant in the adjusted model. To not over-interpret these findings, cautious considerations could

perhaps include subsidising the cost of fruit in regional and remote areas. This could be made possible through subsidies of core food freight or through vouchers at the store-level (Glanz K., 2004). Subsidies have been previously recommended to increase fruit intake among children (Innes-Hughes et al., 2010; Pollard, Landrigan, et al., 2014; Sacks et al., 2008). In addition, increased reliance on local food supply options may reduce fruit price (Bastian et al., 2011; Sacks et al., 2008; Tasmanian Food Security Council, 2012). Research recommendations could include an investigation into the importance of school food programs, to determine their contribution to children's fruit intake.

8.6 Conclusion

This study contributes new information to the scarce evidence base in regional and remote WA, and suggests that food price may play a role in children's fruit intake. Considerations outlined in this study, such as fruit subsidies in regional and remote communities, may facilitate adherence to the ADG among the one-third of WA children currently consuming inadequate fruit.

8.7 Summary

This chapter explored whether there was an association between FSD and adequate fruit consumption among regional and remote WA children. Key findings included that food price contributed to adequate fruit intake among children. Figures 34-36 include reference to the conference presentations developed, relating to this chapter. The subsequent chapter, Chapter 9, will contribute to answering the second part of RQ 5: to determine whether FSD are related to adequate vegetable consumption among children.

8.8 Research impact activities arising from chapter 8.

The following includes a visual demonstration of the conference presentations, delivered nationally and internationally, that relate to this chapter.

Figure 34: Godrich, S., Lo, J., Davies, C., Darby, J., Devine, A. (2016, July). How do social and economic factors influence fruit and vegetable consumption amongst regional and remote Western Australian children? Paper accepted for oral presentation at the International Conference on Public Health, Colombo, Sri Lanka.

Figure 35: Godrich, S., Lo, J., Davies, C., Darby, J., Devine, A. (2016, September). Are knowledge and preferences associated with adequate child fruit and vegetable consumption? Paper accepted for oral presentation, Public Health Association of Australia 44th Annual Conference and 20th Chronic Diseases Network Conference, Alice Springs, Northern Territory.

Top Fruit and Vegetable Messages Recalled in Regional and Remote Western Australia

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INTRODUCTION:

Many Western Australian (WA) children have suboptimal fruit and vegetable (F&V) consumption,[1] with research suggesting knowledge of specific F&V messages can increase intake.[2] One example of a previously-run fruit and vegetable promotional campaign in WA with specific F&V messages was the "Go for 2&5®" campaign. This campaign informed target audiences of the recommended amounts of fruit and vegetables to consume each day, in addition to strategies to incorporate them into dietary patterns.[3] This study aimed to identify which specific F&V messages were recalled by regional/remote WA children and their caregivers.

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METHODS:

Children aged 9-13 years and their caregivers (n=256 matched dyads) comprised the sample and were recruited through WA Schools.

Participants were sampled from across WA regions, across Inner Regional, Outer Regional, Remote and Very Remote locations[4] and locations ranging in Socio-Economic Index for Areas (SEIFA) Index of Relative Socio-Economic Disadvantage deciles.[5]

Participants completed self-administered paper-based pictorial surveys containing F&V questions including **"What health slogans/messages Can you think of relating to fruit?"** and **"What health slogans/messages can you think of relating to vegetables?"**. Children completed surveys in class at school and caregivers completed surveys at home, returning them to their child's class teacher in a sealable A4 envelope.

Data analyses were conducted using IBM SPSS Statistics (version 23), with descriptive statistics being reported on in this poster.

RESULTS:

Three quarters of children (75.0%) recalled a **fruit** message/slogan. A total of **72.2% of caregivers** recalled a fruit message/slogan. There was no significant difference between caregiver-child dyads for recall of a fruit message (p=0.442). Top fruit messages related to the Go for 2&5® campaign, including "2 fruit" variants.

Fig. 1. Child and Caregiver Responses to the Question: "What Health Slogans/Messages Can You Think of Relating to Fruit?"

Fewer children recalled a **vegetable** message **(64.1%)** than recalled a fruit message. **Fewer caregivers (60.6%)** recalled a **vegetable** message, compared with a fruit message. There was no significant difference between caregiver-child dyads for recall of a vegetable message (p=0.380). Top-of-mind vegetable messages related to the Go for 2&5® campaign, including "5 vegetables" variations.

Fig. 2. Child and Caregiver Responses to the Question: "What Health Slogans/Messages Can You Think of Relating to Vegetables?"

Recall of Fruit and Vegetable Messages

Regional WA | Remote WA

Fig. 3 Proportion of Regional WA children that recalled a fruit message

Fig. 4 Proportion of Remote WA children that recalled a fruit message

Significantly more regional WA children recalled fruit messages than remote WA children (p<0.001)

Fig. 5 Proportion of Regional WA children that recalled a vegetable message

Fig. 6 Proportion of Remote WA children that recalled a vegetable message

Significantly more regional WA children recalled vegetable messages than remote WA children (p=0.042)

Example fruit messages recalled:	Example vegetable messages recalled:
"Fruit is yummy for your tummy"	"Carrots will improve your sight by day and night"
"Give junk food the boot and switch to fruit"	"Eat the colours of the rainbow"

CONCLUSION:

Caregivers and children were more likely to recall fruit than vegetable messages, with a larger variety of specific fruit messages recalled than vegetable messages. Top-of-mind messages most often related to the Go for 2&5® campaign, despite this campaign no longer being funded in WA, this demonstrates successful reach beyond the life of the campaign. Recall of both fruit and vegetable messages was significantly lower among remote WA children, compared with regional WA children. This is suggested to be caused by fewer communication channels available in remote areas for message dissemination, such as lower health service provision. There was no difference in message recall for caregivers by remote location. Implications for practice include health workers continuing to promote specific F&V messages across regional/remote WA, to facilitate recall of important health messages. Further research should investigate key sources of health messages, to determine the most effective promotional channels, and ascertain whether there is an association between recall and health behaviour.

References:

Figure 36: Godrich, S., Davies, C., Darby, J., Lo, J., Devine, A. (2016, September). Top fruit and vegetable messages recalled in regional and remote Western Australia. Paper accepted for poster presentation, Public Health Association of Australia 44th Annual Conference and 20th Chronic Diseases Network Conference, Alice Springs, Northern Territory.

CHAPTER 9: WHICH FOOD SECURITY DETERMINANTS PREDICT ADEQUATE VEGETABLE CONSUMPTION AMONG RURAL WESTERN AUSTRALIAN CHILDREN?

9.0 Foreword

This chapter concludes the third concept investigated in this PhD, ***the relationship between FSD and F&V consumption among regional and remote WA children.*** *The chapter examines whether FSD are related to adequate vegetable consumption among regional and remote WA children, contributing significant new knowledge to a sparse evidence base. This chapter completes the answer to* ***RQ 5: Are FSD related to F&V consumption and which determinant has the greatest influence on consumption among children in regional and remote WA?*** *This paper is published in International Journal of Environmental Research and Public Health (special issue 'Environmental influences on maternal and child health') (Figure 37). The chapter includes a brief abstract, introduction, methods, key results, discussion, conclusion and the draft infographic developed as a result of this chapter's findings.*

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MDPI

Article

Which Food Security Determinants Predict Adequate Vegetable Consumption among Rural Western Australian Children?

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Abstract: Improving the suboptimal vegetable consumption among the majority of Australian children is imperative in reducing chronic disease risk. The objective of this research was to determine whether there was a relationship between food security determinants (FSD) (i.e., food availability, access, and utilisation dimensions) and adequate vegetable consumption among children living in regional and remote Western Australia (WA). Caregiver-child dyads ($n = 256$) living in non-metropolitan/rural WA completed cross-sectional surveys that included questions on FSD, demographics and usual vegetable intake. A total of 187 dyads were included in analyses, which included descriptive and logistic regression analyses via IBM SPSS (version 23). A total of 13.4% of children in this sample had adequate vegetable intake. FSD that met inclusion criteria ($p \leq 0.20$) for multivariable regression analyses included price; promotion; quality; location of food outlets; variety of vegetable types; financial resources; and transport to outlets. After adjustment for potential demographic confounders, the FSD that predicted adequate vegetable consumption were, variety of vegetable types consumed ($p = 0.007$), promotion ($p = 0.017$), location of food outlets ($p = 0.027$), and price ($p = 0.043$). Food retail outlets should ensure that adequate varieties of vegetable types (i.e., fresh, frozen, tinned) are available, vegetable messages should be promoted through food retail outlets and in community settings, towns should include a range of vegetable purchasing options, increase their reliance on a local food supply and increase transport options to enable affordable vegetable purchasing.

Keywords: food security; vegetables; regional and remote Australia; child

1. Introduction

The Food and Agriculture Organisation states that food security incorporates the key dimensions of food availability, food access, food utilisation, and stability of these dimensions [1]. Each dimension includes a range of food security determinants (FSD). At the food availability level, key FSD include availability in outlets, price, promotion, quality; location of outlets; and variety [2,3]. Food access determinants include social support, household financial resources; transportation to outlets; distance to outlets; and mobility [2,3]. Food utilisation determinants include nutrition knowledge and skills; food preferences; household food storage facilities; cooking and food preparation facilities; and time to procure and prepare food [2-4].

Figure 37: Godrich, S.L., Lo, J., Davies, C.R., Darby, J., Devine, A. (2017). Which food security determinants predict adequate vegetable consumption among rural Western Australian children? International Journal of Environmental Research and Public Health. 14 (40), pp 1-15. doi:10.3390/ijerph14010040. Copyright © 2017 by the authors. licensee MDPI, Basel, Switzerland. Online link: http://www.mdpi.com/1660-4601/14/1/40/html

9.1 Abstract

Objective: Improving the suboptimal vegetable consumption among the majority of Australian children is imperative in reducing chronic disease risk. The objective of this research was to determine whether there was a relationship between FSD (i.e., food availability, access, and utilisation dimensions) and adequate vegetable consumption among children living in regional and remote WA.

Methods: Caregiver-child dyads (n = 256) living in non-metropolitan/rural WA completed cross-sectional surveys that included questions on FSD, demographics and usual vegetable intake. A total of 187 dyads were included in analyses, which included descriptive and logistic regression analyses via IBM SPSS (version 23).

Results: A total of 13.4% of children in this sample had adequate vegetable intake. FSD that met inclusion criteria ($p \leq 0.20$) for multivariable regression analyses included price; promotion; quality; location of food outlets; variety of vegetable types; financial resources; and transport to outlets. After adjustment for potential demographic confounders, the FSD that predicted adequate vegetable consumption were, variety of vegetable types consumed ($p = 0.007$), promotion ($p = 0.017$), location of food outlets ($p = 0.027$), and price ($p = 0.043$).

Conclusion: Food retail outlets should ensure that adequate varieties of vegetable types (i.e., fresh, frozen, tinned) are available, vegetable messages should be promoted through food retail outlets and in community settings, towns should include a range of vegetable purchasing options, increase their reliance on a local food supply and increase transport options to enable affordable vegetable purchasing.

9.2 Introduction

The Food and Agriculture Organisation states that food security incorporates the key dimensions of food availability, food access, food utilisation, and stability of these dimensions (Food and Agriculture Organization, 2008). Each dimension includes a range of FSD. At the food availability level, key FSD include availability in outlets, price, promotion, quality; location of outlets; and variety (Innes-Hughes et al., 2010; Rychetnik et al., 2003). Food access determinants include social support, household financial resources; transportation to outlets; distance to outlets; and mobility (Innes-Hughes et al., 2010; Rychetnik et al., 2003). Food utilisation determinants include

nutrition knowledge and skills; food preferences; household food storage facilities; cooking and food preparation facilities; and time to procure and prepare food (Innes-Hughes et al., 2010; Rychetnik et al., 2003).

Locations where availability and access to healthy food is difficult or absent, have been referred to as “food deserts” (Smith et al., 2009; Tasmanian Food Security Council, 2012). The limited food resources in such locations are often unaffordable and of poor quality (Cummins et al., 2010). These issues can negatively impact health (Smith et al., 2009) as a result of poorer dietary intake from important food groups such as vegetables (World Health Organization, n.d.-a).

Adequate vegetable consumption among children aged 9–11 and females aged 12–13 years is deemed by the 2013 ADG to be five or more serves, whereby a serve is equivalent to one cup of salad or half a cup of cooked vegetables. For males aged 12–13 years, the requirement increases to 5.5 serves per day (National Health and Medical Research Council, 2013b). Currently in Australia, the majority (almost 97%) of children consume inadequate amounts of vegetables (Australian Bureau of Statistics, 2015b). Children living in WA consume slightly higher amounts, however, the majority (almost 92%) do not achieve the recommended vegetable intake (Tomlin et al., 2014). While evidence demonstrates most WA children are consuming inadequate amounts of vegetables, the way in which FSD impact children’s vegetable consumption remains largely unknown.

The majority of studies investigating the association between children’s vegetable consumption and food security have been limited to examining FS status (Amaro, 2015; Dave et al., 2009; Grutzmacher et al., 2011; Howard L.L, 2013; Mook, 2016; Trapp, 2015a) rather than FSD. Current evidence relating to FSD suggests the consumption of adequate vegetables is determined by cost, social support, location of food outlets, and transport to outlets. The cost of healthy food options has been suggested to be beyond the budget of many disadvantaged families (Kettings et al., 2009; Pollard et al., 2015; Rosier, 2011). Further, social support significantly increased F&V intake among adolescents (Di Noia, 2013). Children were also more likely to have infrequent vegetable consumption if they attend schools in locations with low supermarket density (Svastisalee, 2012). Residents living in neighbourhoods lacking in transport may have further difficulty accessing healthy food (Jetter, 2006).

This study answers the call of previous research to examine how food security impacts dietary outcomes (Department of Health, 2010; Innes-Hughes et al., 2010). The aim of the current study was to determine whether FSD were associated with adequate vegetable consumption among regional and remote WA children.

9.3 Methods

9.3.1 Sampling and recruitment

This study was conducted in non-metropolitan, rural areas of WA. Reference in this paper to "regional WA" and "remote WA" schools include the locations defined by the ASGS (Australian Bureau of Statistics, 2014b). That is, locations outside of WA's metropolitan area encompassing "Inner regional" and "Outer regional" (herein referred to as "regional WA"), "Remote" and "Very remote" (herein referred to as "remote WA") (Australian Bureau of Statistics, 2014b). In Australia, the remoteness of locations is defined by an area's access to services (Australian Bureau of Statistics, 2014b). Schools who were eligible to participate in the Foodbank WA *Food Sensations*® program were invited. Children aged 9–13 years and their caregivers were selected to facilitate comparisons between children's vegetable intake and the ADG recommendations for F&V (National Health and Medical Research Council, 2013a). The WA DOE annual student census was used to inform a sample size calculation for the research question relating to this manuscript, and determined the sample required (n = 160 children and 160 of their caregivers based on an effect size of 0.15 (small), α = 0.05, 80% power) (Department of Education WA, 2012b). School authority websites (Association of Independent Schools of Western Australia (Inc). 2012; Catholic Education WA, 2012; Department of Education WA, 2012a) were used to compile a Master Schools Database which listed schools by WA region (Department of Regional Development, 2014) (e.g., Pilbara), remoteness (Australian Bureau of Statistics, 2012a), and SEIFA IRSD score (Australian Bureau of Statistics, 2013e).

School principals were initially engaged via an introductory telephone call to explain the study, followed by an email containing a principal IL and CF, in addition to a DOE approval letter. Almost three-quarters (72%, n = 23) of the school principals invited to participate consented for their school to participate. Principals nominated classes of students aged between 9–13 years (n = 71 teachers of 76 classes) on their principal CF. Almost all (97%, n = 69 teachers, 74 classes) teachers invited via a teacher IL returned

the signed teacher CF to the study centre. Where possible (*n* = 51 classes), a teacher and class briefing session was delivered, explaining the study to classes, disseminating the caregiver and child IL/CF envelopes, and providing survey packs to teachers. Teachers of the 23 classes that did not participate in a briefing session were mailed study packs for dissemination. A total of 1814 caregivers and their children were invited to participate in the study, with 347 caregivers and 340 children providing written informed consent. A child-caregiver dyad was the chosen method to facilitate comparisons between data in the wider study, and given matched caregiver and child surveys were a requirement for inclusion, a total of 256 dyads were included in the sample. Due to missing data for some study variables, a total of 187 dyads have been included in analyses.

9.3.2 Instruments

9.3.2.1 Socio-demographic questions

The research team developed cross-sectional, self-administered, pictorial, paper-based child and caregiver surveys. Socio-demographic questions included caregiver and child age, gender, caregiver educational attainment, etc., and are summarised in Table 18. For example, the caregiver survey enquired about caregiver educational attainment, including response options of ‘primary school’; ‘secondary school’; ‘apprenticeship or diploma’; ‘university degree’ and ‘postgraduate university degree’.

Table 18: Simple logistic regression models for confounding variables/socio-demographic factors and adequate vegetable consumption, among regional and remote Western Australian children (n = 187).

Confounding Variables/Socio-Demographic Factors		Adequate Vegetable Consumption		
		Total *n* (%)	OR [#] (95% CI [^])	*p*-Value
Caregiver age (years)	26–63 years	40.6 [†]	1.02 (0.95, 1.10)	0.437
Caregiver gender	Male	28 (15.0)	1.51 (0.51, 4.42)	0.452
	Female	159 (85.0)	1.00 (ref)	
Caregiver highest level of educational attainment	Overall			0.311
	Primary school/ Secondary school	79 (42.2)	1.00 (ref)	
	Diploma/Apprenticeship	59 (31.6)	2.09 (0.74, 5.89)	0.159
	Undergraduate University degree/Post-graduate University degree	49 (26.2)	2.00 (0.67, 5.93)	0.208
Child age (years)	9–13	10.9 [†]	0.77 (0.51, 1.17)	0.225
Child gender	Male	64 (34.2)	1.09 (0.45, 2.63)	0.841
	Female	123 (65.8)	1.00 (ref)	
SEIFA IRSD range [1]	Overall			0.450
	High disadvantage	121 (64.7)	1.00 (ref)	
	Medium disadvantage	49 (26.2)	0.50 (0.16, 1.58)	0.245
	Low disadvantage	17 (9.1)	1.22 (0.32, 4.70)	0.766
Geographical location [2]	Regional	111 (59.4)	1.03 (0.43, 2.43)	0.944
	Remote	76 (40.6)	1.00 (ref)	

OR [#] = Odds Ratio; CI [^] = Confidence Interval; [†] Mean; 1.00 (ref) = reference category;
[1] SEIFA (Socio-economic Index for Areas) Low score (High disadvantage) includes IRSD (Index of Relative Socio-economic Disadvantage) scores of 1–3; Medium score (Medium disadvantage) includes IRSD scores of 4–6; High score (Low disadvantage) includes IRSD scores of 7–10;
[2] Geographical location "regional" includes the Australian Statistical Geography Standard Remoteness Areas (ASGS RA) of "Inner regional" and "Outer regional" (Australian Bureau of Statistics, 2014b); geographical location of "remote" includes the ASGS RA of "Remote" and "Very remote" (Australian Bureau of Statistics, 2014b).

Table 19: Simple logistic regression models for food security determinants and adequate vegetable consumption, among regional and remote Western Australian children (n = 187).

FS dimension	FSD	Description	Response	Adequate Vegetable Consumption		
				Total *n* (%)	OR [#] (95% CI [^])	*p*-Value
Food Availability	**Availability in Outlets**	Caregiver reported agreement that they would eat healthier food if more healthy options were available in their community's stores [1]	Disagree	93 (49.7)	1.33 (0.57, 3.12)	0.502
			Agree/Unsure	94 (50.3)	1.00 (ref)	
	Price	Caregiver reported agreement that the cost of healthy eating is higher in their community than other places [1]	Disagree	39 (20.9)	1.98 (0.78, 5.02)	**0.146** [+]
			Agree/Unsure	148 (79.1)	1.00 (ref)	
	Promotion	Caregiver recall of a promotional health slogan or message relating to vegetables	No	66 (35.3)	1.00 (ref)	
			Yes	121 (64.7)	3.25 (1.06, 9.92)	**0.038** [+]
	Quality	Caregiver reported agreement that they would eat more vegetables if they did not spoil so often [1]	Disagree	124 (66.3)	3.00 (0.98, 9.18)	**0.053** [+]
			Agree/Unsure	63 (33.7)	1.00 (ref)	
	Location of Food Outlets	Caregiver reported agreement that there are enough food stores in their community [1]	Unsure/Disagree	43 (23.0)	1.00 (ref)	
			Agree	144 (77.0)	3.89 (0.88, 17.25)	**0.073** [+]
	Variety	Number of vegetable types consumed by child in past month [2]	Overall			**0.105** [+]
			1–2	86 (46.0)	1.00 (ref)	
			3	75 (40.1)	0.90 (0.33, 2.43)	0.847
			4–5	26 (13.9)	2.80 (0.94, 8.31)	0.064
Food Access	**Social Support**	Who caregiver would tell if they were finding it difficult to feed their family	Overall			0.649
			No-one	32 (17.1)	1.00 (ref)	
			Informal Support (Family/friend)	146 (78.1)	0.75 (0.25, 2.22)	0.616
			Formal Support (School/Agency)/ both Informal and Formal social support	9 (4.8)	1.54 (0.24, 9.70)	0.644
	Financial Resources	Family receipt of government income support	No	141 (75.4)	2.65 (0.75, 9.30)	**0.128** [+]
			Yes	46 (24.6)	1.00 (ref)	
		Caregiver employment status	Overall			0.743
			Unemployed/Volunteer	31 (16.6)	1.00 (ref)	

			Part time	77 (41.2)	1.39 (0.35, 5.44)	0.634
			Full time	79 (42.2)	1.67 (0.43, 6.38)	0.452
		Number of household residents	2–14	4.6 (100)	0.87 (0.60, 1.27)	0.877
	Transport to Food Outlets	Number of transport modes used to purchase vegetables [3]	Overall			**0.129** [+]
			1	129 (69.0)	1.00 (ref)	
			2	40 (21.4)	0.53 (0.14, 1.92)	0.338
			3	18 (9.6)	2.53 (0.80, 8.00)	0.113
	Distance to Food Outlets	Distance to food outlet to purchase vegetables (km)	0–200 km	11.0 [†]	0.99 (0.96, 1.01)	0.495
Food Utilisation	**Nutrition Knowledge and Cooking Skills**	Caregiver reported agreement that they do not know how to use vegetables in meals	Disagree	184 (98.4)	N/A	0.999
			Agree/Unsure	3 (1.6)	1.00 (ref)	
	Food Preferences	Caregiver reported agreement that their children don't like the taste of vegetables	Disagree	165 (88.2)	3.57 (0.45, 27.82)	0.224
			Agree/Unsure	22 (11.8)	1.00 (ref)	
	Storage Facilities	Household storage facilities available [4]	Less than three food storage options	4 (2.1)	1.00 (ref)	
			Three food storage options	183 (97.9)	0.45 (0.04, 4.53)	0.500
	Food Preparation and Cooking Facilities	Household food preparation and cooking facilities used [5]	Gas/electrical appliances only	151 (80.7)	1.00 (ref)	
			Fire and gas/electrical appliances	36 (19.3)	1.05 (0.36, 3.03)	0.919
	Time	Time required to travel to food outlets (minutes)	0–120 minutes	7.89 [†]	0.99 (0.96, 1.03)	0.919

[#] OR = Odds Ratio; CI [^] = Confidence Interval; 1.00 (ref) = reference category; [+] Significant at $p \leq 0.20$. Included in multivariable model; [†] Mean; N/A = Estimates unavailable due to low counts of SA/A/Unsure;
[1] Questions sourced from Hendrickson, D., Smith, C., Eikenberry, N. (Hendrickson et al., 2006);
[2] Vegetable types included "Fresh", "Frozen", "Tinned", "Dried", "Juice";
[3] Number of transport modes includes the sum of "Car", "Bus", "Bicycle", and "Walk" options. Note: no respondents reported using all four transport modes;
[4] Household storage facilities includes the sum of "Refrigerator", "Freezer", "Cupboard/pantry" options (either all three options or less than three options);
[5] Household food preparation and cooking facilities includes the sum of gas/electrical appliances: "Stove/cook top", "Oven", "Barbecue", "Microwave", and sum of gas/electrical appliances plus "Open fire".

9.3.2.2 Independent variable questions

FSD were the independent variables in this study. FSD across community-level food availability, household-level, and individual-level food access and utilisation dimensions were measured by questions underpinned by the Determinants of Food Security (Rychetnik et al., 2003) model. These were based on previous research (Hendrickson et al., 2006) and investigator-initiated questions (Table 19). For example, transportation modes to access F&V included 'car', 'bus', 'walk', 'bicycle', 'no transport', or 'other' response options. Some FSD variables were measured using a five-point Likert scale of 'strongly agree', 'agree', 'unsure', 'disagree', or 'strongly disagree'. For example, caregiver knowledge and skills were measured via level of agreement with the statement: *"I don't know how to use vegetables in meals"*. Number of vegetable types consumed in the previous month was measured through the question *"Please tick which type of vegetables your child ate in the previous month".* Options included 'fresh', 'frozen', 'tinned', 'dried', and 'juice'. All vegetable types included the response options 'yes' or 'no'.

9.3.2.3 Dependent variable question

"Adequate vegetable consumption" was the dependent variable in this study. The question measuring usual vegetable serves consumed by children was based on the WA Child and Adolescent Physical Activity and Nutrition Survey (Martin et al., 2008) (used with permission). Children's usual daily vegetable serves, as reported by their caregiver, were measured using the *question "How many serves of vegetables does your child usually eat each day?"* Prompts were provided to outline what constitutes a serve of vegetables (i.e., one cup of salad vegetables). Response options included: 'My child doesn't eat vegetables'; 'one serve or less each day'; '2 serves each day'; '3 serves each day'; '4 serves each day'; '5 serves each day'; '6 or more serves each day'; 'don't know'. Responses were compared with the ADG recommendation (National Health and Medical Research Council, 2013a) to ascertain whether intake was "adequate" (≥ 5 serves of vegetables each day) or "inadequate" (< 5 serves of vegetables each day). As these survey tools were developed prior to the release of the 2013 ADG, information relating to half serves was not collected. Therefore, male children aged 12 and 13 years were deemed to have consumed adequate vegetable serves if they consumed ≥ 5 serves instead of the recommended ≥ 5.5 serves.

9.3.3 Data collection

Data collection commenced in March 2013 and concluded in December 2015. This included a pilot phase where face validity and reliability testing were conducted and confirmed in one school with 26 dyads. The child survey was completed in class with their class teacher, with completed surveys sealed by students for privacy. Caregiver surveys were completed at home, with a sealable envelope provided for privacy. Schools returned all CF and completed surveys to the study centre in a pre-paid postal envelope. Teachers and caregivers provided written feedback regarding information provided about the study, question wording, convenience of the study processes, and suggestions for improvement.

9.3.4 Data analysis

A unique ID number was allocated to each caregiver-child dyad, with child and caregiver surveys entered into separate, password-protected Microsoft Excel datasets. Datasets were imported into IBM SPSS (version 23) (IBM Corp, 2015) for analyses. Any cases with missing data were excluded in analyses; only complete cases remained (n = 187). Caregiver-reported FSD and vegetable intake of their children was included in this paper.

9.3.4.1 Variable recoding

Due to low cell counts, a number of socio-demographic variables required recoding, including caregiver educational attainment, caregiver employment status, SEIFA IRSD decile, and number of household residents. For example, caregiver educational attainment was recoded to ‘primary school or secondary school’, ‘diploma or apprenticeship’ or ‘undergraduate/postgraduate university degree’ (Table 18). Independent variables that required recoding included variables with five-point response options (i.e., ‘strongly agree’, ‘agree’, ‘unsure’, ‘disagree’, or ‘strongly disagree’) (Table 19).

9.3.4.2 Simple regression analyses

The relationship between each of the independent variables and the outcome variable were assessed via simple logistic regression analyses. All independent variables were entered as categorical variables except for number of residents in the household, distance to food outlets, and time required to travel to food outlets, which were entered

as continuous variables. Potential confounding variables including caregiver age and child age were entered as continuous variables. Inclusion criterion for entry into multivariable analyses was a conservative significance level of $p \leq 0.20$. The use of a conservative inclusion criteria is a validated approach (Bursac et al., 2008) and was used to elucidate important variables for inclusion in the multivariable analyses, as has been used in other studies (Mills et al., 2009).

9.3.4.3 Multivariable Regression Analyses

Significant FSD variables identified in the simple logistic regression analyses were entered into two multivariable models (Table 20), the latter of which was controlled for socio-demographic factors demonstrated in the literature to be associated with adequate vegetable consumption, such as caregiver educational attainment (Jones et al., 2010), SEIFA (Giskes et al., 2002; Neumark-Sztainer et al., 1996), and child gender (Neumark-Sztainer et al., 1996). Child age (Neumark-Sztainer et al., 1996; Svastisalee, 2012), caregiver age (Trapp, 2015b), caregiver gender (Trapp, 2015b), and remoteness (Ding Ding., 2012; McNaughton, n.d.) were also included as potential confounders. The level of significance was set at $p \leq 0.05$.

9.3.5 Ethical approval

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and was approved by the Edith Cowan University Human Research Ethics Committee (project identification code 8635).

Table 20: Multivariable logistic regression models for food security determinants and adequate vegetable consumption, among regional and remote Western Australian children (n = 187).

FS Dimension	FSD	Description	Response	1. Adequate Vegetable Consumption (Unadjusted Model)		2. Adequate Vegetable Consumption (Adjusted for Socio-Demographic Factors)	
				OR # (95% CI ^)	*p*-Value	OR # (95% CI ^)	*p*-Value
Food Availability	**Price**	Caregiver reported agreement that the cost of healthy eating is higher in their community than other places [1]	Disagree	2.56 (0.85, 7.74)	**0.095 ***	3.79 (1.04, 13.87)	**0.043 ****
			Agree/Unsure	1.00 (ref)		1.00 (ref)	
	Promotion	Caregiver recall of a promotional health slogan or message relating to vegetables	No	1.00 (ref)		1.00 (ref)	
			Yes	3.83 (1.14, 12.84)	**0.029 ****	5.62 (1.36, 23.20)	**0.017 ****
	Quality	Caregiver reported agreement that they would eat more vegetables if they did not spoil so often [1]	Disagree	2.40 (0.69, 8.29)	0.164	1.99 (0.49, 8.08)	0.331
			Agree/Unsure	1.00 (ref)		1.00 (ref)	
	Location of Food Outlets	Caregiver reported agreement that there are enough food stores in their community [1]	Unsure/Disagree	1.00 (ref)		1.00 (ref)	
			Agree	5.08 (0.98, 26.31)	**0.052 ***	10.29 (1.30, 81.43)	**0.027 ****
	Variety	Number of vegetable types consumed by child in past month [2]	Overall		**0.017 ****		**0.007 ****
			1–2	1.00 (ref)		1.00 (ref)	
			3	0.89 (0.30, 2.57)	0.829	1.10 (0.35, 3.44)	0.868
			4–5	5.72 (1.51, 21.62)	0.010	10.30 (2.22, 47.69)	0.003
Food Access	**Financial Resources**	Family receipt of government income support	No	3.72 (0.87, 15.80)	**0.074 ***	2.22 (0.44, 11.23)	0.332
			Yes			1.00 (ref)	
	Transport to Food Outlets	Number of transport modes used to purchase vegetables [3]	Overall		0.132		**0.063 ***
			1	1.00 (ref)		1.00 (ref)	
			2	0.42 (0.10, 1.76)	0.239	0.37 (0.07, 1.81)	0.223
			3	2.58 (0.67, 9.97)	0.168	3.95 (0.79, 19.63)	0.093

OR # = Odds Ratio; CI ^ = Confidence Interval; 1.00 (ref) = reference category; ****** Significant at $p \leq 0.05$; ***** Significant at $p \leq 0.10$; [1] Questions sourced from Hendrickson, D., Smith, C., Eikenberry, N. (Hendrickson et al., 2006); [2] Vegetable types included "Fresh", "Frozen", "Tinned", "Dried", "Juice"; [3] Number of transport modes includes the sum of "Car", "Bus", "Bicycle", and "Walk" options. Note: no respondents reported using all four transport modes; Nagelkerke R Square statistic was 0.363; The *p*-value of the Hosmer and Lemeshow Goodness of Fit Test was 0.982.

9.4 Results

9.4.1 Demographics of sample

The majority of caregiver respondents were female (85.0%) with an age range of 26–63 years and a mean age of 40.6 years ± 6.0. Overall, 59.4% of the respondents were from regional WA, while 40.6% were from remote WA. The highest level of education attained by almost half of the respondents (42.2%) was completion of primary (junior, previously in WA year 1 to 7) or secondary (senior, year 8–12) school. Over two-thirds of the child sample was females, while the average age of children was 10.9 years (the equivalent of the final year of junior/primary school in WA). A total of 64.7% of families lived in locations deemed as having a high level of socio-economic disadvantage.

9.4.2 Food security determinants across food availability, access, and utilisation dimensions

The results of this study highlighted the inequalities associated with living in regional and remote WA. Over half (50.3%) of the respondents indicated they would eat healthier food if their food outlets stocked healthier options, while 79.1% believed food in their community cost more than other communities. One-third indicated food quality was suboptimal. The importance of informal social support networks was highlighted by 78.1% of respondents indicating they would turn to a family member or friend if they were having difficulty feeding their family; however, almost one in five (17.1%) would not tell anyone. The majority of caregivers reported knowing how to incorporate vegetables into meals, while 11.8% agreed/were unsure whether their child disliked the taste of vegetables (Table 19).

9.4.3 The association between food security determinants and vegetable consumption

A total of 13.4% of children in this study sample had adequate vegetable intake. Variables that met the inclusion criteria ($p \leq 0.20$) for multivariable regression analyses included caregiver agreement that healthy food cost more in their community (FSD of price); caregiver recall of a promotional health message or slogan relating to vegetables (Promotion); caregiver agreement that they would eat more vegetables if they did not spoil so often (Quality); agreement that there were enough food outlets in their community (Location of food outlets); number of vegetable types consumed by the

child (Variety); family receipt of government income support (Financial resources); and number of transport modes used by the family to purchase vegetables (Transport to food outlets) (Table 19). After inclusion in multivariable analyses, significant determinants (significant at $p \leq 0.05$) that predicted adequate vegetable intake in the adjusted model included number of vegetable types consumed by the child (Variety) ($p = 0.007$); caregiver recall of a promotional health message or slogan relating to vegetables (Promotion) ($p = 0.017$); caregiver reported agreement that there are enough food stores in their community (Location of food outlets) ($p = 0.027$); and caregiver reported agreement that the cost of healthy eating is not higher in their community than other places ($p = 0.043$) (Price). Children who consumed four to five different types/forms of vegetables (i.e., fresh, frozen, tinned, dried, juice) were approximately ten times more likely to consume adequate amounts of vegetables (≥5 serves) (National Health and Medical Research Council, 2013a) compared to those that consumed one or two types. Children whose caregivers recalled a promotional vegetable message or slogan were approximately five times more likely to consume adequate amounts of vegetables for good health, compared to children whose caregivers did not recall a message. Children of caregivers that agreed there were enough food outlets in their town were approximately ten times more likely to eat enough vegetables, while caregivers who believed the cost of healthy eating was not higher in their town, compared to other towns, were approximately three times more likely to have children that consumed adequate vegetables. Number of transport modes used by the family to purchase vegetables (Transport to food outlets) was weakly associated with adequate vegetable consumption ($p = 0.063$). Children whose family used three transport modes to purchase vegetables were more likely to eat enough vegetables in comparison to children whose family used only one transport mode (Table 20). Child age was the only significant confounding variable in this model ($p = 0.022$), in that children's consumption reduced with age.

9.5 Discussion

The aim of this research was to determine whether FSD were associated with adequate vegetable consumption among regional and remote WA children. The significant determinants that predicted adequate vegetable consumption at the multivariable level were within the food availability dimension and included children's consumption of four to five vegetable types/forms; caregiver recall of a promotional health message or

slogan relating to vegetables; presence of sufficient food outlets in their town; and similar vegetable prices to other towns/communities. The number of transport options used by families to purchase vegetables was weakly associated with adequate vegetable consumption among children.

The importance of controlling for potential confounding variables was highlighted in this study. The number of transport modes was not a significant predictor in the unadjusted model, yet after adjustment, was significant at $p \leq 0.10$. A number of FSD increased in significance from $p \leq 0.10$ to $p \leq 0.05$ between the unadjusted and adjusted models (food price, location of food outlets). FSD that remained significant between unadjusted and adjusted models included promotion and variety of vegetable types, indicating these factors are key drivers of vegetable consumption regardless of socio-demographic factors. In contrast, after adjustment, financial resources no longer significantly predicted children's vegetable intake.

Inclusion of a range of vegetable types in the diet, such as fresh, frozen, and tinned, are all recommended for good health by the ADG (National Health and Medical Research Council, 2013a). Previous research indicated availability, cost, and quality of fresh vegetables is a critical issue for regional and remote areas (Pollard, Landrigan, et al., 2014; Pollard, Nyaradi, et al., 2014) Therefore ensuring a range of alternative vegetable types including frozen and tinned offers more opportunities for children to consume adequate quantities of vegetables at a more affordable cost with fewer quality issues than fresh vegetables (Produce for Better Health Foundation, n.d.). Further, many of these types are convenient and may be more readily available when their fresh counterparts are out of season (NSW Health, 2011).

Our finding that 13.4% of children within this study sample met the ADG for vegetables was slightly higher than other Western Australian data, which found that 8.8% of children met vegetable guidelines (Tomlin et al., 2014).

Our finding that caregiver recall of a vegetable promotional message increased the likelihood of adequate vegetable consumption was consistent with previous evidence. The "Go for 2&5®" campaign national evaluation measured recall of campaign messages (Woolcott Research, 2007). Almost half of the parents surveyed indicated the campaign prompted them to take action to improve their family's vegetable consumption, such as increasing the vegetable quantities their family consumed, adding

an extra serve of vegetables, or employing the use of vegetable based recipes. Actions to increase their family's vegetable consumption were significantly higher in the second follow up survey of the national evaluation, compared to the baseline survey (Woolcott Research, 2007). Among WA adults, vegetable consumption increased by 0.6 serves per person during the life of the "Go for 2&5®" campaign (Pollard, 2007; State of Western Australia, n.d.). With regards to communication channels to promote health messages, recognition of vegetable promotional messages in the New South Wales "Eat It To Beat It" campaign were highest for school or other newsletter articles (44%), television or community announcement (42%), recipe cards (24%), and vegetable recipe demonstrations (14%) (Glasson, 2013). Exposure to each additional promotional strategy resulted in a significant increase in vegetable serves (Glasson, 2013).

Our finding that sufficient food outlets predicted adequate vegetable consumption concurred with previous literature. Adequate food outlets located in towns are key drivers of food purchasing and consumption decisions (Rychetnik et al., 2003), with poor density of food outlets shown previously to be associated with inadequate vegetable consumption among adolescents (Svastisalee, 2012).

Strengths of this study include, to our knowledge, the first investigation in Australia to measure the relationship between a wide range of FSD and adequate vegetable consumption. This study sample also comprised participants living in all WA RA, and the majority of WA regions and levels of disadvantage. Additionally, the investigation of vegetable consumption through a FSD lens increases understanding about the relationship between FSD and vegetable consumption. This is particularly useful for advocacy, practice, and research efforts to improve "food deserts", such as in some regional and remote areas. However, there were a number of limitations associated with this study. The low participation rate was suggested to be, in part, a result of the consent processes required for study approval. Active written consent was required from school principals, each class teacher, each caregiver, and each child. Further, children/caregivers were excluded from the study if their child/caregiver counterpart did not participate. This negatively impacted the sample size included in analyses.
This research highlighted the range of FSD that can affect a child's likelihood of consuming adequate amounts of vegetables for good health. Our study findings suggest resulting points of intervention should occur primarily within the food and nutrition system, such as in food outlets (i.e., supermarkets) or direct retail options such as

farmers' markets (Rychetnik et al., 2003). Recommendations relating to significant determinants identified in this study (significant at $p \leq 0.05$) include (i) increasing the range and promotion of vegetable types (i.e., fresh, frozen, tinned, dried, juice) available to and within local food retail outlets across regional and remote WA. This could increase the likelihood of children living in these locations consuming adequate vegetables; (ii) long-term, consistent promotion of specific vegetable messages utilising a wide range of promotional strategies; (iii) consideration of town planning to enable multiple food retail options (i.e., supermarkets, farmers' markets, produce stalls) (Godrich, 2016b) for regional and remote families to source vegetables from, positioned in accessible locations within the town. In addition, consideration of community gardens or edible landscapes could increase opportunities to source and consume adequate vegetables; (iv) increased reliance on a local food supply to reduce the cost of vegetables in regional and remote locations, or core food freight subsidies. Table 21 provides detailed implementation strategies for each of the significant determinants of adequate vegetable consumption. Due to weak associations, cautious recommendations relating to the issue of "transport" could be considered and could include increasing the number of transport options available in towns to increase the potential for families to access food (Bastian et al., 2011; Jetter, 2006; Rychetnik et al., 2003) For example, recommendations could be made for increasing availability or efficiency of public transport, or changes to the built environment to facilitate more active transport. As this paper only reports on investigations into vegetable consumption, further research could "complete the picture" by ascertaining which FSD impact children's fruit consumption. Although approximately two-thirds of WA children are consuming adequate amounts of fruit (Tomlin et al., 2014), further investigation of the factors that predict fruit consumption could improve intake among the current one-third of children consuming suboptimal amounts of fruit (Tomlin et al., 2014).

Table 21: Recommendations and implementation strategies to increase regional and remote Western Australian children's vegetable consumption, based on key findings from this study and previous research.

Recommendation	Setting	Strategies
(i) Increasing the range and promotion of vegetable types/forms (i.e., fresh, frozen, tinned, dried, juice) available to and within local food outlets	Local food retail outlets (i.e., supermarket, farmers' markets, online)	• Training of food outlet owners/managers regarding selection, stocking, pricing, and maintenance a range of vegetable types (Centers for Disease Control and Prevention, 2011b) could be undertaken through management and/or a nutritionist working with the food outlet (Glanz K., 2004; Pollard, Nyaradi, et al., 2014). • Purchasing and consuming less well-promoted types (i.e., tinned vegetables) could be promoted through positioning these types in easy-to-locate areas of the food outlet, online, etc. (Glanz K., 2004; Rychetnik et al., 2003).
	Any settings where health practitioners work	• Health practitioners should promote consumption of a range of vegetable types ("low sodium"/"no added salt" versions of tinned vegetables) with families and children, which is consistent with the ADG recommendations (National Health and Medical Research Council, 2013a). This may increase community requests or advocacy (Rychetnik et al., 2003) for a range of vegetable types. Further, it may assist children to achieve the recommended vegetable quantities for good health (National Health and Medical Research Council, 2013a).
(ii) Long-term, consistent promotion of specific vegetable messages utilising various promotional strategies	Local food retail outlets (i.e., supermarket, prepared food outlets, farmers' markets, online)	• Government-funded reinstatement of the "Go for 2&5®" campaign in WA, or development of a similar vegetable promotional campaign with clear, consistent, action-based vegetable messages. The campaign should target parents and families, with promotional paraphernalia provided free of charge to food outlets, farmers' markets, etc. • Promotional strategies to disseminate vegetable messages could include Point-of-Purchase information such as shelf labels/talkers (Glanz K., 2004), provision of in-store/online recipe cards (Gardiner, 2013), in-store radio and regular "specials" (Rychetnik et al., 2003), or locally created posters (Deakin University, 2005; Miller, 2000). This should be coupled with interactive strategies (Gardiner, 2013; Miller, 2000) such as supermarket/market tours (Glanz K., 2004) and recipe demonstrations incorporating seasonal vegetables and promoting identified messages (Deakin University, 2005). Promotional strategies for core foods (i.e., vegetables) should also be adopted for online shopping through supermarket websites.
	Schools, out-of-school care centres, community centres, other	• Local strategies should support mass media campaigns and local media promoting vegetable consumption (i.e., through community announcements on radio and television) (Rychetnik et al., 2003). • Food outlet vegetable promotion should be reinforced by promotion in settings-based interventions where parents are engaged (i.e., schools, out-of-school care centres, community centres) (Deakin University, 2005; Department of Health, 2010) and also be delivered with children (i.e., the "Crunch & Sip®" program in schools) (Cancer Council Western Australia, 2015). • Credible health agencies endorsing interventions across settings is an effective strategy (Miller, 2000).

(iii) Increase opportunities for families to acquire vegetables from multiple sources in their town	Local food outlets (i.e., supermarket, prepared food outlets, farmers' markets, online); community settings	• Consideration of town planning to enable multiple food retail options (i.e., supermarkets, farmers' markets, produce stalls) (Godrich, 2016b) for regional and remote families to source vegetables from, in accessible locations within the town (McNaughton, n.d.; Rychetnik et al., 2003) (Ding Ding., 2012) • Consideration of community gardens or edible landscapes (Rychetnik et al., 2003).
(iv) Increased reliance on a local food supply to reduce cost as a barrier to vegetable consumption	Local food outlets (i.e., supermarket, prepared food outlets, farmers' markets, online)	• Increased reliance on a local food supply (Bastian et al., 2011; Tasmanian Food Security Council, 2012) to reduce the cost of vegetables, or core food freight subsidies (Innes-Hughes et al., 2010; Pollard, Landrigan, et al., 2014; Sacks et al., 2008).

9.6 Conclusion

This study makes a significant contribution to literature through its investigation into the key FSD impacting regional and remote WA children's vegetable consumption. Action taken to implement the recommendations and associated strategies suggested by this research, relating to increasing availability of a range of vegetable types, promotion, increasing range of food outlets, reduced price, and increasing transport options, may assist in increasing the largely inadequate vegetable consumption among children living in regional and remote WA.

9.7 Summary

This chapter explored whether there was an association between FSD and adequate vegetable consumption among regional and remote WA children. Key findings included that child consumption of a variety of vegetable types (i.e. fresh, frozen, tinned, dried, juice), caregiver recall of a vegetable promotional message, location of food outlets, and price significantly predicted adequate intake of vegetables. Given these findings were within the 'food availability' FS dimension, recommendations have therefore been made within this dimension along with supporting recommendations for other key community settings. Figure 38 includes the infographic developed with this chapter's research findings. The final chapter, 'General Discussion' concludes this Thesis with Publication.

9.8 Research impact activity arising from Chapter 9

The following includes the draft infographic that was based on this chapter's findings.

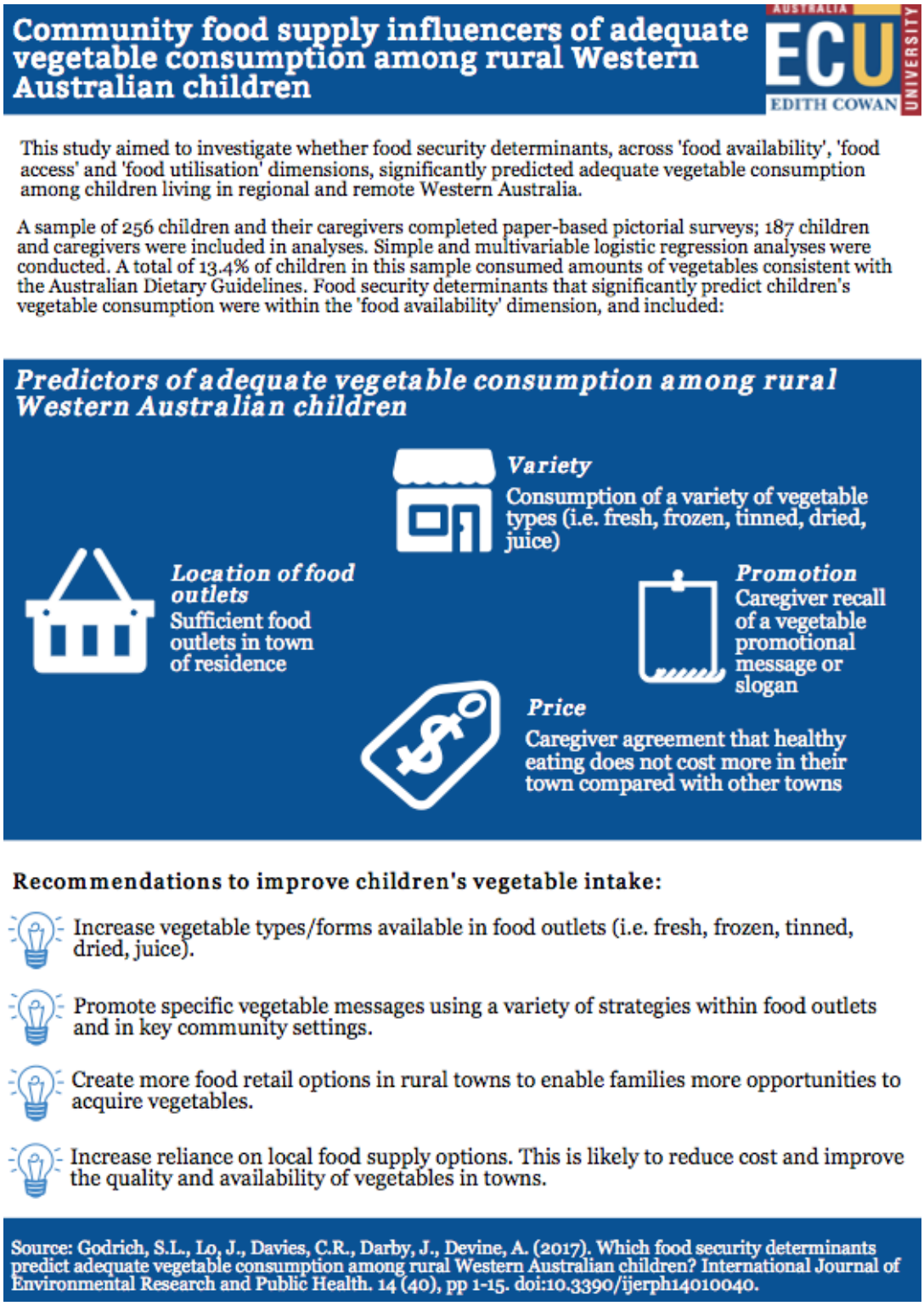

Figure 38: Paper 6 draft infographic for stakeholder review

CHAPTER 10: GENERAL DISCUSSION

10.0 Foreword

This final thesis chapter outlines the key findings of this PhD in relation to each of this study's RQ and manuscripts included in this Thesis with Publication. The significant, original contribution to knowledge this PhD study makes will be highlighted, strengths and limitations of the research will be evaluated and an overview of research translation opportunities will be provided. A communication plan is included to demonstrate the wide-reaching communication channels that could be utilised to promote this study's results. This section concludes this thesis.

10.1 Overview

This PhD study established the multiple factors influencing food availability, access and utilisation, and the impact on children's fruit and vegetable consumption. This new evidence identified inequalities in healthy food supply, social support and nutrition education opportunities, supporting policy advocacy efforts. It has also provided focus for health interventions targeting children and their families and identified future research directions.

This PhD study had the following aim:

To explore the relationship between FSD and F&V consumption among 9-13 year old children living in regional and remote WA.

The study included an exploration of three concepts:

Concept 1: F&V consumption among regional and remote WA children;
Concept 2: FS among regional and remote WA children; and
Concept 3: The relationship between FSD and F&V consumption among regional and remote WA children.

The five RQ included:

RQ1: What are the determinants of F&V consumption among regional and remote WA children?

RQ2: What quantities, varieties and types of F&V do children living in regional and remote WA consume and how do these compare to the serves recommended by the ADG?

RQ3: What are the determinants of FS among regional and remote WA children?

RQ4: What is the proportion of children in regional and remote WA that are FI?

RQ5: Are FSD related to F&V consumption and which determinant has the greatest influence on consumption, among children in regional and remote WA?

The five RQ were investigated through Chapters 4-9 in this Thesis with Publication. **Chapter 4** (**RQ 1**) included an investigation of the determinants of F&V consumption. The exploration of themes across levels of influence, underpinned by an Ecological Model of Health Behaviour, uncovered a range of key intervention points for future focus to improve consumption. Further, this study contributed to the national and state evidence base and provided closer scrutiny of regional and remote WA children's F&V consumption in relation to quantities, types, and varieties of F&V consumption (**Chapter 5, RQ 2**). This revealed research areas that required further investigation in order to increase the currently suboptimal consumption, particularly of vegetables. **Chapter 6** included an exploration of FSD among regional and remote WA children (**RQ 3**), across three key dimensions: food availability, food access, and food utilisation. This qualitative work revealed the complex, interwoven factors that influence children's FS and provided a suite of practical approaches to improve FS among regional and remote WA children across these dimensions. **Chapter 7** contributed the first published prevalence of child FI from a child's perspective in Australia, in addition to an examination of the socio-demographic factors that predict child FI (**RQ 4**). Finally, the associations between FSD and adequate fruit consumption (**Chapter 8, RQ 5**) and FSD and adequate vegetable consumption (**Chapter 9, RQ 5**) were explored. This has contributed significant new knowledge regarding which FSD impact F&V consumption and offers potential intervention approaches to improve F&V intake among regional and remote children. The following section provides a summary of key findings in relation to each RQ.

10.2 Key study findings

10.2.1 The determinants of fruit and vegetable consumption among regional and remote Western Australian children (RQ 1)

Using a combination of theory-driven and data-driven approaches, determinants of WA children's F&V consumption were established. To our knowledge, this was the first published, comprehensive examination of F&V determinants in regional and remote WA. Key findings included that skill sharing was suggested by key informants to improve food literacy skills and role modelling was often lacking, but was considered a critical facilitator of skill development among children. Key settings such as schools were essential to develop health-promoting behaviours; availability of F&V in food outlets was critical yet inequitable across WA. Collaboration among service providers was often inadequate but vital in the consistent promotion of health messages relevant for communities. Store policies that made good quality, healthy food accessible and affordable for residents were well regarded.

10.2.1.1 Policy recommendations

- Continue investment in school food literacy programs, given schools are key settings for the establishment of health-promoting behaviours;
- Invest in programs that are delivered collaboratively between agencies and focus on local priorities for families;
- Increase support for food outlets to implement healthy eating policies and source produce from a local food supply.

10.2.1.2 Practice recommendations

- Deliver family-focused programs that emphasise parental involvement and role modelling. This will aid in the continued reinforcement of positive health behaviours within the home environment;
- Design health promotion programs that are linked to the national curriculum to increase uptake in school settings and transferability across curriculum areas;
- Deliver child-focused programs that have a focus on fun rather than health.

10.2.1.3 Research recommendations

- Investigate the determinants of F&V consumption from both child and parent perspectives;

- Further investigate household provision of F&V;
- Further investigate school and agency emergency food relief provision of F&V.

10.2.2 Quantities, varieties and types of fruit and vegetables consumed by children living in regional and remote Western Australia and comparison to the Australian Dietary Guidelines (RQ 2)

Caregiver survey results determined that 65.8% of the whole sample met ADG for fruit, while only 15.4% met vegetable recommendations. According to the 24-hour FD, regional children were more likely than remote children to consume 'pome, tropical and stone fruit', 'starchy vegetables', 'red/orange vegetables' and 'dark green leafy vegetables' variety groups, while remote WA children were more likely to consume 'dried fruit'. These findings built upon the existing national evidence base to provide closer scrutiny of children's F&V consumption between regional and remote areas. This is in comparison to the existing macro level view where regional and remote findings were grouped into 'non-metropolitan' or 'country' findings (Australian Institute of Health and Welfare, 2014; Martin et al., 2008; Tomlin et al., 2014).

10.2.2.1 Research recommendations

- Determine which factors lead to significantly higher consumption of specific F&V types and variety groups in certain locations;
- Undertake a region-by-region investigation of F&V consumption;
- Identify the setting that contributes the largest amount of F&V to children's diet, i.e. school, home, friend's house.

10.2.3 The determinants of food security among regional and remote Western Australian children (RQ 3)

Using a conceptual framework of the Determinants of Food Security (Rychetnik et al., 2003), factors within the dimensions of food availability, access and utilisation were explored through qualitative interviews. To our knowledge, this is the first study in Australia to investigate FSD across these dimensions, specifically relating to regional and remote areas. Key findings at the food availability level exposed inequalities across regional and remote areas in relation to food availability, cost, quality and promotion. This revealed the existence of food deserts across WA. Within the food access dimension, the importance of efficient social support service provision was highlighted;

many locations had insufficient access to formal services for people with few financial resources. Therefore, informal support between family members and friends assisted to fill the gap. Local food trading groups provided a community-based FS strategy. Findings relating to food utilisation included the importance of children and parents possessing nutrition knowledge and cooking skills. Children successfully dictated their preference for unhealthy food to their parents.

10.2.3.1 Policy recommendations

- Increase support for local food supply options, such as through land use management to enable locally-controlled food production;
- Subsidise core food freight to remote areas;
- Facilitate an equitable distribution of formal social support options across WA and encourage partnerships within and across the sector to conduct activities such as poverty screening. This will contribute to ensuring adequate service provision and may assist in the prevention of people 'slipping through the net';
- Support informal networks such as food growing and exchanging programs that act as an additional level of local social support;
- Fund food literacy programs targeting parents and their children, with a focus on food budgeting and skill building.

10.2.3.2 Practice recommendations

- Deliver child-focused food literacy programs that focus on food growing, cooking and tasting, to improve attitude towards and skills to prepare healthy food;
- Deliver parent-focused programs that provide quick, healthy recipe ideas.

10.2.3.3 Research recommendations

- Conduct quantitative research across WA to determine which FSD are associated with FI;
- Conduct quantitative research to determine the impact of FI on health outcomes;
- Conduct a closer examination into the coping strategies parents/caregivers use when food insecure;
- Conduct qualitative research with children to understand their perspective of FI and how the eating environment may relate to FI.

10.2.4 Prevalence of food insecurity among regional and remote Western Australian children (RQ 4)

Using the CFSSM (Connell et al., 2004), we found that one in five children in our sample were FI. Primary concerns for children included that food would run out before their family could afford to buy more or that their meals contained cheap foods. Socio-demographic predictors of child FI in simple regression analyses included caregiver educational attainment, number of household residents, SEIFA IRSD and family receipt of government income support. After inclusion in multivariable analyses, receipt of government income support and residing in a location classified as Medium SEIFA IRSD significantly predicted child FI. To our knowledge, this paper contributes the first published prevalence in Australia of child FI from a child's perspective.

10.2.4.1 Policy recommendations

- Incorporate goals and strategies to reduce FI among WA communities into existing health plans or policies. Where this is impractical, develop stand-alone FS policies;
- Increase access to quality, affordable, nutritious food options for vulnerable groups across regional and remote areas, such as through food subsidies;
- Ensure that social welfare policies provide adequate funds for people in need, acting as a safety net, but also assist families out of poverty;
- Increase opportunities for regional and remote residents to gain meaningful local employment;
- Invest in school and adult education and training to increase the chances of regional and remote residents to gain employment.

10.2.4.2 Practice recommendations

- Deliver food literacy programs that focus on food budgeting, to provide participants with the skills to purchase and prepare healthy meals on a budget;
- Offer these programs at a discounted rate or for free to 'at risk' groups;
- Deliver food literacy programs in accessible locations such as community hubs.

10.2.4.3 Research recommendations

- Improve monitoring of FI across Australia, particularly among children;

- Undertake research that examines FI from multiple perspectives including those experiencing FI;
- Investigate how FI may impact children's health behaviours and associated outcomes.

10.2.5 Food security determinants that predict adequate fruit intake among regional and remote Western Australian children (RQ 5)

This paper investigated the relationship between FSD and adequate fruit consumption among regional and remote WA children, using simple and multivariable logistic regression analyses. In simple regression analyses, fruit price and family access to social support met inclusion criteria ($p \leq 0.20$) for multivariable analysis. Unadjusted and adjusted (for socio-demographic factors) models were created. In the unadjusted model, children's fruit intake was significantly predicted by the price of fruit. However, after adjustment, price no longer remained significant. In the adjusted model, overall, social support did not significantly predict children's fruit intake.

10.2.5.1 Policy recommendations

- Subsidise the cost of fruit in regional and remote WA.

10.2.5.2 Research recommendations

- Conduct further research to determine the contribution of school programs to children's fruit intake.

10.2.6 Food security determinants that predict adequate vegetable consumption among children in regional and remote Western Australia (RQ 5)

Underpinned by the Determinants of Food Security framework (Rychetnik et al., 2003), this paper investigated the relationship between FSD and adequate vegetable consumption among regional and remote WA children. After inclusion in simple logistic regression analyses, factors that met inclusion criteria ($p \leq 0.20$) for multivariable analyses included vegetable price; promotion; quality; location of food outlets; variety; household receipt of government income support; and transport to foot outlets. Multivariable regression analyses controlled for caregiver age, caregiver gender, caregiver educational attainment, child age, child gender, SEIFA IRSD and remoteness. After adjustment for socio-demographic factors, adequate vegetable consumption among children was predicted by consumption of a variety of vegetable types; caregiver

recall of a vegetable promotional message/slogan; location of food outlets; and price. Overall, *number of vegetable types consumed* by children in the past month (variety) had the greatest influence on children's vegetable consumption. To our knowledge, this manuscript contributes the first examination in Australia of the association between a suite of FSD and children's vegetable consumption.

10.2.6.1 Policy recommendations

- Government-funded reinstatement of the Go for 2&5® campaign, or a similar campaign, that promotes specific action-based vegetable messages targeting families;
- Increase reliance on a local food supply, or vegetable subsidies, to assist with the reduction of vegetable cost;
- Consider supporting multiple food retail options for families to purchase vegetables from. This may additionally include 'edible landscapes' or community gardens to increase vegetable access.

10.2.6.2 Practice recommendations

- Train food outlet managers/owners with the aim of improving purchasing, storage, promotion and pricing of a range of vegetable types/forms (i.e. fresh, frozen, tinned);
- Promote consumption of a range of vegetable types (i.e. fresh, frozen, tinned) in regional and remote WA, which may assist children to consume adequate quantities;
- Continue long-term promotion of specific vegetable messages using a range of promotional strategies in food outlets (i.e. point-of-purchase) and in key community settings where parents are engaged.

10.2.6.3 Research recommendations

- Conduct further research to determine the contribution of school programs to children's vegetable intake.

Table 22: Summary of policy, practice and research recommendations for each research question

RQ	Policy Recommendations	Practice Recommendations	Research Recommendations
1. What are the determinants of F&V consumption among regional and remote WA children?	1.1 Continue investment in school food literacy programs; 1.2 Invest in programs that are delivered collaboratively between agencies and focus on local priorities; 1.3 Increase support for food outlets to implement healthy eating policies and source produce from a local food supply.	1.4 Deliver family-focused programs that emphasise parental involvement and role modelling; 1.5 Design health promotion programs that are linked to the national curriculum; 1.6 Deliver child-focused programs that have a focus on fun rather than health.	1.7. Investigate the determinants of F&V consumption from both child and parent perspectives; 1.8. Further investigate household provision of F&V; 1.9. Further investigate school and agency emergency food relief provision of F&V.
2. What quantities, varieties and types of F&V do children living in regional and remote WA consume and how do these compare to the serves recommended by the ADG?			2.1 Determine which factors lead to significantly higher consumption of specific F&V types and variety groups across WA; 2.2 Undertake region-by-region investigation of F&V consumption; 2.3 Identify the setting that contributes the largest amount of F&V to children's diet, i.e. school.
3. What are the FSD among regional and remote WA children?	3.1 Increase support for local food supply options; 3.2 Subsidise core food freight to remote areas; 3.3 Facilitate an equitable distribution of formal social support options across WA and encourage partnerships within and across the sector to conduct activities such as poverty screening; 3.4 Support informal social support networks such as food growing and exchanging programs; 3.5 Fund food literacy programs targeting parents and their children, with a focus on food budgeting and skill building.	3.6 Deliver child-focused food literacy programs that focus on food growing, cooking and tasting, to improve attitude towards and skills to prepare healthy food; 3.7 Deliver parent-focused programs that provide quick, healthy recipe ideas.	3.8 Conduct quantitative research across WA to determine which FSD are associated with FI; 3.9 Conduct quantitative research to determine the impact of FI on health outcomes; 3.10 Conduct a closer examination into the coping strategies parents/caregivers use when food insecure; 3.11 Conduct qualitative research with children to understand their perspective of FI and how the eating environment may relate to FI.
4. What is the proportion of children in regional and	4.1 Incorporate goals and strategies to reduce FI among WA communities	4.6 Deliver food literacy programs that focus on food budgeting, to provide	4.9 Improve monitoring of FI across Australia, particularly among children;

remote WA that are FI?	into existing health plans or policies. Where this is impractical, develop stand-alone FI policies; 4.2 Increase access to quality, affordable, nutritious food options for vulnerable groups across regional and remote areas; 4.3 Ensure that social welfare policies provide adequate funds for people in need, acting as a safety net, but also assist families out of poverty; 4.4 Increase opportunities for regional and remote residents to gain meaningful local employment; 4.5 Invest in school and adult education and training to increase the chances of regional and remote residents to gain employment.	participants with the skills to purchase and prepare healthy meals on a budget; 4.7 Offer these programs at a discounted rate or for free to 'at risk' groups; 4.8 Deliver food literacy programs in accessible locations such as community hubs.	4.10 Undertake research that examines FI from multiple perspectives including those experiencing FI; 4.11 Investigate how FI may impact children's health behaviours and associated outcomes.
5. Are FSD related to F&V consumption and which determinant has the greatest influence on consumption among children in regional and remote WA?	5.1 Subsidise the cost of fruit in regional and remote WA; 5.2 Government-funded reinstatement of the Go for 2&5® campaign, or a similar campaign that promotes specific action-based vegetable messages targeting families; 5.3 Increase reliance on a local food supply, or vegetable subsidies; 5.4 Consider supporting multiple food retail options for families to purchase vegetables from.	5.5 Train food outlet managers/owners with the aim of improving purchasing, storage, promotion and pricing of a range of vegetable types; 5.6 Promote consumption of a range of vegetable types; 5.7 Continue long-term promotion of specific vegetable messages using a range of promotional strategies in food outlets (i.e. point-of-purchase) and key community settings where parents are engaged.	5.8 Conduct further research to determine the contribution of school programs to children's fruit intake. 5.9 Conduct further research to determine the contribution of school programs to children's vegetable intake.

Table 23: Matrix of recommendations that could be implemented by various agents and within a range of contexts

Action	Agent type					
	Federal Government	State Government	Local Government	Non-Government Agencies	Universities/ Research institutions	Professional/ Advocacy groups
Food policy or funding	1.1; 1.2; 1.3; 3.1; 3.2; 3.3; 3.5; 4.2; 4.3; 4.4; 4.5; 5.1; 5.3; 5.4, 5.5; 5.7	1.1; 1.2; 1.3; 3.1; 3.2; 3.3; 3.4; 3.5; 4.1; 4.2; 4.3; 4.4; 4.5; 4.8; 5.1; 5.2; 5.3; 5.4; 5.5; 5.6; 5.7	1.3; 3.1; 3.2; 3.4; 3.5; 4.1; 4.2; 4.4; 4.5; 4.8; 5.1; 5.3; 5.4; 5.5; 5.6; 5.7			All that align with mission, objectives, policies and position statements of group
Practice/delivery		1.4; 1.6; 3.5; 3.6; 3.7; 4.6; 4.7; 4.8; 5.5; 5.7	5.5; 5.7; 5.8	1.4; 1.5; 1.6; 3.6; 3.7; 4.6; 4.7; 4.8; 5.5; 5.6; 5.7; 5.8		
Promotion	1.3; 5.6	1.3; 3.6; 5.2; 5.6; 5.7	1.3; 5.3; 5.2; 5.6; 5.7	1.3; 3.4; 3.6; 3.7; 5.2; 5.6; 5.7.	1.7; 1.8; 1.9; 2.1; 2.2; 2.3; 2.4; 3.8; 3.9; 3.10; 3.11; 4.9; 4.10; 4.11; 5.8; 5.9	
Research	4.9; 4.10	4.9; 4.10		4.9; 4.10; 5.6	1.7; 1.8; 1.9; 2.1; 2.2; 2.3; 3.8; 3.9; 3.10; 3.11; 4.9; 4.10; 4.11; 5.8; 5.9	
Advocacy						

10.3 Study strengths

Study strengths and limitations have been incorporated into each manuscript included in this Thesis with Publication. However, a number of strengths and limitations apply to multiple manuscripts and thus are described further below.

10.3.1 State wide study

The inclusion of participants across WA regions and degrees of remoteness, according to the ASGS RA (Australian Bureau of Statistics, 2014b), broadened the understanding of issues across the state.

10.3.2 Under-researched subject

Currently, in Australia, FS is an under researched but important topic, particularly amongst disadvantaged groups. To our knowledge, this study provides a starting point for the investigation of FI among children within Australia and answers the call of previous research to further investigate the issue among children. The findings generated from both qualitative and quantitative data streams has provided evidence for advocacy activities and practitioners to develop tailored programs for specific target groups.

10.3.3 Mixed-methods study design

Use of quantitative and qualitative data enabled an in-depth investigation into the study topics. The qualitative data provided greater insight into the concepts, supporting the quantitative data findings and contributing to a greater range of perspectives.

10.3.4 Use of established theories of health behaviour and conceptual models

Use of an Ecological Model of Health Behaviour within the qualitative data stream facilitated understanding of complex issues across multiple levels of influence. This allows both an individual and systems-based investigation of problems, which generates more comprehensive strategies for solutions. Use of the Determinants of Food Security framework (Rychetnik et al., 2003) for the FS component of this study facilitated an understanding of theoretically-determined FSD. This provided established and targeted research on the issue. Further, use of this framework for both qualitative and quantitative data streams facilitated an in-depth investigation of the same topics.

10.3.5 Diversity of participant perspectives

The quantitative data stream utilised a caregiver-child dyad, which facilitated the examination of FS and F&V from child and adult perspectives. Within the qualitative data stream, key informants from health worker, school/youth worker and food supply worker groups provided a range of perspectives from people involved in children's F&V consumption and FS. For example, health workers facilitated community-based nutrition education programs or worked in clinical settings discussing family meal patterns; school/youth workers were teachers involved with school breakfast programs or F&V provision in the schooling environment or youth centres; food supply workers managed local food outlets or farmers' markets. In addition, the inclusion of participants from locations ranging in SEIFA IRSD (Australian Bureau of Statistics, 2013f) ensured that the issues were investigated across levels of disadvantage.

10.3.6 Use of a rich, thick description of qualitative data

Analyses of the qualitative data across the whole dataset enabled a broad understanding of qualitative data, highlighting the complexities associated with both influences on F&V intake, as well as FSD.

10.4 Study limitations

10.4.1 Low response rate for quantitative data stream

School teachers noted the consent processes required for approval of this study as a significant barrier to participation within the quantitative data stream. The response rate in this data stream was lower than anticipated, which possibly limited the study's ability to compare findings between WA regions. Further, the study design included a caregiver-child dyad, resulting in exclusion of a caregiver or child participant if their caregiver/child counterpart did not consent and participate.

10.4.2 Non-random sampling

The use of only schools that were registered with Foodbank WA could have affected the prevalence of FI in our sample in comparison with a random sample, if undertaken. Schools were eligible to register for Foodbank WA if they had a Community Socio-Educational Advantage (ICSEA) decile of 6-10 and/or students at risk of disadvantage (Godrich, 2016a). The ICSEA value indicates the level of education advantage of a school's population in comparison to other schools (Australian Curriculum Assessment

and Reporting Authority, 2015). Foodbank WA employed the PhD candidate during a large proportion of the study period and travel across WA was a component of employment. This facilitated face-to-face rapport-building strategies during recruitment. Budgetary constraints meant that the same study design could not have been undertaken if the majority of the travel to locations was not already occurring.

10.4.3 Non-representative sample

Significant differences existed between our sample and the WA population ($p < 0.001$) in relation to the proportion of regional to remote residents, females, and caregivers aged 25-74, children and people per household in this sample. While due consideration was given to the sampling of participants, self-selection resulted in a non-representative sample.

10.4.4 Cross-sectional study

The use of a cross-sectional study resulted in the inability to draw any causal conclusions from this study.

10.4.5 Release of the new Australian Dietary Guidelines mid-study

This study commenced prior to the release of the new ADG in 2013. Therefore, one of the vegetable serve size prompts, the potato, was provided based on the previous ADG (2003) amount of 1 medium potato, as opposed to the new half a medium potato serve size (National Health and Medical Research Council, 2013a). When further investigation was undertaken, only a small proportion of our sample consumed potato in the 24-hour FD (17%) and therefore any impact is believed to be minimal. Another impact of the release of the new ADG was that this study did not collect information on half-serves. The 2013 ADG classifies adequate vegetable intake for boys aged 12-13 years as 5.5 serves. Therefore, ≥ 5 serves was considered adequate vegetable consumption for boys within that age range in this study. This may have resulted in an overestimation of adequate vegetable consumption for these participants (8.6%, $n = 22$).

10.4.6 Response and non-response bias

One school declined the invitation to participate due to the perception that FI was an issue in their town and they did not want it to be highlighted. Therefore, this could have affected the FI prevalence in our study. However comparisons between demographics of participating schools and non-participating schools were not conducted.

10.4.7 Lack of parent and child perspectives in qualitative data stream

Key informants were the chosen sample for the qualitative data stream, however parent and child samples were not included due to time constraints and the possibility of social desirability bias. It is believed that inclusion of these two additional samples would have enabled triangulation of data on the same topic areas and therefore provided a more detailed understanding of the issue from this range of perspectives.

10.4.8 Underreporting

Due to the sensitive nature of the topic of FI, one school chose not to ask their participating students to complete the CFSSM component of our child survey, due to concerns that children would not accurately report their FI. Among children at schools that did complete the FI related questions, it is believed that underreporting possibly occurred in both the child and caregiver surveys (quantitative data stream) due to the sensitive nature of the questions. However, this is only speculative.

10.4.9 Self reported dietary intake and over reporting

While self-reported dietary intake is appropriate for children above 9 years of age, with increasing reliability among children aged 10-12 years (Watson et al., n.d.), recordings may be impacted due to the perceived healthiness of foods recorded, such as fruit and vegetables. Therefore, the self-reported dietary intake by participants in this study may have been influenced by social desirability, whereby participants reported higher consumption of healthy foods (Agudo, 2005).

10.5 Research Impact

Research impact is an important component of any study, and extends beyond the contribution to academia. Table 24 below outlines the proposed contribution this study may have on health and welfare, public policy, practitioners and services, based on the recommendations arising from each manuscript included in this thesis.

Table 24: Anticipated research impact of this study

Type of research impact		
Health and welfare	**Public Policy**	**Practitioners and services**
• Potential contributions to advocacy to address child FI, through the establishment of child FI prevalence in regional and remote WA; • More evidence provided by this research to support reinstatement of effective public health campaign.	• Policy relating to food access in regional and remote communities may be improved through increased use of local food supply options; • This research may inform public policy relating to improvement of income support.	• Research Translation Reference Group assists with the creation of relevant, practical infographics for health practitioners; • NGO sector and government health workers may utilise research findings in their health, social support and advocacy practice; • Advocacy and consumer groups may use research findings to inform their work relating to certain advocacy focus areas; • Quality of food outlet promotion and stocking of healthy foods may improve.

Table 25: Communication plan

Key messages to be communicated	Target audience	Potential outcomes	Communication method	Timeline
Academic contribution				
New evidence relating to children's F&V consumption, FS, and the relationship between F&V consumption and FSD.	• Policymakers; • Academics.	• Contribution to a scarce evidence base; • Building on evidence base with future research. • Potential future research partnerships or collaboration.	Journal articles	By December 2017
• Knowledge sharing; • Calls to action (policy/practice/research).	Conference and workshop participants	• Changes to practice; • Potential future partnerships or collaboration.	Presentations/ Workshops	2017
Practice contribution				
• Knowledge sharing (evidence from this research); • Calls to action (policy/practice/research); • Potential for future collaborations relating to this research.	*Interagency groups*, for example: • Attendees of the Charitable Food Sector Community of Practice WA chapter forum (currently being planned); • Attendees at the 'Australia's Charitable Food Sector National Forum'; • WA Health Promoting Schools Association; • Public Health Association of Australia PHAA WA branch committee meetings and seminars; • Australian Health Promotion Association WA branch committee; • Connecting Early Years Networks.	• Research results dissemination through target group; • Changes to practice; • Future research and practice collaborations.	• Guest speaking/ • Presentations; • Social media (i.e. twitter); • Infographics; • Vignettes.	2017
• Knowledge sharing (evidence from this research); • Calls to action (practice).	*Agency practitioners*, for example: • WA Country Health Service Regional Dietitians; • Foodbank WA; • Cancer Council WA; • Diabetes WA; • EON Foundation;	• Tailored messages according to type of organisation and sector they operate within.		As requested in 2017 and beyond

	• WA School Canteen Association.			
Community contribution				
• Sharing of research findings/outcomes	• DOE WA; • Parents; • Children; • School teachers; • School principals; • Other community members.	• Increased understanding of the issue; • Empowerment advocate using information.	• Report to DOE; • School newsletter inserts to schools; • Any community presentations as a result of further funding; • Media (traditional and social).	2017

The following flyer showcases the research translation activity of presentations:

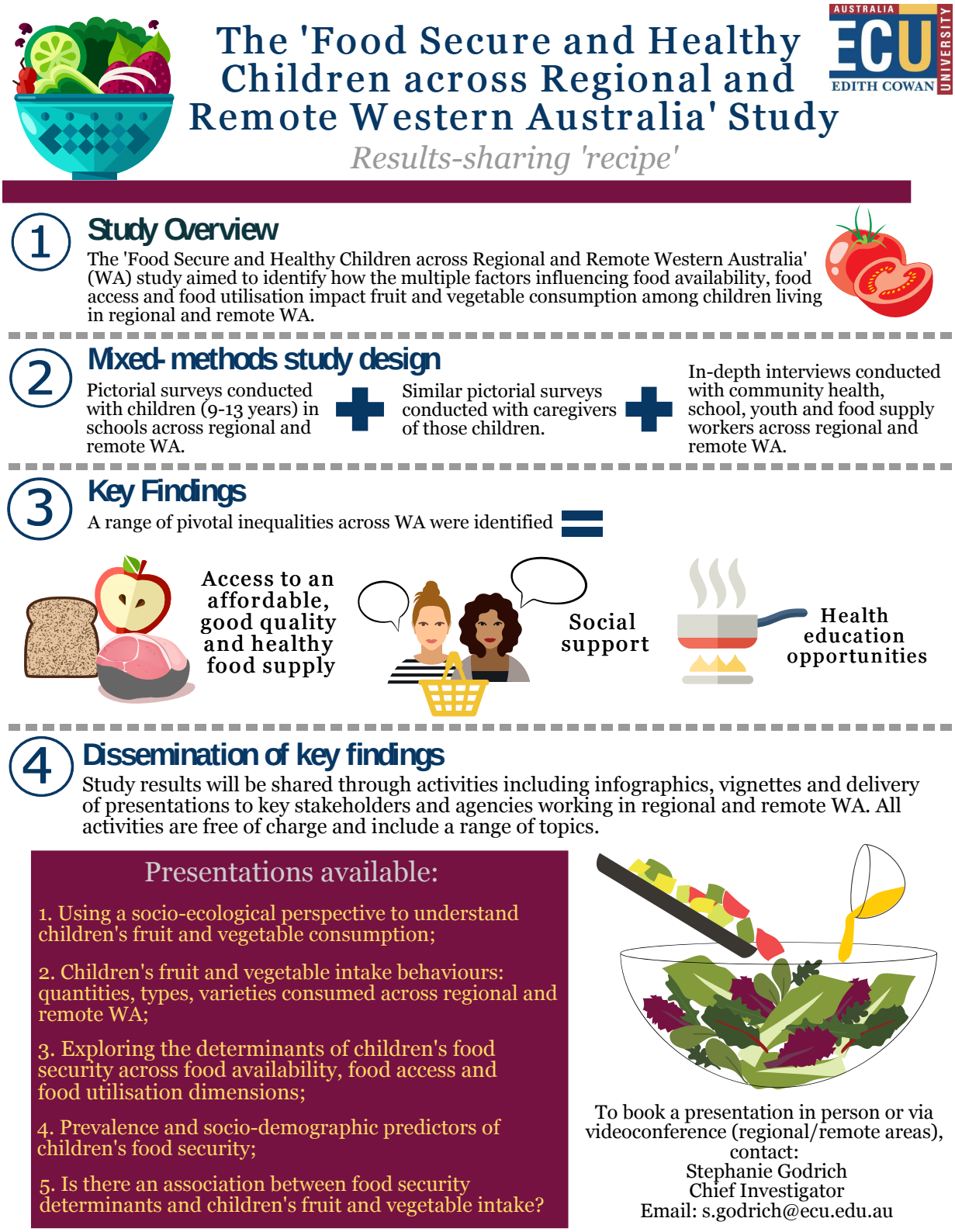

Figure 39: Results-sharing activities flyer

10.6 Conclusion

Overall, this study highlighted key issues across regional and remote WA in relation to availability, affordability and quality of a healthy **food supply**, as well as highlighting critical gaps in access to formal **social support** and **nutrition education** opportunities. This study makes a substantial contribution to the currently scarce evidence base and provides a range of practical recommendations to improve the supply of healthy food, social, nutrition education and health-related service provision across regional and remote WA.

We found that regional and remote WA children's FS, as well as their consumption of F&V, were substantially impacted by their community's **food supply**. Our quantitative research highlighted that certain F&V types and varieties were consumed in significantly different proportions between regional and remote children. Qualitative findings suggested this was caused by inequitable availability and access to a variety of affordable, good quality F&V. This critical impact of the food and nutrition system was verified by our quantitative findings that demonstrated children's vegetable consumption was significantly associated with price, promotion, location of outlets and variety. Key recommendations relating to improving FS and F&V consumption included increased reliance on a local food supply and/or core food freight subsidies, as well as multiple opportunities for families to purchase F&V (i.e. through several food outlets and community gardens or edible landscapes). Healthy store policies, increasing the range and promotion of vegetable types (i.e. fresh, frozen, tinned, dried, juice) available to and within local food outlets and long-term, consistent promotion of specific vegetable messages in-store and through other key community settings (i.e. schools) were additional strategies recommended. Collectively, these are likely to increase availability, quality and decrease the cost of healthy food across regional and remote WA locations.

The importance of **social support** was highlighted by this study, in relation to both FS and F&V intake among children. Inequitable availability of formal social support options for families, such as access to emergency food relief, existed across WA. Key informants suggested that schools largely filled this gap through emergency food provision via breakfast and lunch programs. This reportedly not only improved FS but also made a significant contribution to children's F&V intake. This highlighted the substantial contribution the school setting was considered to make to children's FS and

F&V, but also revealed the need for additional support for interventions implemented *outside* of school settings. Other significant findings relating to formal social support included that receipt of government income support significantly predicted child FI. This was reinforced by our qualitative findings, which suggested low-income and welfare-dependent families had increased difficulty providing a healthy diet for their children. The important role of informal social support provided through families and friends, such as *"meal sharing",* was shown to mediate FI. Our study also reinforced the potential for social community spaces, such as community gardens and kitchens, to increase F&V consumption. Recommended windows for intervention in relation to social support included: agencies working collaboratively to ensure equitable service provision across WA, and the strengthening of informal FS options such as community-driven food growing and trading groups and community gardens. In addition, incorporating FS strategies into existing or new government public health plans and ensuring income support assists families out of poverty were considered essential next steps.

Access to **nutrition education** opportunities, to develop or reinforce nutrition knowledge and cooking skills, was relevant to both F&V and FS study concepts. Parental knowledge was found to vary considerably across regional and remote areas, with peer-to-peer knowledge, recipe sharing and role modelling considered pertinent factors by our qualitative research to improve children's consumption of F&V. These findings also suggested a prominent knowledge-action gap existed, whereby children and their parents did not necessarily translate health knowledge into health-promoting behaviours. Schools were acknowledged for their significant contribution towards children's nutrition knowledge and F&V intake. However, time constraints, fatigue and a lack of interest or valuing of nutrition reduced the potential for important follow up and consolidation of knowledge and skills in the home environment. Key practice recommendations included experiential nutrition and cooking programs, aimed at children and families, which focused on budgeting and contained a vital role modelling component. These programs should focus on local community priorities, contain curriculum linkages and be delivered collaboratively between service providers, to increase message consistency.

This thesis has made a significant contribution to new knowledge in the under-researched area of child FS, FSD, F&V consumption and the relationship between FSD

and F&V consumption across regional and remote WA. Use of a mixed-methods approach enabled a range of perspectives in which to examine the issues and determine practical strategies for policy, practice and research utilising a combination of downstream, midstream and upstream approaches.

Access to food is a basic human right (United Nations, 1948) and all Australians have the right to expect to be FS (Public Health Association of Australia, 2012). Therefore, actions taken to ensure all Australians are FS and have the opportunity to consume adequate F&V for good health is vitally important. This is particularly imperative for vulnerable groups such as children living in regional and remote areas.

APPENDICES

APPENDIX A - STUDY INSTRUMENTS

Child Survey

Edith Cowan University
School of Exercise and Health Sciences

Student Survey

Name: _____ **Town or Community:** _____

Q1a. Are you a boy or a girl? *(Tick ✓ one box only)* ☐1 Boy ☐2 Girl

Q1b. How old are you? _____

Q1c. Including you, how many people live in your house? _____

Q1d. Are you Aboriginal and/or Torres Strait Islander? *(Tick ✓ one box only)* ☐1 Yes ☐2 No

Q2. In your house do you have any of the following? *(Tick ✓ either 'yes' or 'no' for each item)*

	YES	NO
 A working refrigerator	☐1 Yes	☐2 No
 A working freezer	☐1 Yes	☐2 No
 A stove/cook top	☐1 Yes	☐2 No
 An oven	☐1 Yes	☐2 No
 Running water	☐1 Yes	☐2 No
 Electricity	☐1 Yes	☐2 No

	YES	NO
 Utensils & cooking equipment	☐1 Yes	☐2 No
 A BBQ	☐1 Yes	☐2 No
 A microwave	☐1 Yes	☐2 No
 A bench top	☐1 Yes	☐2 No
 Cupboard or pantry	☐1 Yes	☐2 No
 Open fire or flour drum stove for bush cooking	☐1 Yes	☐2 No

Q3a. Write down all the types of fruit you can think of: _____

_____

Q3b. Write down all the types of vegetables you can think of: _____

_____

Q4. Please tick how often each of these things have happened to you. [1]

In the last month	*A lot*	*Sometimes*	*Never*
a). Did you **worry** that food at home would run out before your family got money to buy more?	☐ 1	☐ 2	☐ 3
b). Did the food that your family had **run out** and you didn't have money to get more?	☐ 1	☐ 2	☐ 3
c). Did your meals only include a few kinds of **cheap foods** because your family was running out of money to buy food?	☐ 1	☐ 2	☐ 3
d). How often were you not able to eat a **balanced meal** because your family didn't have enough money	☐ 1	☐ 2	☐ 3
e). Did you have to **eat less** because your family didn't have enough money to buy food?	☐ 1	☐ 2	☐ 3
f). Has the size of your meals **been cut** because your family didn't have enough money for food?	☐ 1	☐ 2	☐ 3
g). Did you have to **skip a meal** because your family didn't have enough money for food?	☐ 1	☐ 2	☐ 3
h). Were you **hungry** but didn't eat because your family didn't have enough food	☐ 1	☐ 2	☐ 3
i). Did you ever not eat for the **whole day** because your family didn't have enough money for food?	☐ 1	☐ 2	☐ 3

Q5a. How many serves of fruit do you usually eat each day? [2]
(Tick ✓ one box only)

☐ 0 I don't eat fruit
☐ 1 1 serve of fruit or less each day
☐ 2 2 serves of fruit each day
☐ 3 3 serves of fruit each day
☐ 4 4 serves of fruit or more each day
☐ 5 Don't know

A serve of fruit equals 1 medium piece of fruit or 2 small pieces or 1 cup of chopped or canned fruit

Source: National Health and Medical Research Council

Q5b. How many serves of vegetables do you usually eat each day? [2] *(Tick ✓ one box only)*

☐ 0 I don't eat vegetables
☐ 1 1 serve of veggies or less each day
☐ 2 2 serves of veggies each day
☐ 3 3 serves of veggies each day
☐ 4 4 serves of veggies each day
☐ 5 5 serves of veggies each day
☐ 6 6 serves of veggies or more each day
☐ 7 Don't know

A serve of veggies equals ½ cup cooked or 1 medium potato or 1 cup salad

Source: National Health and Medical Research Council

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School of Exercise and Health Sciences

Q6a. How many days this week did you eat fruit? *(Tick ✓ one box only)*

☐0 None ☐1 Once this week ☐2 A few days this week ☐3 Every day this week ☐4 Don't know

Q6b. How many days this week did you eat vegetables? *(Tick ✓ one box only)*

☐0 None ☐1 Once this week ☐2 A few days this week ☐3 Every day this week ☐4 Don't know

Q7a. Please tick which type of fruit you ate in the last month. *(Tick ✓ either 'yes' or 'no' for each item)*

	YES	NO
 Fresh	☐1 Yes	☐2 No
 Frozen	☐1 Yes	☐2 No
 Tinned	☐1 Yes	☐2 No
 Dried	☐1 Yes	☐2 No
 Juice	☐1 Yes	☐2 No

Q7b. Please tick which type of vegetables you ate in the last month. *(Tick ✓ either 'yes' or 'no' for each item)*

	YES	NO
 Fresh	☐1 Yes	☐2 No
 Frozen	☐1 Yes	☐2 No
 Tinned	☐1 Yes	☐2 No
 Dried	☐1 Yes	☐2 No
 Juice	☐1 Yes	☐2 No

Q8a. Do you like the taste of fruit? ☐1 Yes ☐2 No

Q8b. Do you like the taste of vegetables? ☐1 Yes ☐2 No

Q9a. What health slogans or messages can you think of relating to "Fruit"?

_____

Q9b. What health slogans or messages can you think of relating "Vegetables"?

_____

Q10. Why do you think you should eat fruit and vegetables?

_____

Q11. Do you ever buy food for you and your family to eat? ☐ Yes ☐ No

If "yes" **a. How many times have you done this in the last week?** _____ **b. How much money did you spend on food the last time you went to the shops?** $ _____

Q12. How does your family normally get to the shop to buy fruit & vegetables?

(Tick ✓ either 'yes' or 'no' for each item)

	YES	NO		YES	NO
 Car	☐1 Yes	☐2 No	 Bike	☐1 Yes	☐2 No
 Bus	☐1 Yes	☐2 No	 I have no transport	☐1 Yes	☐2 No
 Walk	☐1 Yes	☐2 No	Other (Please write above)	☐1 Yes	☐2 No

Q13. How long does it take your family to get to the shop where you usually buy your fruit & vegetables? _____ Minutes OR _____ Hours

Q14. In the last week, have you made a meal or snack for yourself or family?

☐1 Yes ☐2 No

Q15. If you were hungry, who would you tell? ☐0 No One

☐1 A family member (e.g. mum, aunty) ☐2 Someone at your school (e.g. teacher)

☐3 A friend ☐4 Other (please specify)

_____

1. Connell, C., et al., *Food Security of Older Children Can Be Assessed Using a Standardized Survey Instrument.* The Journal of Nutrition, 2004. **134**(10): p. 2566.
2. Martin, K., et al., *Move and Munch Final Report. Trends in physical activity, nutrition and body size in Western Australian children and adolescents: the Child and Adolescent Physical Activity and Nutrition Survey (CAPANS).* 2008, Premier's Physical Activity Taskforce: Perth.

24-hour food diary

Edith Cowan University
School of Exercise and Health Sciences

Food Diary [1]

Your name..... **Your School** .....**Your Year**.....

What to do:

- Eat or drink what you usually have
- Write when, what, where, how much
- Bring your Record Book back tomorrow.

How to use this book

You have been given this book to write down everything that you eat and drink, including water, for the **next 24 hours**. Special pages are provided for writing.

- Do not record salt, pepper, herbs and spices.
- Keep this book with you at all times so that you can write down foods and drinks when you have them.
- Do not change what you eat and drink because it is hard to measure.
- Use the instructions to help you measure and record.

1

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How to fill in your record

Use a **black or blue** pen or **pencil** when writing down everything that you eat and drink. You will need to fill in **four columns**.

Column 1: Time

- Every time you have something to eat or drink, write down the time that you started.
- Write am for the morning and pm for the afternoon or night.

Column 2: Describing the food or drink you are eating

- Start a new line for each food or drink but you may use more than one line to describe each one.
- Write the type and name of each food and drink.
- Write down the brand of the food.
- Check the container or packet for these details if you have it. For example; Arnotts milk arrowroot biscuit

- If the food was cooked, write down how it was cooked. For example; grilled
- If the food had a coating, write down if it was coated with flour, crumbs or batter.
- Write down if the fat on meat was eaten or not eaten.
- Write down if the skin on chicken was eaten or not eaten

How to describe mixed dishes

Mixed dishes could be pizza, stew, soup, and things like sandwiches.

- If the dish was a mix of several foods, name the dish and all of the ingredients you can see in it or know are there.
- You can write a recipe for mixed foods on the back page of this book by writing the name of the dish, the names and amounts of each ingredient, and how it was cooked.
- For sandwiches and rolls write down the type of bread and everything that it has in it.

To see how chicken stew and mashed potato are described, see the example on page 4.

Column 3: Source

- For each food and drink, write where it was made, for example at home. To save space, use the following letters instead of words.

H for Home;
F for friend's house;
C for Canteen;
V for Vending Machine;
T for Takeaway or deli;
O for Other

Column 4: Amount eaten

- Measure amounts of food, drink or supplement served using the special pictures in your CLASS PACK which show the size of different portions.
- You can write down how much the food weight for packet foods, eg 25g packet of chips.
- For a dish that is a mixture of several foods, just write down the total amount eaten.
- For meat and chicken, write down if the meat had the bone or without bone and if it had fat on it or not.

If you have leftovers:

- If you do not eat all of the food or drink served, just write down how much you ate.
- Don't worry about left over cores or bones.

How to measure your food and drinks

- If your food is cooked, measure it cooked, not raw.
- Measure the food after it is served - look at what's on your plate.

24 Hour Food Record

Start time: ———Day———Date———

Finish time: ———Day———Date———

Source codes
H for Home; **F** for friend's house;
C for Canteen; **V** for Vending Machine;
T for Takeaway or deli; **O** for Other

Office use only
ID sticker here.

Start date ___/___/___

Use only blue or black pen or pencil

Started am/pm	*Follow the instructions for describing foods on page 2*	*See box above*	*Follow the instructions on how to measure foods on page 3*
1. Time	**2. Name, type, brand, cooking method**	**3. Source**	**4. Amount eaten**
10.30am	Uncle Toby's fruit filled bar blueberry 97% fat free 60g bar	C	½ bar
10.30am	Tap water from school tap	O	6 mouthfuls
12.30pm	Wholemeal bread (brand not known)		ices 10cm x 10cm x 1cm (1/2 eaten)
12.30pm	Coon cheddar cheese grated	H	Thin layer (1/2 eaten)
12.30pm	Meadow Lea polyunsaturated margarine	H	Thin scrape (1/2 eaten)
12.30pm	Apple juice Daily Juice 100% 250ml	C	250ml carton
12.30pm	Chocolate cake with chocolate icing Betty Crocker packet mix	H	1 slice 5cm 8cm 8cm
4.00pm	Apple green medium	F	1 medium ¾ eaten
6.30pm	Chicken casserole-chicken meat with skin, peas, carrots, onion	H	1 cup

EXAMPLE

4

Edith Cowan University
School of Exercise and Health Sciences

24 Hour Food Diary

Start time: ---------Day--------Date--------

Finish time: --------Day--------Date--------

Use only blue or black pen or pencil

Source codes
H for Home;
F for friend's house;
C for Canteen;
V for Vending Machine;
T for Takeaway or deli;
O for Other

Office use only
ID sticker here.

Start date ___/___/___

Started am/pm	*Follow the instructions for describing foods and drinks on page 2*	*See box above*	*Follow the instructions on how to measure foods and drinks on page 3*
1. Time	**2. Name, type, brand, cooking method**	**3. Source**	**4. Amount eaten**

5

Edith Cowan University
School of Exercise and Health Sciences

Use only blue or black pen or pencil

Source code
H for Home; **F** for friend's house;
C for Canteen; **V** for Vending Machine;
T for Takeaway or deli; **O** for Other

Started am/pm	*Follow the instructions for describing foods and drinks on page 2*	*See box above*	*Follow the instructions on how to measure foods and drinks on page 3*
1. Time	**2. Name, type, brand, cooking method**	**3. Source**	**4. Amount eaten**

6

Edith Cowan University
School of Exercise and Health Sciences

Source code	
H for Home;	**F** for friend's house;
C for Canteen;	**V** for Vending Machine;
T for Takeaway or deli;	**O** for Other

Use only blue or black pen or pencil

Started am/pm	*Follow the instructions for describing foods and drinks on page 2*	*See box above*	*Follow the instructions on how to measure foods and drinks on page 3*
1. Time	**2. Name, type, brand, cooking method**	**3. Source**	**4. Amount eaten**

Please answer this question.

Was the amount of food and drink that you had yesterday about usual, less than usual or more than usual for that day of the week?

Tick one box

1. Usual ☐
2. Less than usual ☐ Reason?.....
3. More than usual ☐ Reason?.....

7

Use this page for notes and recipes.

To record a recipe, give the:
- name of the dish
- names and amounts of each ingredient
- how it was cooked

1. Martin, K., et al., *Move and Munch Final Report. Trends in physical activity, nutrition and body size in Western Australian children and adolescents: the Child and Adolescent Physical Activity and Nutrition Survey (CAPANS)*. 2008, Premier's Physical Activity Taskforce: Perth.

Caregiver Survey

Edith Cowan University
School of Exercise and Health Sciences

Office use only ID sticker

Caregiver Survey

Name: _____ **Town or Community you live in:** _____

Q1a. Are you male or female? *(Tick ✓ one box only)* ☐1 Male ☐2 Female

Q1b. How old are you? _____

Q1c. Including you, how many adults live in your house? _____

Q1d. How many children live in your house? _____

Q1e. Are you Aboriginal and/or Torres Strait Islander? *(Tick ✓ one box only)* ☐1 Yes ☐2 No

Q2. Is there a supermarket or food store selling fruit and vegetables in the town you live in? *(Tick ✓ one box only)* ☐1 Yes ☐2 No

Q3a. Where do you mostly get your fruit and vegetables from? *(Tick ✓ one box only)*

☐1 Supermarket in my town ☐2 Small grocery store in my town ☐3 Supermarket in another town

☐4 Bush Tucker ☐5 Home or Community Garden ☐6 Other (please specify)_____

Q3b. If you buy fruit and vegetables from a shop, how far away is it? _____ km

3c. How long would it take you to get there? _____ minutes

Q4. How does your family normally get to the shop to buy fruit & vegetables?
(Tick ✓ either 'yes' or 'no' for each row below)

	YES	NO
Car	☐1 Yes	☐2 No
Bus	☐1 Yes	☐2 No
Walk	☐1 Yes	☐2 No

	YES	NO
Bike	☐1 Yes	☐2 No
I have no transport	☐1 Yes	☐2 No
Other (Please write above)	☐1 Yes	☐2 No

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Q5. In your house do you have any of the following? *(Tick ✓ either 'yes' or 'no' for each item)*

	YES	NO
 A working refrigerator	☐1 Yes	☐2 No
 A working freezer	☐1 Yes	☐2 No
 A stove/cook top	☐1 Yes	☐2 No
 An oven	☐1 Yes	☐2 No
 Running water	☐1 Yes	☐2 No
 Electricity	☐1 Yes	☐2 No

	YES	NO
 Utensils & cooking equipment	☐1 Yes	☐2 No
 A BBQ	☐1 Yes	☐2 No
 A microwave	☐1 Yes	☐2 No
 A bench top	☐1 Yes	☐2 No
 Cupboard or pantry	☐1 Yes	☐2 No
 Open fire or flour drum stove for bush cooking	☐1 Yes	☐2 No

Q6a. What health slogans or messages can you think of relating to "Fruit"? _____

_____

Q6b. What health slogans or messages can you think of relating to "Vegetables"? _____

_____

Q7a. How many days this week did your child eat fruit? *(Tick ✓ one box only)*

☐0 None ☐1 Once this week ☐2 A few days this week ☐3 Every day this week ☐4 Don't know

Q7b. How many days this week did your child eat vegetables? *(Tick ✓ one box only)*

☐0 None ☐1 Once this week ☐2 A few days this week ☐3 Every day this week ☐4 Don't know

Q8. Please indicate your level of agreement with the following questions:

(Tick ✓ one box per row)

In the last month	*Strongly agree*	*Agree*	*Unsure*	*Disagree*	*Strongly disagree*
a). Crime in my community makes it harder for me to get food [1]	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b). Fresh fruits are available in my community [1]	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c). Fresh vegetables are available in my community [1] ...	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
d) Canned fruits are available in my community [1]	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
e) Canned vegetables are available in my community.....	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
f). Transportation problems make healthy eating hard for me [1].....	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
g) I would eat more fruits if they didn't go bad so often [1].....	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
h). I would eat more vegetables if they didn't go bad so often [1]	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
i). People in my community never go hungry [1]	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
j). There are enough food stores in my community [1] ...	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
k). The cost of healthy eating is higher in my community than other places [1]	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
l). The food available in my community is safe to eat [1]	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
m). I would eat healthier food if the community stores offered more healthy options [1].....	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
n). I don't know how to use fruit in meals.....	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
o). I don't know how to use vegetables in meals.....	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
p). My children don't like the taste of fruit.....	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
q). My children don't like the taste of vegetables.....	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q9a. In the last 12 months, were there any times that you ran out of food and couldn't afford to buy more? [2] *(Tick ✓ one box only)*

☐ 1 I/We ran out of food and had no money to buy more ☐ 2 I/We did not run out of food ☐ 3 Don't know

Q9b. If you ticked that you 'ran out of food and had no money to buy more' to Q9a, how often do you run out of food before the end of the month? [3] *(Tick ✓ one box only)*

☐ 0 I/We do not run out of food ☐ 1 Seldom ☐ 2 Sometimes

☐ 3 Most of the time ☐ 4 Almost always

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Q10. Please indicate whether the following statements were often true, sometimes true or never true for your house in the last 12 months [4] *(Tick ✓ one box per row)*

	Often True	*Sometime True*	*Never True*	*Don't know*
The food we bought didn't last, and we didn't have money to get more	☐ 1	☐ 2	☐ 3	☐ 4
We couldn't afford to eat balanced meals	☐ 1	☐ 2	☐ 3	☐ 4

Q11a. In the last 30 days, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food? [4] *(Tick ✓ one box only)*

☐ 1 Yes *(GO TO QUESTION 11b)* ☐ 2 No *(GO TO QUESTION 12)* ☐ 3 Don't Know

Q11b. If you answered 'yes' to question 11a, how often did this happen? [4]

_____days ☐ 0 Don't know

Q12. Please tick the answer most true for your household over the last 12 months [4]
(Tick ✓ one box per row)

	YES	NO	DON'T KNOW
In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?	☐ 1	☐ 2	☐ 3
In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?	☐ 1	☐ 2	☐ 3

In the space provided below, please write in the name of your child. If more than one of your children has brought a survey home, please answer the questions about the child whose birthday is closest to today's date. ***Childs name*** _____

Q13a. How many serves of fruit does your child usually eat each day? [5] *(Tick ✓ one box only)*

☐ 0 My child doesn't eat fruit
☐ 1 1 serve of fruit or less each day
☐ 2 2 serves of fruit each day
☐ 3 3 serves of fruit each day
☐ 4 4 serves of fruit or more each day
☐ 5 Don't know

A serve of fruit equals 1 medium piece of fruit or 2 small pieces or 1 cup of chopped or canned fruit

Source: National Health and Medical Research Council

Q13b. How many serves of vegetables does your child usually eat each day? [5] *(Tick ✓ one box only)*

☐ 0 My child doesn't eat vegetables
☐ 1 1 serve of veggies or less each day
☐ 2 2 serves of veggies each day
☐ 3 3 serves of veggies each day
☐ 4 4 serves of veggies each day
☐ 5 5 serves of veggies each day
☐ 6 6 serves of veggies or more each day
☐ 7 Don't know

A serve of veggies equals ½ cup cooked or 1 medium potato or 1 cup salad

Source: National Health and Medical Research Council

Q14a. Please tick which type of fruit your child ate in the last month. *(Tick ✓ 'yes' OR 'no' each item)*

	YES	NO		YES	NO
 Fresh	☐1 Yes	☐2 No	 Dried	☐1 Yes	☐2 No
 Frozen	☐1 Yes	☐2 No	 Juice	☐1 Yes	☐2 No
 Tinned	☐1 Yes	☐2 No			

Q14b. Please tick which type of vegetables your child ate in the last month. *(Tick ✓ 'yes' OR 'no' for each item)*

	YES	NO		YES	NO
 Fresh	☐1 Yes	☐2 No	 Dried	☐1 Yes	☐2 No
 Frozen	☐1 Yes	☐2 No	 Juice	☐1 Yes	☐2 No
 Tinned	☐1 Yes	☐2 No			

Q15. If you were finding it difficult to feed your family, who would you tell?

☐0 No One ☐1 A family member (e.g. mum, aunty) ☐2 Someone at your child's school (e.g. teacher)
☐3 A friend ☐4 Other (please specify) _____

Q16. Please tick the box which shows your highest level of education:

☐1 I completed primary school ☐2 I completed high school
☐3 I completed an apprenticeship or Diploma ☐4 I completed a University degree
☐5 I completed a post-graduate university degree ☐6 I Don't know

Q17. Please tick one box below about your employment status:

☐0 I am *not in the labour force* ☐1 I am a *Volunteer*
☐2 I am employed in *Part Time work* ☐3 I am employed in *Full Time work*

Q18. Do you receive Government financial assistance, for example Centrelink? ☐1 Yes ☐2 No

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1. Hendrickson, D., C. Smith, and N. Eikenberry, *Fruit and vegetable access in four low-income food deserts communities in Minnesota.* Agriculture and Human Values, 2006. **23**(3): p. 371-383.
2. McLennan, W. and A. Podger, *National Nutrition Survey Selected Highlights Australia 1995.* 1995, Australian Bureau of Statistics: Canberra.
3. Palmer-Keenan, D., et al., *Measures of Food Insecurity/Security.* Journal of Nutrition Education, 2001. **33**(1): p. S49-S58.
4. Blumberg S.J., et al., *The effectiveness of a short form of the Household Food Security Scale.* American Journal of Public Health, 1999. **89**(8): p. 1231-1234.
5. Martin, K., et al., *Move and Munch Final Report. Trends in physical activity, nutrition and body size in Western Australian children and adolescents: the Child and Adolescent Physical Activity and Nutrition Survey (CAPANS).* 2008, Premier's Physical Activity Taskforce: Perth.

Key Informant Interviews – Semi Structured Interview Guide

Question 1: Tell me what it has been like for you, working in regional and remote WA?

Question 2: Tell me a bit about the communities you work/live in – what is the food situation like?

Question 3: What key issues associated with food insecurity exist in these communities?

Prompt: What can you tell me about location of food outlets?

Prompt: Tell be a bit about food availability in outlets

Prompt: What information can you give me about food price?

Prompt: Can you talk about food quality?

Prompt: What information can you say about variety available?

Prompt: What about promotion of food?

Prompt: How about financial resources of local residents?

Prompt: What can you tell me about distance and transport to shops?

Prompt: What about knowledge, skills and food preferences?

Prompt: How are food storage facilities?

Prompt: What are people's preparation and cooking facilities like?

Prompt: How about time and mobility to access food?

Prompt: Can you talk a bit around social support?

Question 4: What are your thoughts around the amount of fruit and veg kids are eating in the areas you live/work in?

Question 5: What about the types?

Question 6: What about the quality?

Question 7: What types of things make it hard for children to eat fruit and veg in the areas you live/work in?

Question 8: What makes it easier for kids to eat fruit and veg?

Question 9: How can we make fruit and veg more appealing?

Question 10: What sorts of strategies do you think would work to increase fruit and veg consumption?

Question 11: What successful strategies have you seen in regional and remote WA?

Question 12: What do you think are the biggest motivators for fruit and veg consumption among kids?

Question 13: How do you think kids feel about the consequences of low fruit and veg consumption?

Question 14: Is there anyone else you suggest I contact to interview?

APPENDIX B - STUDY APPROVALS

ECU HREC approval

RE

Research Ethics <research.ethics@ecu.edu.au>

Tue 18/10, 11:02 AM

Stephanie GODRICH

Reply all

You forwarded this message on 18/10/2016 11:04 AM

Hi Stephanie

Project 8635 - A Cross-Sectional Study to Measure and Describe the Association Between Fruit and Vegetable Consumption and Food Security Determinants of children (9-13 years) Living in Regional and Remote Western Australia

Thank you for letting us know about the proposed changes to your project. As the changes do not raise any further ethical implications, I am happy to grant approval for the changes on behalf of the Ethics Committee.

An extension of ethics approval until 31 December 2017 has also been granted.

Regards
Kim

Kim Gifkins, Senior Research Ethics Advisor, Office of Research & Innovation, Edith Cowan University, 270 Joondalup Drive, Joondalup, WA 6027
Email: [research.ethics@ecu.edu.au]**research.ethics@ecu.edu.au** Tel: +61 08 6304 2170 | Fax: +61 08 6304 5044 | CRICOS IPC 00279B

HUMAN RESEARCH ETHICS COMMITTEE
For all queries, please contact:
Research Ethics Officer
Edith Cowan University
270 Joondalup Drive
JOONDALUP WA 6027
Phone: 6304 2170
Fax: 6304 5044
E-mail: research.ethics@ecu.edu.au

AUSTRALIA ECU UNIVERSITY
EDITH COWAN

OFFICE OF RESEARCH
AND INNOVATION

270 Joondalup Drive,
Joondalup
Western Australia 6027
Telephone 134 328
Facsimile: (08) 9300 1257
CRICOS 00279B

ABN 54 361 485 361

13 February 2015

Ms Stephanie Godrich
Faculty of Health, Engineering and Science
JOONDALUP CAMPUS

Dear Stephanie

EXTENSION OF ETHICS APPROVAL

Project Code:	**8635**	
Project Title:	**A Cross-Sectional Survey to Describe and Measure the Association Between Fruit and Vegetable Consumption and Food Security Determinants of children (9-13 years) Living in Regional and Remote Western Australia**	
Chief Investigator:	Ms Stephanie Godrich	
Approval Dates:	From: 27 November 2012	To: 30 June 2016

Funding Source: Healthway Health Promotion Research Training Scholarship

Ethics approval was initially granted from 27 November 2012 to 30 June 2015.

This letter is to confirm that an extension of ethics approval until 30 June 2016 was granted by the ECU Human Research Ethics Committee.

We wish you success with this research project.

Yours sincerely

Kim Gifkins
RESEARCH ETHICS OFFICER

Department of Education WA Pilot Study Approval

Government of **Western Australia**
Department of **Education**

Your ref :
Our ref : D13/0222212
Enquiries :

Ms Stephanie Godrich
2/4 Wesley St
BALCATTA WA 6021

Dear Ms Godrich

Thank you for your request received 26 April 2013 to extend the pilot of your research project, *A Cross-Sectional Survey to Describe and Measure the Association Between Fruit and Vegetable Consumption and Food Security Determinants of Children (9-13 years) Living in Regional and Remote Western Australia* to the main phase of your research.

As all of the conditions specified in the approval for your pilot study have been met, I give permission for you to approach site managers to invite their participation in your main study as outlined in your application. It is a condition of approval, however, that upon conclusion the results of this study are forwarded to the Department at the email address below.

Consistent with Department policy, participation in your research project will be the decision of the schools invited to participate, individual staff members, the children in those schools and their parents. A copy of this letter must be provided to site managers when requesting their participation in the research. Researchers are required to sign a confidential declaration and provide a current Working with Children Check upon arrival at the Department of Education site.

Responsibility for quality control of ethics and methodology of the proposed research resides with the institution supervising the research. The Department notes a copy of a letter confirming that you have received ethical approval of your research protocol from the Edith Cowan University Human Research Ethics Committee.

Any proposed changes to the research project will need to be submitted for Department approval prior to implementation.

Please contact Ms Joanna Devereux, Research and Evaluation Officer, on (08) 9264 5512 or researchandpolicy@education.wa.edu.au if you have further enquiries.

Very best wishes for the successful completion of your project.

Yours sincerely

GAVIN MORRIS
A/DIRECTOR
EVALUATION AND ACCOUNTABILITY

2 May 2013

Department of Education WA Approval

Government of **Western Australia**
Department of **Education**

Your ref :
Our ref : D13/0111216
Enquiries :

Ms Stephanie Godrich
Unit 2
4 Wesley Street
BALCATTA WA 6021

Dear Ms Godrich

Thank you for your completed application received 6 December 2012 to conduct research on Department of Education sites.

The focus and outcomes of your research project, *A Cross-Sectional Survey to Describe and Measure the Association Between Fruit and Vegetable Consumption and Food Security Determinants of Children (9-13 years) Living in Regional and Remote Western Australia,* are of interest to the Department. I give permission for you to approach site managers to invite their participation in the pilot stage of your project, as outlined in your application. It is a condition of approval that you forward to the Department, to the email address below, a summary report and any amendments to your research materials upon conclusion of the pilot. These documents must be submitted to the Department before approval for the main study can be granted.

Consistent with Department policy, participation in your pilot study will be the decision of the schools invited to participate, individual staff members, the children in those schools and their parents. A copy of this letter must be provided to site managers when requesting their participation in the research. Researchers are required to sign a confidential declaration and provide a current Working with Children Check upon arrival at Department of Education sites.

Responsibility for quality control of ethics and methodology of the proposed research resides with the institution supervising the research. The Department notes a copy of a letter confirming that you have received ethical approval of your research protocol from the Edith Cowan University Human Research Ethics Committee.

Any proposed changes to the research project will need to be submitted for Department approval prior to implementation.

Please contact Ms Joanna Devereux, Research and Evaluation Assistant, on (08) 9264 5512 or researchandpolicy@education.wa.edu.au if you have further enquiries.

Very best wishes for the successful completion of your project.

Yours sincerely

ALAN DODSON
DIRECTOR
EVALUATION AND ACCOUNTABILITY

18 March 2013

151 Royal Street, East Perth Western Australia 6004

Catholic Education WA Approval

CATHOLIC EDUCATION
WESTERN AUSTRALIA
EXECUTIVE DIRECTOR OF CATHOLIC EDUCATION

25 May 2015

Mrs Stephanie Godrich
c/o Dr Amanda Devine
Edith Cowan University
School of Exercise and Health Sciences
270 Joondalup Drive
JOONDALUP WA 6027

Dear Mrs Godrich

RE: A CROSS-SECTIONAL SURVEY TO DESCRIBE AND MEASURE THE ASSOCIATION BETWEEN FRUIT AND VEGETABLE CONSUMPTION AND FOOD SECURITY DETERMINANTS OF CHILDREN (9-13 YEARS) LIVING IN REGIONAL AND REMOTE WESTERN AUSTRALIA

Thank you for your completed application received 11 May 2015, whereby the aim of this research is to examine fruit and vegetable consumption of 9-13 year old children in regional and remote WA, in relation to food insecurity.

I give in principle support for the selected Catholic school in Western Australia to participate in this valuable study. However, consistent with Catholic Education Western Australia (CEWA) policy, participation in your research project will be the decision of the individual principal and staff members. A copy of this letter must be provided to principals when requesting their participation in the research.

Responsibility for quality control of ethics and methodology of the proposed research resides with the institution supervising the research. The CEWA notes that Edith Cowan University Human Research Ethics Committee has granted permission for the duration of this research project until 30 June 2016 (Project Code: 8635).

Any changes to the proposed methodology will need to be submitted for CEWA approval prior to implementation. The focus and outcomes of your research project are of interest to CEWA. It is therefore a condition of approval that the research findings of this study are forwarded to CEWA.

Further enquiries may be directed to Jane Gostelow at gostelow.jane@ceo.wa.edu.au or (08) 6380 5118.

I wish you all the best with your research.

Yours sincerely

Dr Tim McDonald

EXECUTIVE DIRECTOR OF CATHOLIC EDUCATION
50 Ruislip Street, Leederville WA 6007 | PO Box 198, Leederville WA 6903
T (08) 6380 5210
E mcdonald.tim@ceo.wa.edu.au W ceo.wa.edu.au

Kimberley Aboriginal Health Planning Forum (Research Subcommittee) Approval

KR KAHPF Research Sub Committee <kahpfressub@kamsc.org.au>

To: Stephanie GODRICH; Cc: Julia Marley (rcs) <julia.marley@rcswa.edu.au>; 'ethics@ahcwa.org';

Reply all

Fri 9/10/2015 2:03 PM

You replied on 19/10/2015 12:20 PM.

Action Items

Hi Stephanie

Re: 2015-015: A Cross-Sectional Study to Measure and Describe the Association Between Fruit and Vegetable Consumption and Food Security Determinants of children (9-13 years) Living in Regional and Remote Western Australia

Thank you for your response to the concerns raised by the Subcommittee. The Subcommittee accepts your response and is supportive of the project 2015-015: A Cross-Sectional Study to Measure and Describe the Association Between Fruit and Vegetable Consumption and Food Security Determinants of children (9-13 years) Living in Regional and Remote Western Australia.

When you obtain ethics approval for this project please forward to me and let the Subcommittee know when the project is due to commence.

The Subcommittee requests that you provide half page progress reports every 12 months and a final report once the project has been completed (forms are available on the Subcommittee website: http://www.kamsc.org.au/research/KAHPF.html). Progress reports are due on the 30th June each year and the final report is due once the project has been completed. Please note that the Subcommittee will not accept a final report from any other institution and the Subcommittee's final report form must be used.

A reminder will be sent at least two weeks before the due date with a copy of the forms. If the Subcommittee does not receive annual progress reports within four weeks of the due date we will contact your institutional ethics committee and WAAHEC and let them know that you have not adhered to the conditions of the Subcommittee.

The Subcommittee also requires that you provide an electronic copy of any publications that arise from this research.

To help coordinate research across the Kimberley the Subcommittee lists the projects carried out here on the Subcommittee website (http://www.kamsc.org.au/research/KAHPF.html). We will use the summary section of your form for this purpose. We can post the final plain language report on this website to increase dissemination of the results.

Please note that the Subcommittee does not provide formal letters of support and this email can be used for this purpose – I have cc'd the secretariat from WAAHEC into this email (ethics@ahcwa.org).

Kind regards

Mardi Edwards (on behalf of)
Research Subcommittee
Kimberley Aboriginal Health Planning Forum
Postal Address: PO BOX 1377, Broome WA 6725
Phone (08) 9194 3256
Email: kahpfressub@kamsc.org.au
Website: http://www.kamsc.org.ai/research/KAHPF.html

APPENDIX C - INFORMATION LETTERS AND CONSENT FORMS

Principal information letter

Edith Cowan University
School of Exercise and Health Sciences

Principal Invitation Letter

Dear

RE: A Cross-Sectional Study to Measure and Describe the Association between Fruit and Vegetable Consumption and Food Security Determinants of children (9-13 years) Living in Regional and Remote Western Australia

My name is Stephanie Godrich and I would like to invite your school to participate in a research project which aims to look at the relationship between fruit and vegetable consumption and food security among 9-13 year old children. The project is being conducted as part of my Post Graduate Research at Edith Cowan University. The study will focus on regional and remote WA.

What are the anticipated project outcomes?

- An understanding of the food habits of 9-13 year olds, as well as barriers and enablers to healthy eating with a focus on fruit and vegetables.
- An estimate of food insecurity prevalence among the sample, as reported by the children and their caregivers.
- All information collected in this study will contribute to my Post Graduate Research and publication purposes. Results will contribute towards evidence for future interventions and policy decisions around food security and nutrition education, and contribute to knowledge and strategies to increase the prevalence of healthy eating in regional and remote WA.

What is required of our school?

The methodology will include self-completed surveys by children aged 9-13 years of age. We will ask for your help in the following areas:

- Class teachers will be asked to distribute a take home package (including project information sheet, caregiver/child consent form, and caregiver survey) to the children in their class. Class teachers will be asked to remind the students about the survey during the consent form return period (1 week).
- Class teachers will be asked to collect the returned consent forms and completed caregiver surveys.
- Class teachers will be asked to distribute a student survey to complete in class, which is anticipated to take 20 minutes to complete.
- Students will be asked to complete a diary of all the food they eat for 24-hours (1day).
- Teachers are to collect these once finished and hand into administration.
- The school administration will be asked to post the envelopes of completed student, caregiver surveys and 24-hour food diaries to the researcher, in pre-paid satchels paid by ECU.

What will the benefits be for our school?

- Your school will receive an aggregated summary of project results.
- Your class teachers involved will be provided with an educational fruit and vegetable book as a thank you for their time and effort.
- Your school will go into a study-wide draw to receive a school garden kit containing seed packets and educational resources, to promote healthy eating.
- Participating students will go into a draw to win a healthy eating fun pack.
- Participating caregivers receive a healthy cook book.

Is participation voluntary?

Participation by all participants, including the school, teachers, students and parents is voluntary. Participants can withdraw from the study at any time without any consequences. If a decision by any participant is made to withdraw from the study, any information collected before the decision to withdraw will be destroyed by shredding of paper copies and deletion of electronic copies.

Is the research approved?

School of Exercise and Health Sciences Telephone: +61 134 328 Fax: +61 6304 5991 Web: www.ecu.edu.au

The research has been approved by Edith Cowan University Human Research Ethics Committee (project number 8635) and has met the policy requirements of the Department of Education WA as indicated in the attached letter.

Is confidentiality assured?
The identity of participants and the school will not be disclosed at any time, except in circumstances that require reporting under the Department of Education WA Child Protection policy, or where the research team is legally required to disclose that information. Participant privacy, and the confidentiality of information disclosed by participants, is assured at all other times.

Do all members of the research team who will be having contact with children have their Working with Children Check?
Yes. Under the Working with Children (Criminal Record Checking) Act 2004, people undertaking work in Western Australia that involves contact with children must undergo a Working with Children Check. The researcher will present their Working with Children Check card upon entry onto the school site.

What will the results be used for?
The data will be used only for this project (Stephanie Godrich's Post Graduate Research including thesis, journal publications, conference publications etc), and will not be used in any extended or future research without first obtaining explicit written consent from participants.

Safeguard
Although unlikely, there is possibility that a small number of participants could find some of the questions around food insecurity upsetting. A safeguard is the provision of a list of social and food relief services in the region of residence in the caregiver packs.

Who do I contact if I wish to discuss the project further?
If you would like to talk about any aspect of this study please contact me on the number provided below or my supervisor. If you wish to speak with a Research Ethics Officer from Edith Cowan University, telephone (08) 6304 2170 or research.ethics@ecu.edu.au and quote project number 8635.

To explore the opportunity to be involved in this innovative research project I will contact you over the following week.

Kind regards,

Stephanie Godrich
PhD Student, ECU
T: 0417 910 186
E: sgodrich@our.ecu.edu.au

Primary Supervisor:
A/Prof Amanda Devine
Phone: 6304 5527 or Email:
a.devine@ecu.edu.au

Edith Cowan University
School of Exercise and Health Sciences

Consent Form

- I have read and understood the information letter about the project, or have had it explained to me in language I understand.
- I have been provided with the invitation to ask any questions I may have had, and if I have asked any questions, I am satisfied with the answers I received.
- I understand that participation by students of our school in the project is entirely voluntarily.
- I am willing for students and teachers of our school to become involved in the project, as described.
- I understand the school, students, caregivers and teachers at our school are able to withdraw their participation at any time without affecting their relationship with this school.
- I consent to research data gathered for this study to be used for the purpose of Stephanie Godrich's Post Graduate Research or other related reports and publications, provided my name and the names of my students and any other identifying information is removed.

Name of School (printed): _____

Name of Principal (printed) _____

Signature of Site Manager/Principal: _____ Date: / /

Name and email of selected teacher of class 1: _____
Name and email of selected teacher of class 2: _____
Name and email of selected teacher of class 3: _____
Name and email of selected teacher of class 4: _____

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Study Process

We are hoping to work with students aged between 9 and 13 years. The study timeline is as follows:

1. ***Class selection***
   - Principal to invite up to four classes containing students aged between 9 and 13 years old to join the study.
   - Duration of task: **10 minutes.**

2. ***Distribution of Consent Forms***
   - A short teacher briefing will be conducted where possible. Teachers will be provided with an information pack (containing forms, DVD and information)
   - Duration of task: **5 minutes**
   - Where possible, I will discuss the study with the classes. The teacher will distribute a study pack containing caregiver/child information letters, consent form and caregiver survey, which caregivers will be asked to complete at home and return in the sealable envelope with their child to teacher.
   - Duration of task: **5 minutes**

3. ***Reminder to bring back forms:***
   - Class teachers remind students 2 days later to talk about the study with their caregivers and to bring back consent forms and completed caregiver surveys within one week.
   - Duration of task: **5 minutes.**

4. ***Collection of consent forms***
   - Students are to return their consent envelope to class teachers by the nominated date.
   - Teachers are asked to collect this envelope from the students, place them into the Class Envelope # 1, caregiver survey/consent, check the consent for the child has been ticked on the front of the envelope, and tick next to their name on the class list that they can participate.
   - Duration of task: **10 minutes.**

5. ***Completion of student survey in class***

Distribution of in-class child survey:

- Class teachers will be asked to distribute a survey to their students. They survey is to be completed in class.
- Duration of task: **20 minutes**
- Given the potentially sensitive nature of the topic, and the assurances of confidentiality we have provided to caregivers, we ask that you don't probe students for answers. If they ask you to explain a question feel free to explain it, but please refrain from asking them to provide information about their specific situation. It is important that students can answer the questions in a private manner from students and teachers hearing their answers.
- Once students have completed their surveys, teachers are to collect the sealed surveys, placing them into the big class envelope labelled *Class Envelope # 2, child survey* provided in the teacher pack.

6. 24-hour food diary

Playing of the 24-Hour diary DVD and distribution of the 24 hour diaries:

- Teachers to distribute the 24 hour food diaries provided in the teacher pack for completion by students over the following 24 hours.
- Teachers asked to play the short food record DVD to demonstrate how to fill in a food diary.
- Over the next 24 hours, students to fill in all food eaten over next 24 hours. If students have difficulty completing the food diary, please assist them by directing them to the food pictures guide within their diary to assess the serve size consumed.
- The next day, the students will (hopefully) bring back their 24 hour diary.
- Teachers to collect all diaries and place them into the *Class Envelope # 3, food diaries*, which will be sealed by the teacher.
- Duration of task: **10 minutes.**

7. Packing of envelopes/post packs and postage (Teacher and Administrative Staff instructions)

Each of the participating classes has their own set of envelopes. Please see below for instructions of what is to be placed into respective envelopes:

Class Envelope # 1: Place signed consent form envelopes (with caregiver surveys inside) here.
Class Envelope # 2: Place completed student surveys in here.
Class Envelope # 3: Place completed food diaries in here.
Master Post Pack: kept at school administration and will be addressed and reply paid. Envelopes 1-3 need to all be placed inside the *Master Post Pack*. Pack to be sent to Researcher by administration staff.

Duration of task: **5 minutes.**

Total school investment in study: 70 minutes

Teacher Information Letter and Consent Form

Edith Cowan University
School of Exercise and Health Sciences

AUSTRALIA ECU EDITH COWAN UNIVERSITY

Teacher Information Sheet

Dear Teacher

RE: A Cross-Sectional Study to Measure and Describe the Association between Fruit and Vegetable Consumption and Food Security Determinants of children (9-13 years) Living in Regional and Remote Western Australia

My name is Stephanie Godrich and I would like to invite your class to participate in a research project which aims to look at the relationship between fruit and vegetable consumption and food security among 9-13 year old children. The project is being conducted as part of my Post Graduate Research at Edith Cowan University and will focus on regional and remote WA.

What are the anticipated project outcomes?

- An understanding of the food habits of 9-13 year olds as well as barriers and enablers to healthy eating with focus on fruit and vegetables.
- An estimate of food insecurity prevalence among the sample, as reported by the children and their caregivers.
- All information collected in this study will contribute towards my Post Graduate Research used for publication and thesis purposes. Results will also contribute towards evidence to obtain funding for future interventions around food security and nutrition education, specifically tailored for regional and remote WA.
- It is intended that the findings of this study will be made into a report detailing key barriers and enablers to fruit and vegetable consumption in regional and remote WA, and the impact of food insecurity on consumption. This report may be incorporated into the evidence base utilised by Foodbank WA and other health organisations to support future funding to develop tailored community based health promotion programs.

What is required of our class?

The study will include self-completed surveys by children aged 9-13 years of age and a 24-hour food diary. We will ask for your help in the following areas:

- Reminder of Obtaining Caregiver Consent
- Collection of Caregiver Consent and Survey
- Distribution of one in-class Child Survey
- Playing of a short 24-Hour diary DVD and distribution of the 24 hour diaries for students to fill in.

Please find a detailed timeline of school requirements on page 3.

Safeguards for participants:

Although unlikely, there is a small possibility that some participants may find some of the questions around food insecurity upsetting. A safeguard is the provision of a list of food relief and other community services in the region of residence in the caregiver packs.

What will the benefits be for our school?

- Your school will receive aggregated results in a summary booklet.
- As a class teacher involved, you will be provided with an educational fruit and vegetable book as a thank you for your time and effort.
- Your school will go into the study draw to receive a school garden kit containing seed packets and educational resources, to promote healthy eating.
- Participating students will go into a school draw to win a healthy eating fun pack.
- Participating caregivers will each receive a cook book.

What will happen to the information collected?

The data will be used only for this project (Stephanie Godrich's Post Graduate Research including thesis, journal publications, conference publications etc), and will not be used in any extended or future research without first obtaining explicit written consent from participants.

School of Exercise and Health Sciences Telephone: +61 134 328 Fax: +61 6304 5991 Web: www.ecu.edu.au

Is confidentiality assured?
The identity of participants and the school will not be disclosed at any time, except in circumstances that require reporting under the Department of Education Western Australia Protection policy, or where the research team is legally required to disclose that information. Participant privacy, and the confidentiality of information disclosed by participants, is assured at all other times.

Who do I contact if I wish to discuss the project further?
If you would like to talk about any aspect of this study please contact me on 0417 910 186 or my Post Graduate Research Supervisor, Dr. Amanda Devine on (08) 6304 5527. If you wish to speak with a Research Ethics Officer from Edith Cowan University, telephone (08) 6304 2170 or research.ethics@ecu.edu.au and quote project number 8635.

If you are happy to be involved in this study, please complete the consent form at the end of this letter, scan and email it to me at sgodrich@our.ecu.edu.au and also your Principal/Site Manager.

Kind regards,

Stephanie Godrich
PhD Student, Edith Cowan University
M: 0417 910 186
E: sgodrich@our.ecu.edu.au

Primary Supervisor:
A/Prof Amanda Devine
Phone: 6304 5527 or Email:
a.devine@ecu.edu.au

Study Process

The study timeline is as follows:

1. ***Study Overview***
   - A short teacher briefing session will be conducted. Teachers will be provided with a Teacher Information Pack (containing forms, DVD and information).
   - Duration of task: **5 minutes**
   - I will discuss study with class and distribute a study pack containing consent forms and caregiver survey, which caregivers will be asked to complete at home and return in the sealable envelope with their child to teacher.
   - Duration of task: **5 minutes**

2. ***Reminder to bring back forms:***
   - Class teachers will be asked to remind students to talk about the study with their caregivers and to bring back consent forms and completed caregiver surveys within one week.
   - Duration of task: **5 minutes.**

3. ***Collection of consent forms and parent survey***
   - Students are to return their caregiver consent envelope to class teachers within **1 -2 weeks** of them being handed out. Please advise me how long you need.
   - Teachers are asked to collect this envelope from the students, place them into the Class Envelope # 1, caregiver survey/consent, check the consent for the child has been ticked on the front of the envelope, and tick next to their name on the class list that they can participate.
   - Duration of task: **10 minutes.**

4. ***Completion of student survey in class***

Distribution of in-class child survey:

   - Class teachers will be asked to distribute a survey to their students. They survey is to be completed in class.
   - Duration of task: **10-15 minutes**
   - Given the potentially sensitive nature of the topic, and the assurances of confidentiality we have provided to caregivers, we ask that you don't probe students for answers. If they ask you to explain a question feel free to explain it, but please refrain from asking them to provide information about their specific situation. It is important that students can answer the questions in a private manner from students and teachers hearing their answers.
   - Please remind students that they can decide not to answer questions and can stop at any time.
   - Once students have completed their surveys, please ask students to fold them in half and stick it closed with the 10cm x 3cm sticky seal provided in your teacher pack.
   - Please then walk around the class and collect the sealed surveys, placing them into the big class envelope labelled *Class Envelope # 2, Student Survey Envelope* provided in your pack.

5. ***24-hour food diary***

Playing of the 24-Hour diary DVD and distribution of the 24 hour diaries:

- Teachers to distribute the 1 day food diaries for completion by students over the following 24 hours.
- Teachers asked to play the short food record DVD to demonstrate how to fill in a food diary.
- Over the next 24 hours, students to fill in all food eaten. Please ask students to keep the diary with them anytime they are eating food so they can record what they are eating at the time they are eating it. It is important that students record the ***brand and type*** of the food or drink wherever possible, especially when it comes to juice. E.g. ***Brownes Orange C 25% fruit drink***.
- If students have difficulty completing the food diary, please assist them by directing them to the food pictures guide within their diary to assess the serve size consumed.
- The next day, the students will (hopefully) bring back their 24 hour diary.
- Teachers to collect all diaries and place them into the *Class Envelope # 3, Food Diary Envelope*, which will be sealed by the teacher.
- Duration of task: **10 minutes.**

6. Packing of envelopes/post packs and postage (Teacher and Administrative Staff instructions)

Each of the participating classes has their own set of envelopes. Please see below for instructions of what is to be placed into respective envelopes:

Class Envelope # 1: Place signed consent form envelopes (with caregiver surveys inside) here. *Class Envelope # 2:* Place completed student surveys in here. *Class Envelope # 3*: Place completed food diaries in here. *Master Post Pack:* kept at school administration and will be addressed and reply paid. Class envelopes need to all be placed inside the *Master Post Pack*. Pack to be sent to Researcher by administration staff.

Duration of task: **10 minutes.**

Total school investment in study: 60 minutes

Consent Form

- I have read and understood the information letter about the project, or have had it explained to me in language I understand.
- I have been provided with the invitation to ask any questions I may have had, and if I have asked any questions, I am satisfied with the answers I received.
- I understand that participation by students of our school in the project is entirely voluntarily.
- I am willing for my class to participate in this project.
- I understand students in my class are able to withdraw their participation at any time without affecting their relationship with this school.
- I agree that research data gathered for this study may be used for the purpose of Stephanie Godrich's Postgraduate Research or related reports and publications, provided my name and the names of my students and any other identifying information is removed.

Name of School (printed):	
Name of Teacher (printed):	
Signature of Teacher:	
Your email address:	
Number of students in your class:	
Date:	

Class Study Timetable

Step 1:

Job	Tick when job is done
• We will receive packs to take home and talk to our parents about.	

Step 2:

Job	Tick when job is done
• Our teacher needs to remind us to bring back our study 'joining in' forms and carer's survey, in order for us to go into the draw to win the healthy eating prize pack.	

Step 3:

Job	Tick when job is done
• Our teacher collects our study consent forms and caregiver surveys.	
• Those people in our class who are going to join in the study do a short survey in class	
• Next, we are going to do a 1 day food diary (not in class), but first we need to watch a 3-minute video played in class, showing us how to complete the diary.	

Step 4:

Job	Tick when job is done
• Our teacher needs to put all the finished surveys and food diary in their envelopes and take them to the school office, so they can post them back to Stephanie.	

Caregiver information letter

"Fruit and Vegetable and Food Security Study"

***Caregiver* Information Sheet**

Hello, *my name is Steph Godrich and I'm working on a project that is looking at the eating patterns of 9-13 year old children. This project is being undertaken as part of my Post Graduate Research at Edith Cowan University. We would like to invite you and your child to participate in the study because your child is aged 9-13 years.*

What's Involved with the Parent/Caregiver Survey?

We need your help to do a *Parent/caregiver Survey* about the food habits of your child.

1. Please fill in the short 10-minute survey your child has brought home in the envelope.
2. Please put the finished survey in the sealable envelope and give it to your child to take to school. Their class teacher will collect the sealed envelope.

As a thank you for your time and effort, you will receive a cook book.

What's Involved with the Child Survey?

If you consent to your child joining in, we'll be asking them to fill in a 10 minute *Child Survey* at school (given out by their class teacher) and will also be asked to fill in a 1 day (24-hour) food diary, of everything they eat. Some will be done at school and some entries will need to be done at home.

As a thank you to kids for participating, they will go into a school draw to win a *healthy eating fun pack.*

Do we have to take part?

Participation in the survey is voluntary. Neither you nor your child has to take part in the project. We will respect your choice of whether or not you or your child joins in. Your choice will not affect your relationship with the school. If you decide that you and your child would like to join in, you can change your minds at any time. Also, when completing the survey, you don't have to answer any questions you don't want to.

What will happen to the information I give?

- I will use the results for my Post Graduate Research.
- The identity of participants and the school will not be disclosed at any time, except in circumstances that require reporting under the Department of Education Child Protection policy, or where the research team is legally required to disclose that information. Participant privacy, and the confidentiality of information disclosed by participants, is assured at all other times.
- Any information that identifies your child will be taken out of data collected. Surveys will be kept secure and confidential for 5 years in a locked cabinet and then will be destroyed by shredding. Electronic copies will be on a password protected computer and will be deleted after 5 years. The data will be used only for this project, and will not be used in any extended or future research without first obtaining explicit written consent from participants. The data will be shredded and deleted if you drop out of the study.
- This project has been approved by Edith Cowan University (ECU) and the Department of Education and all research staff have Working with Children Checks. If you or your child feels uncomfortable or upset because of the questions asked in the survey, or you require assistance, we have provided some details of services near you which may be able to help.

Who do I contact if I wish to discuss the project further?

Please call me on **0417 910 186** or my research Supervisor Amanda Devine, on **(08) 6304 5527.**

If you wish to speak with a different person please contact the Research Ethics Officer from ECU on (08) 6304 2170 or research.ethics@ecu.edu.au and quote project number 8635.

How do we join in the study? ***Please fill in all parts of the consent form, to show you are happy for you and your child to join in. We also need your child to sign that they want to join in the study.***

Thanks, Steph Godrich. 0417 910 186, sgodrich@our.ecu.edu.au and A/Prof Amanda Devine (08) 6304 5527, a.devine@ecu.edu.au

Child information letter

Edith Cowan University
School of Exercise and Health Sciences

"Fruit and Vegetable and Food Security Study"

***Child* Information Sheet**

Hello!

My name is Steph Godrich. I have a project that you might like to help me with. The project is about kids' and the food they eat. Would you like to help me by filling in a short survey in class and writing down a diary of all the food you eat over 1 day?

You don't have to join in the project if you don't want to and if you want to stop at any time, that's OK, you can.

I won't tell anyone what you say while helping me with the project, unless I need to tell someone like your teacher if you tell me that you have been hurt by someone lately.

Your parents, or the person who looks after you, has talked with you about helping with the project.

If you would like to help with the project, please draw a circle around the word **YES**, on the page that the person who looks after you has. If you don't want to help with the project – that's OK too.

Steph Godrich
PhD Student, Edith Cowan University
Phone: (
Email: sgodrich@our.ecu.edu.au

Supervisor:
A/Prof Amanda Devine
Phone: 6304 5527 or Email:
a.devine@ecu.edu.au

A Cross-Sectional Study to Describe and Measure the Association Between Fruit and Vegetable Consumption and Food Security Determinants of children (9-13 years) Living in Regional and Remote Western Australia

Caregiver and child consent form

Edith Cowan University
School of Exercise and Health Sciences

AUSTRALIA ECU EDITH COWAN UNIVERSITY

CONSENT FORM FOR CAREGIVER/PARENT participation in the project

- ✓ I have read and understood the information letter about the project, or have had it explained to me in language I understand.
- ✓ I have been provided with the invitation to ask any questions I may have had, and if I have asked any questions, I am satisfied with the answers I received.
- ✓ I understand that participation in the project is entirely voluntarily.
- ✓ I am willing to become involved in the project, and understand I will need to fill in the short *Caregiver Survey* attached to this letter.
- ✓ I understand that I and my child are both free to stop participating at any time without affecting my relationship with my child's school of Foodbank WA, and that any data collected will be destroyed.
- ✓ I understand that my identity will be kept confidential.
- ✓ I give my permission for the data collected for the purposes of this research project to be used for Stephanie Godrich's Post Graduate Research and publications.

Caregiver/parent Name: _____ **Caregiver/parent signature to join in:**_____

CONSENT FORM FOR MY CHILD/CHILD I CARE FOR to join in project

- ✓ I have read and understood the information letter about the project and understand my child will be asked to complete a short survey at school and 1 day food diary, which I may need to help them fill in at home. I also understand I can contact the research team if I have any questions.
- ✓ I understand that my child's participation in this project is entirely voluntary.
- ✓ I have talked to my child about what it means to join in this project. He/she showed they want to join in, and have signed their name below.
- ✓ I understand that my child can stop taking part in the project at any time without affecting the family's relationship with my child's teacher or school or Foodbank WA and any collected data will be destroyed.
- ✓ I freely give my permission for my child's answers to be used for Stephanie Godrich's Post Graduate Research thesis and related publications, as long as my child or the school are not identified in any way.

Caregiver/ parent Name: _____ **Caregiver/parent signature for child to join in:** _____

CHILD CONSENT FORM – Please ask your child to read and sign if they want to join in

- ✓ I know I have a choice whether or not I want to do this project and can stop whenever I want.
- ✓ I know that I will be doing *a survey and 1 day food book* as part of the project.
- ✓ I know that I need to *draw a circle around the word YES* on this page before I can help with the project.

Please circle YES or NO to let us know if you want to help with the project.

YES ☺	OR	NO ☹
I would like to help with the project		I do not want to help with the project

Child's name: _____ **Today's Date:** / /

Child's Signature _____

Key Informant information letter and consent form

Edith Cowan University
School of Exercise and Health Sciences

Information Letter – Key Informant Participation

Dear

A Cross-Sectional Study to Measure and Describe the Association between Fruit and Vegetable Consumption and Food Security Determinants of children (9-13 years) Living in Regional and Remote Western Australia

I am conducting a research project that aims to determine food insecurity prevalence among children 9-13 years in WA and find what affects the amount of fruit and vegetables these children are eating. The project is being conducted as part of a Doctoral degree at Edith Cowan University. I would like to invite you to take part in the project, as you are an important community member who could contribute a great deal of knowledge within the context of your local community.

What does participating in the research involve?

- You are invited to participate in an interview, either face-to-face or via telephone/skype. The interview will take about 30- 45 minutes to complete. With your permission, I would like to audiotape the interview. The interview will include questions around:
- Your opinions around the quality of local fruit and vegetables available;
- The major factors which motivate people in your town to consume fruit and vegetables, and the major factors which make it difficult for people to consume fruit and vegetables;
- Successful strategies you have seen encourage local residents to consume more fruit and vegetables.
- Aspects of food security (such as knowledge and cooking skills).

Do I have to take part?

No. Participating in this research project is entirely voluntary and this decision should always be made completely freely. All decisions made will be respected by members of the research team without question.

What if I wanted to change my initial decision?

If you wish to participate, your decision will need to be made by the day of my visit. Once a decision is made to participate, you can change your mind at any time, and any information collected before you decide to withdraw will be destroyed. There will be no consequences relating to any decision you make regarding participation. These decisions will not affect your relationship with ECU.

What will happen to the information I give, and is privacy and confidentiality ensured?

- The identity of participants and the school (if applicable) will not be disclosed at any time, except in circumstances that require reporting under the Department of Education Child Protection policy, or where the research team is legally required to disclose that information. Participant privacy, and the confidentiality of information disclosed by participants, is assured at all other times.
- The data will be stored on a password-protected computer, and any notes will be stored securely in a locked cupboard in an office. Paper based information will be stored for 5 years after which time it will be destroyed and electronic information destroyed. Participant privacy and confidentiality of information disclosed by participants is assured at all times, except in circumstances where the research team is legally required to disclose that information. The data will be used only for this project, and will not be used in any extended or future research without first obtaining explicit written consent from participants.
- Results will be used for Stephanie Godrich's Post Graduate Research (e.g. thesis, journal publications, conference publications etc). It is intended that the findings of this study will be made into a report detailing key barriers and enablers to fruit and vegetable consumption in regional and remote WA, and the impact of food insecurity on consumption.

Is this research approved?
The research has been approved by Edith Cowan University and has met the policy requirements of the Department of Education.

Who do I contact if I wish to discuss the project further?
Please contact me on 0417 910 186 or my Research Supervisor, Dr. Amanda Devine, on (08) 6304 5527. If you wish to speak with an independent person about how the project is being conducted or was conducted, please contact a Research Ethics Officer from Edith Cowan University on 6304 2170 or research.ethics@ecu.edu.au and quote the project number 8635.

How do I become involved?
If you have had all questions about the project answered to your satisfaction, and are willing to become involved, please complete the **Consent Form** on the next page and email it to sgodrich@our.ecu.edu.au. This information letter is for you to keep. Once I have received your consent form, I will contact you to arrange a mutually convenient time to conduct the interview via telephone.
Kind regards,

Steph Godrich
PhD Candidate, Edith Cowan University
Phone: (
Email: sgodrich@our.ecu.edu.au

Dr Amanda Devine
Phone: 6304 5527 or Email:
a.devine@ecu.edu.au

Edith Cowan University
School of Exercise and Health Sciences

Consent Form – Key Informant Participation

- I have read and understood the information letter about the project, or have had it explained to me in language I understand.
- I have taken up the invitation to ask any questions I may have had, and am satisfied with the answers I received.
- I understand that participation in the project is entirely voluntarily.
- I am willing to become involved in the project, as described.
- I give my permission for the interview to be recorded.
- I understand I am free to withdraw that participation at any time without affecting my relationship with ECU.
- I agree that research data gathered for this study may be used for the purpose of Stephanie Godrich's Post Graduate Research, provided my name and any other identifying information is removed.

Name of Participant (printed): _____

Organisation or school _____

Signature of Participant: _____ Date: / /

Email of participant _____

APPENDIX D - DATA COLLECTION PROCESS TOOLS

Teacher and class briefing session script

- Hi everyone! Thank you very much for having me at your school. My name is Stephanie, I'm a nutritionist, and I am from Edith Cowan University. I am working on a very special project to find out what kinds of things kids all over WA are eating.
- I am visiting your school today because your school has been chosen to take part in this very important study.
    - *Put your hand up if you've eaten fruit today?*
- This is the sort of question my survey will ask you if you decide to join in.
- To help you decide if you would like to take part in this special study, I'm going to spend the next few minutes telling you about the 2 things we'd be asking you to do if you participate:
    1. First of all, I would ask you to fill in a short survey in class that your teacher will give out, which will ask about the type of food you eat.
    2. The second thing we will ask you to do is fill in a Food Diary. We will show you a movie explaining how to do this.
        - *Does anyone know what a food diary might be?*
- This is really easy - all you have to do write down all the different foods you eat and drink over 1 day into a diary.
- That's all we will be asking you to do – It's all very easy and it doesn't cost anything to be in the study.
- If you would like to help us and be in the study we need your parents or the main person who looks after you to sign a permission slip. Given that you are all very important people too, we also need you to write your name too so we know you want to be part of it.
- Today we will be giving you all an envelope addressed to your parents which contains the permission slip and an information sheet. The permission slip needs to be signed by your parent and given back to your teacher by [insert date].
- Thank you all for listening to me today! I would like to really encourage you all to take part in this really important study because it is a great opportunity for you to make a real difference in what we know about what kids your age are eating. Each

student who takes part in this study will go into a school draw to receive a small thank you gift – a healthy eating fun pack that has lots of fun things inside like cook books.

- So, a quick quiz:
    - Who can tell me what 2 things this study will ask you to do?
    - What date do all forms need to be to your teacher by if you are joining in?
- Great work!
- Finally, are there any questions about the study?

Caregiver precautionary support information (Provided with IL and CF envelope)

Example: Goldfields Region Emergency Relief Services (Kalgoorlie)

24-hour Crisis Services

Life threatening emergencies	000 Police, fire, ambulance
Alcohol and Drug Information	(08) 9442 5000
Health Direct	1800 022 222
Poisons Information	13 11 26

24-hour Phone Counseling

Lifeline	13 11 14
Salvation Army HQ	(08) 9260 9500
Crisis Care	(08) 9223 1111 or 1800 199 008
Samaritans	(08) 9381 5555 or 1800 198 313
Samaritan Youthline (under 25's)	(08) 9388 2500
Kids Help Line	1800 551 800

Mental Health Emergency Response Line:
1800 552 002

Assistance in Kalgoorlie

Food Relief

9022 4822

Australian Red Cross
32 Lane Street
KALGOORLIE WA 6430
(08) 9026 1605

Foodbank Kalgoorlie-Boulder
Lot 4496 Forrest Street
Boulder WA 6432
Ph: (08) 9093 0284 Fax: (08) 9093 0284
kalgoorlie-boulder@foodbankwa.org.au

Ngunytju Tjtjipirni
459 Hannan Street,
KALGOORLIE WA 6430
(08) 9091 7862

The Salvation Army
Cnr Oberthur & Hopetoun Street,

SOUTH KALGOORLIE WA 6430
(08) 9021 2615

Mental Health Services

Centrecare - Goldfields
7-9 Dugan Street, Kalgoorlie WA 6430
PO BOX 10500, Kalgoorlie WA 6433
9091 1833

Community Mental Health Team - Kalgoorlie
Corner Maritana Street and Piccadilly Street, Kalgoorlie WA 6430
Locked Bag 7, Kalgoorlie WA 6433
9088 6200

Goldfields Mental Health Action Group Inc
36 President Street, Kalgoorlie WA 6430
PO Box 2116, Boulder WA 6432
9022 4741

Goldfields Women's Health Care Centre
15 Dugan Street, Kalgoorlie WA 6430
PO Box 370 Kalgoorlie WA 6430
9021 8266

Kalgoorlie-Boulder Community Mental Health
CMHS, "The Brick Quarters", cnr Maritana and Piccadilly Streets, Kalgoorlie WA 6430
CMHS Locked Bag 7, Kalgoorlie WA 6433
9088 6200

Caregiver and Teacher Feedback Forms (Pilot study only)

Parent feedback form

I would be grateful if you could assist me in improving the process of this research project by completing this feedback form and putting it into the envelope along with your second survey.

Information provided:

1. **Please comment on the quality of information provided to you, explaining this study:**

_____

_____

2. **How could we improve on the information provided to you explaining the study?**

_____

_____

Survey Tools

3. **How appropriate were the survey tools (Child Survey and 24-hour Food Diary) for your child/children?**

_____

_____

4. **Did your child/children have difficulty in completing any part of the Child Survey or 24-hour food diary? If so, which parts?**

_____

_____

_____

Additional Information

5. **Are there any resources or information you think would be helpful for us to provide to other parents and carers joining in the study at a later date?**

_____

_____

_____

6. **Do you have any other comments or suggestions to improve this study?**

_____

_____

_____

Teacher Feedback Form

I would be grateful if you could assist me in streamlining the process of this research project by completing this feedback form and emailing to sgodrich@our.ecu.edu.au

Information provided:

1. **Please comment on the quality of information provided to you, explaining this study:**

_____

_____

2. **How could we improve on the information provided to you explaining the study?**

_____

_____

_____

Survey Tools

3. **How appropriate were the survey tools (Child Survey and 24-hour Food Diary) for your class?**

_____

_____

4. **Did any of your students have difficulty in completing any part of the Child Survey or 24-hour food diary? If so, which parts?**

_____

_____

_____

Additional Information

5. **Are there any resources or information you think would be helpful for us to provide to other schools joining in the study at a later date?**

_____

_____

_____

6. **Do you have any other comments or suggestions to improve this study?**

_____

_____

_____

APPENDIX E - DATA ANALYSIS

24-hour food diary data entry protocol

A Cross Sectional Study to Measure and Describe the Association Between Food Security Determinants and Fruit and Vegetable Intake Among Children (9-13 years old) in Regional and Remote WA

24-HOUR FOOD DIARY ENTRY PROTOCOL

Study background

This study aims to determine the link between food security determinants and fruit and vegetable intake among regional and remote WA children. The study is cross-sectional, meaning that it is a snapshot in time across 20 school populations, many towns of varying remoteness and all WA regions. The methodology includes pictorial student and caregiver surveys, a food diary (preceded by an instructional DVD to demonstrate how to complete the food diary) and semi-structured interviews with 'key informants' to achieve the study aim. This manual is for use when entering 24-hour food diaries into Foodworks Professional Dietary Analysis software ("Foodworks").

Data Entry Process

The food diaries used in this study have included all foods consumed over a 24-hour period, however this study requires entry and use of **fruit and vegetable serves only.**

As well as food type and amount, other data that needs to be coded and added into the Foodworks Food Record Form include:

1. Student ID – e.g. 01
2. Date of first day of food record
3. Whether nutritional supplements were included
4. Whether the amount eaten on the day of the diary was less than usual, usual, more than usual
5. The reason why intake was less than or more than usual
6. The day and time of consumption for each food
7. The 'source code' of each individual food

Coding of Foods

Below includes some brief steps to use when coding fruit and vegetable serves into Foodworks:

1. Type in the first few letters of the food, matching the description of each food

recorded in the diary with the most accurate food description in the database.

2. Once a food item is selected, Foodworks will provide a list of quantity measures appropriate to that food. The coder will select the quantity that is appropriate to that food. Examples of quantity measures include cups, teaspoon, grams, millilitres and some standard amounts for certain foods. For most foods there will be an unspecified serve that could be used if the details of the actual quantity consumed are not listed in the food record.
3. If a suitable code can't be found, the coder will record the identification (I.D) number of the food record and the details of the food-coding query. Stephanie Godrich will need to be contacted to resolve the query.
4. When an unusual food/mixed meal is recorded in the diary, and is not in the Foodworks database, a New Food needs to be created in Foodworks using the Recipe Form. The new food will be based on a similar food in Foodworks and will need to be recorded on the New Food Log.
5. After coding is completed, foods consumed from school canteens, those eaten late at night or early in the morning and foods that appeared to be under or over reported will be checked.
6. Once coding in Foodworks for each food diary is complete, fill in the required details into the '24-hour food diary record sheet' provided to you. This is helpful for checking where you are at in terms of coding, and for quality checking.
7. At the completion of the coding approximately 10% of the sample will be recoded by Stephanie Godrich to check the overall accuracy of the coding process.

Database used in Foodworks – instructions for installation

INSTALLING **AUSNUT 2013**

To use **AusNut 2013** with your current version of **FoodWorks** you need to install it on each computer on which **FoodWorks** is installed.

On each computer where **FoodWorks** is installed:

1. Copy the attached file **AUSNUT 2013 v7.ZIP** to a suitable location.

2. Navigate to the folder where **AUSNUT 2013 v7.ZIP** is located.

3. Extract the files from **AUSNUT 2013 v7.ZIP** and save them to a suitable location.

4. Navigate to **AUSNUT 2013.FWC** and double-click it.

5. Follow the prompts shown.

Alternatively, you can install **AusNut 2013** from within **FoodWorks**:

1. Start **FoodWorks**.

2. From the **Tools** menu click **Install Data Source**.

3. Navigate to the folder containing the **AUSNUT 2013.FWC** file.

4. Select **AUSNUT 2013.FWC** , then click **Open**.

START USING **AUSNUT 2013**

To start choosing foods from **AusNut 2013** you need to either:

· create a new FoodWorks database

or change food selections for an existing database.

To create a new database:

To start using **AusNut 2013** with a new **FoodWorks** database:

1. Using Windows Explorer copy the file **Australia (AUSNUT 2013) v7.FWB** to a suitable location.

2. Rename the copied file (to a more suitable name).

3. Open this database.

To modify an existing database:

1. Open the database using **FoodWorks**.

2. On the **File** menu, click **Database Properties**.

3. Click **Food Selections**.

4. Unselect all data sources (except those you wish to keep selecting from).

5. Click the **Show for:** drop down and select **All**.

6. Select **AUSNUT 2013** (NOTE: **AUSNUT 2013** is only shown if **Show for:** is set to **All**.)

7. Click **OK**.

Amounts to enter for 'Amounts Not Otherwise Specified':

The AusNut 2011-2013 Measures Database will be used in our version of Foodworks (imported as per above), however for any food diaries that do not have an amount of fruit or vegetables written down, you will need to:

1. Refer to the excel ’24-hour food diary record sheet’ for the student’s age (listed in the column next to their ID); and
2. Enter the amount in grams for the fruit or vegetable item listed in the National Nutrition Survey ‘Median Daily Intake of Nutrients’ sheet (Appendix A to this document – on the following page) into the ‘not otherwise specified’ amount in Foodworks. Be careful to enter the amounts for Male and Female. Note: a ‘1’ in this gender column = male and ‘2’ = female.

Qualitative interview coding frame

Concept	Theme	Parent and Child Codes	Description of code	Examplar quote
F&V FS	Individual level influencers	Food preferences Taste Diversity	Discussion of children's preferences for healthy or unhealthy food, closely linked with taste and range of foods familiar or unfamiliar to them	*"The children are actually dictating to the parents what they will and wont eat. Kids chuck tantrums, they refuse to do things. I find the parents actually succumb to a lot of that"*
F&V FS		Nutrition knowledge and cooking skills	Points around children's understanding of F&V, nutrition, health, application of knowledge, ability to prepare food	*"At least its great, bottom up, kids are teaching their parents, mum, dad, we shouldn't be having this, why are we having this, we did this today, planting a veggie garden."*
F&V		Attitude	Discussion of attitude among children towards F&V	*"If fruit's on the cupboard they'll grab it. If it's in the fridge they won't worry about it, they'll go into the cupboard and get a biscuit."*
F&V FS	Interpersonal level influencers	Parental knowledge and skills	The range in level of nutrition knowledge and skills parents have relating to healthy food preparation, such as techniques, recipes	*"If mum can't pass on the knowledge, where are the kids going to get it from, if they don't have it from school. You can't pass on knowledge if you don't have knowledge."*
F&V FS		Household financial resources	Points around low income households, how families spend their money, budgeting, range of economic levels in towns, what families do if they are struggling financially	*"There's a mixed bag really. We have a lot of, what are they called? Low economic families in town, and there's a range…A lot of elderly in town, a lot of working people in town. I guess it's a pretty good mix of everybody."*
F&V		Parental attitude towards fruit and vegetables	What parents prefer to spend their money on instead of F&V, laziness, convenience, negative attitudes towards provision to their children	*"They'll let the kids have a lolly and put proper food back. They don't think. It's easy."*
F&V FS		Family and community social support	Discussion around families or friends supporting each other during times of needs, country 'environment' of helping your neighbour out, social sharing of food	*"Lots of people swap. A lot of people that live in the region are either other farmers or have lots of land. A lot of people have lemon trees or oranges and you just have too much of one thing so they share it around which is actually quite good. Its just another option for people to get more of what they*

Concept	Theme	Parent and Child Codes	Description of code	Examplar quote
				need without having to sell it."
FS		Preparation and cooking facilities	Home facilities to prepare meals such as ovens, microwaves, stoves	*"So a lot of people actually cook and they're quite happy to cook. I would say a normal kitchen but then I know some places only have a microwave and they buy take out."*
F&V FS		Household storage facilities	Range of facilities in homes, such as fridges, freezers, pantries etc or lack of facilities	*"There's a lot of people who go to the coast fishing and they'll come home with a big load of fish and they'll store that…A lot of people have chest freezers, obviously a lot of people have refrigerators... A lot of people out too on the farms or small acreage, they actually have cool rooms."*
F&V		Role modelling	Discussion around parents and friends acting as positive or negative role models for children with regards to healthy eating	*"It's probably a family cultural thing, where they've been brought up in a family where food is not so important and they'll just eat whatever. And they don't have the skills and don't want them."*
F&V FS		Household transport to shops	Transport modes to access food, lack of access, how people access shops when they have no transport	*"Some people stuck over, the poorer people who don't have a car, it's not far for them to walk. I have a lot of walking people here."*
F&V		Household provision of fruit and vegetables	Availability of F&V in the home environment	*"I don't think in the home environment there is much fruit and veg being provided"*
F&V FS		Time spent procuring food	Time to shop for and prepare food for families, shop opening hours	*"Some people will be in the shop for 2-3 times a day. Some people will shop once after work everyday…Again because it's a small community, that is the case in most circumstances. People will stop, have a chat. So their shopping trip is not just a shopping trip, it's a social outing. They'll stop, meet people and talk to them. People can whip in and out, or will be, and it's not such a big shop but can be there for over an hour just doing a shop."*
F&V	Institutional level influencers	Health service provision	Agency based delivery of health promotion programs in communities, targeted at children and their families	*"You learn how to be just flexible and be ready to go with whatever people are ready for at that particular time."*

Concept	Theme	Parent and Child Codes	Description of code	Examplar quote
F&V		School nutrition education and food skills programs	Health based programs running in schools, either taught by teachers or external agencies	*"Some of the courses they are doing are all about food, that's healthy too the school having an input into the education, so that's good I think. I believe that the schools are teaching a lot so it's not just the social media, it's the schools"*
F&V FS		Formal social support • Schools • Agencies	Agencies and how they support families in need, such as emergency food relief	*"A lot of the schools now have School Breakfast Programs and at least three schools have lunch programs. So from the school's side, a lot of schools provide fruit at school and there at least three that do a school lunch program as well."*
F&V		School governance and policy	School based policies to promote healthy eating, such as in the canteen, breakfast or lunch programs	*"What the school have done has been fantastic, and that's get rid of all the unhealthy choices and it can actually be quite nice."*
F&V FS	Community level influencers	Availability in outlets • Good availability of healthy food • Availability it at the mercy of the supply chain • Junk food is more available than healthy food • Availability is driven by community demand	Access to healthy food for the community in the local food outlet – either positive or negative.	*"I think generally in fruit and veg, it's very, very basic veg like lettuces, cucumbers, tomatoes, onions, potatoes, capsicums, limited fruit and veg, probably apples, oranges, lemons occasionally, that's about it. We don't get a lot more. Broccoli is a problem."*
F&V FS		Price • Affordable • Cost is a barrier to healthy food consumption	Discussion around food price in a range of outlets, such as small independent outlets, major supermarkets, other options such as farm gate sales and which have most affordable or expensive prices	*"Our prices are comparable to regional major shopping centres for fruit and veg. I would think our groceries are probably on a par or slightly dearer."*
F&V FS		Promotion • Healthy food is well promoted	Either promotion of healthy or unhealthy food, range of promotional methods	*"I don't know. I guess being a supermarket we have our normal weekly specials that we have to adhere*

Concept	Theme	Parent and Child Codes	Description of code	Examplar quote
		• Junk food is promoted more than healthy food • Local media to promote fruit and vegetables	displayed in store, either store-initiated or local community-initiated	*to, but from our point of view, we always, and in conjunction with our fruit and veg supplier, we always manage to put on four or five extra market specials over the weekend, as a bit more of a promotion that way."*
F&V FS		Quality	Discussion around food quality, such as how quality is improved through local supply options or reduced due to lengthy transport, quality in large vs small shops	*"Quality when it arrives is fairly good. We have a problem maintaining quality over a length of time because we don't have a lot of staff and we don't get deliveries two or three times a week, only once a week into town. Fruit and veg to stretch out is a little bit difficult even though we have cool rooms etc."*
F&V FS		Location of food outlets	Location of food outlet/s within the town, whether centralised or on the periphery, easy or difficult to access	*"It's right in the middle of the street, right on the highway. We've got a highway running through town. It's probably very central."*
F&V FS		Variety	Whether there is good or poor variety, which types of outlets have good variety, what impacts variety	*"Again, because we have such a wide range of people in town…we have the black and gold range but again, we have the top of, your gourmet cheeses and so forth. There's so many different levels of people that live here, some people can only afford the basics and others don't care what they spend, they want that choice. So we do cater to all ranges."*
FS		Governance within food outlets	Store owner or manager ordering of food products and collaboration with local community in regards to ordering of food to stock in store	*"Some barriers that spring to mind are store managers that are resistant to change or who are really overworked already doing the best they can in their capacity and just don't have the energy to implement any changes."*
F&V		Health-promoting spaces	Spaces such as gardens, sporting clubs and community settings that are used to promote health in the town	*"I know a lot of sporting events up this way support the 'eat more fruit and veg' theme that seems to be, you see it more and more. Aside from that, I've been to a lot of swimming carnivals in the last little bit and they always go around with a great big fruit*

Concept	Theme	Parent and Child Codes	Description of code	Examplar quote
				platter and offer all the spectators and judges and time keepers etc."
F&V FS		Public transport to food outlets	Existance of public transport options, frequency/infrequency of transport, reliability	*"It's drive in, drive out. There is no public transport here at all."*
F&V FS		Distance to outlets	Whether towns are spread out or small and therefore outlets are accessible. Discussion around people driving to another town to access food	*"The least affluent area of town is the longest distance from the shops."*
F&V	Public Policy level influencers	Implementation of a store policy	Discussion around whether local outlet has a policy, whether informant thinks they should, what the policy would look like, whether discussions around a policy have taken place, rules around selling produce, links with other community settings such as school	*"It would be great if there was a store policy because then more things could be regulated around access to food."*
FS		Mobility	Built environment and how that improves or hinders access to shops, as well as personal disabilities that may hinder food access	*"The town is incredibly hilly. The main street in the town is just a nightmare for people with mobility issues."*
F&V	F&V quantities and types	F&V quantities	Discussions around the amount of F&V children are consuming	*"I think without the schools that would be much more of an issue. Kids generally, every school here get a morning fruit, a lunch fruit and an afternoon fruit. Veggie intake, I'm guessing would be pretty poor."*
F&V		F&V types	Discussions around the types of F&V children are consuming, such as tinned, frozen, fresh, dried	*"Not often do I come across kids with veggie sticks in their lunch. And fruit, a lot of, you know dried fruits, and fruit juices as opposed to your fresher fruits. They're the main ones. They've got fruit products maybe that aren't necessarily fresh fruit."*
F&V	Strategies to increase F&V	Strategies to increase F&V intake among children • Cognitive motivators	Strategies to increase F&V across a range of example settings and using methods to encourage and drive consumption	*"There is, the eat 2 fruit and 5 veg I think has been a very successful one. That sort of has infiltrated different areas, schools. I took my kids to the Spare Parts Puppet theatre during the holidays and they*

Concept	Theme	Parent and Child Codes	Description of code	Examplar quote
		for children to eat F&V • Community driven service provision • School programs • Cooking tips for parents • Food outlets • Role modelling • Local media • Early years education		*were talking about that there. Events that involve children you often do get the eat 2 fruit and 5 veg message coming through"*
Demographics	People case nodes	Gender • Male • Female	Coding of interview by gender	N/A
		Worker type • School and youth worker • Health worker • Food supply worker	Coding of interview by worker type	N/A
		WA region • Kimberley • Pilbara • Goldfields • Midwest • Wheatbelt • Peel • South West • Great Southern	Coding of interview by region	N/A
		Interview year • 2013	Coding of interview by year	N/A

Concept	Theme	Parent and Child Codes	Description of code	Examplar quote
		• 2014 • 2015		
		Interview method • In-person • Telephone	Coding of interview by method	N/A
		ASGS RA category • Regional • Remote	Coding of interview by remoteness	N/A

APPENDIX F - EVIDENCE OF PEER REVIEW FOR JOURNAL ARTICLES AND CONFERENCE PRESENTATIONS

Manuscript 1: "Which Ecological Determinants Influence Australian Children's Fruit and Vegetable Consumption?"

Accepted for publication in Health Promotion International

From: onbehalfof+EIC-HPI+vichealth.vic.gov.au@manuscriptcentral.com <onbehalfof+EIC-HPI+vichealth.vic.gov.au@manuscriptcentral.com> on behalf of Health Promotion International <onbehalfof+EIC-HPI+vichealth.vic.gov.au@manuscriptcentral.com>
Sent: Monday, 11 July 2016 8:57 AM
To: stephanie.godrich@outlook.com; Stephanie GODRICH
Subject: Health Promotion International - Decision on Manuscript ID HPI-2016-146.R1(mail:50)

10-Jul-2016

Dear Mrs. Godrich,

It is a pleasure to accept your revised manuscript entitled "**Which Ecological Determinants Influence Australian Children's Fruit and Vegetable Consumption?"** in its current form for publication in Health Promotion International.

Thank you for your fine contribution. On behalf of the Editors of Health Promotion International, we look forward to your continued contributions to the Journal.
Sincerely,
Prof. Evelyne de Leeuw
Editor in Chief, Health Promotion International
EIC-HPI@vichealth.vic.gov.au
(mail:50)

Evidence supporting republishing of this article in thesis

From: HEAPRO <heapro@oup.com>
Sent: Tuesday, 6 December 2016 1:02 AM
To: 'Stephanie Godrich'
Cc: stephanie.mcfaull@hotmail.com; Robyn Perlstein
Subject: RE: Inclusion of HPI-published article in PhD Thesis

Dear Stephanie,
As per our guidelines, there are **no restrictions about the version of the article that you use in your PhD thesis and there is no embargo period.**
Best regards,
Pratima.

Manuscript 2: "Are Regional and Remote Western Australian Children Eating for Good Health? An Investigation into Fruit and Vegetable Consumption."

Accepted for publication in Health Promotion Journal of Australia

From: onbehalfof+editorial.he+csiro.au@manuscriptcentral.com <onbehalfof+editorial.he+csiro.au@manuscriptcentral.com> on behalf of Health Promotion Journal of Australia <onbehalfof+editorial.he+csiro.au@manuscriptcentral.com>
Sent: Monday, 21 November 2016 1:36 PM
To: Stephanie GODRICH; stephanie.godrich@outlook.com
Subject: Health Promotion Journal of Australia - Decision on Manuscript ID HE16090.R1

21-Nov-2016

Dear Mrs Godrich

Thank you for responding to the additional comments and suggestions arising from the revision of your manuscript entitled **'Are Regional and Remote Western Australian Children Eating for Good Health? An Investigation into Fruit and Vegetable Consumption.'.** It is a **pleasure to now accept** this manuscript for publication in the Health Promotion Journal of Australia.

Before the manuscript can be published, you and your coauthors are required to sign a Copyright Authority form. If you have not already done this, you will be contacted about it in the near future.

We look forward to publishing your paper in the Health Promotion Journal of Australia, and to your continued contributions to the Journal.

Sincerely,

Dr Lisa Barnett
Associate Editor
Health Promotion Journal of Australia

Evidence supporting republishing of this article in thesis
From: Nicci.Dodanwela@csiro.au <Nicci.Dodanwela@csiro.au>
Sent: Thursday, 22 December 2016 11:22 AM
To: Stephanie GODRICH
Subject: RE: Completed: Proof of HE16090 for your approval

Hi Stephanie

In terms of your thesis, **you are permitted to use the copyedited, final version in your PhD** (provided the PhD is not published for commercial gain).
Kind regards
Nicci

Manuscript 3: "What Are the Determinants of Food Security among Regional and Remote Western Australian Children?"

Accepted for publication in Australian and New Zealand Journal of Public Health

From: onbehalfof+anzjph+substitution.com.au@manuscriptcentral.com <onbehalfof+anzjph+substitution.com.au@manuscriptcentral.com> on behalf of Australian & New Zealand Journal of Public Health <onbehalfof+anzjph+substitution.com.au@manuscriptcentral.com>
Sent: Tuesday, 4 October 2016 1:05 PM
To: stephanie.godrich@outlook.com
Subject: ANZJPH - Decision on Manuscript ID ANZJPH-2016-007.R2

03-Oct-2016
Dear Mrs. Godrich:

It is a pleasure to accept your manuscript entitled **"What Are the Determinants of Food Security among Regional and Remote Western Australian Children?"** for publication in Australian & New Zealand Journal of Public Health.

Please note although the manuscript is accepted the files will now be checked to ensure that everything is ready for publication, and you may be contacted if final versions of files for publication are required.

Your article cannot be published until the appropriate licence agreement has been signed by the corresponding author. In the next few weeks an email will be sent from the Wiley Author Services system to invite the corresponding author to log in and compete the appropriate licence agreement.

On behalf of the Editors of Australian & New Zealand Journal of Public Health, we look forward to your continued contributions to the Journal.

Sincerely,
Chloe Patton
Australian & New Zealand Journal of Public Health

Evidence supporting republishing of this article in thesis

COPYRIGHT TRANSFER AGREEMENT
Date: 2016-10-28
Contributor name: Stephanie Godrich
Contributor address: School of Medical and Health Sciences, Edith Cowan University, 270 Joondalup Drive
Manuscript number: ANZJPH-2016-007
Re: Manuscript entitled What are the determinants of food security among regional and remote Western Australian children? (the "Contribution")
for publication in Australian and New Zealand Journal of Public Health (the "Journal")
published by John Wiley & Sons Australia, Ltd ("Wiley")

3. Final Published Version. The Owner hereby licenses back to the Contributor the following rights with respect to the final published version of the Contribution (the "Final Published Version"):
Re-use in other publications. The right to re-use the Final Published Version or parts thereof for any publication authored or edited by the Contributor (excluding journal articles) where such re-used material constitutes less than half of the total material in such publication. In such case, any modifications must be accurately noted.

From: ANZJPH <anzjph@substitution.com.au>
Sent: Monday, 16 January 2017 7:33 AM
To: Stephanie GODRICH
Subject: RE: ANZJPH Page Proofs for Early View - URGENT: response needed by 16 December

Dear Stephanie,

I have followed up your query on re-use of your article with Wiley. **They confirm that you can use the article in your PhD thesis as long as there is proper citation of the article in the thesis.**

Regards,

Margaret
Australian & New Zealand Journal of Public Health

Manuscript 4: "Prevalence and socio-demographic predictors of food insecurity among regional and remote Western Australian children."

Currently under review

From: onbehalfof+anzjph+substitution.com.au@manuscriptcentral.com <onbehalfof+anzjph+substitution.com.au@manuscriptcentral.com> on behalf of Australian & New Zealand Journal of Public Health <onbehalfof+anzjph+substitution.com.au@manuscriptcentral.com>
Sent: Tuesday, 13 December 2016 4:10 PM
To: stephanie.godrich@outlook.com
Cc: stephanie.godrich@outlook.com; j.lo@ecu.edu.au; christina.davies@uwa.edu.au; j.darby@ecu.edu.au; a.devine@ecu.edu.au
Subject: ANZJPH - Manuscript ID ANZJPH-2016-397 [SE-6-a]

13-Dec-2016

Dear Mrs. Godrich:

Your manuscript entitled **"Prevalence and socio-demographic predictors of food insecurity among regional and remote Western Australian children."** by Godrich, Stephanie; Lo, Johnny; Davies, Christina; Darby, Jill; Devine, Amanda, has been **successfully submitted online** and is presently being given full consideration for publication in Australian & New Zealand Journal of Public Health.

Co-authors: Please contact the Editorial Office as soon as possible if you disagree with being listed as a co-author for this manuscript.

Your manuscript ID is ANZJPH-2016-397.

Please mention the above manuscript ID in all future correspondence or when calling the office for questions. If there are any changes in your street address or e-mail address, please log in to ScholarOne Manuscripts at https://mc.manuscriptcentral.com/anzjph and edit your user information as appropriate.

Thank you for submitting your manuscript to Australian & New Zealand Journal of Public Health.

Sincerely,

Chloe Patton
Australian & New Zealand Journal of Public Health

Manuscript 6: "Which food security determinants predict adequate vegetable consumption among rural Western Australian children?"

Accepted for publication in International Journal of Environmental Research and Public Health.
Special issue: Environmental Influences on Maternal and Child Health

From: krystal.liu@mdpi.com [krystal.liu@mdpi.com]
Sent: Wednesday, 28 December 2016 10:02 AM
To: Stephanie GODRICH
Cc: Johnny LO; Christina R. Davies; Jill DARBY; Amanda DEVINE; IJERPH Editorial Office
Subject: [IJERPH] Manuscript ID: ijerph-167995 - Accepted for Publication

Dear Mrs. Godrich,

We are pleased to inform you that the following paper has been officially **accepted for publication:**
Manuscript ID: ijerph-167995
Type of manuscript: Article

Title: **Which food security determinants predict adequate vegetable consumption among rural Western Australian children?**
Authors: Stephanie L. Godrich *, Johnny Lo, Christina R. Davies, Jill Darby, Amanda Devine
Received: 3 December 2016
E-mails: s.godrich@ecu.edu.au, j.lo@ecu.edu.au, christina.davies@uwa.edu.au, j.darby@ecu.edu.au, a.devine@ecu.edu.au
Environmental Influences on Maternal and Child Health
http://www.mdpi.com/journal/ijerph/special_issues/maternal_childhealth
http://susy.mdpi.com/user/manuscripts/review_info/8c5602c116ab6e5a965c9bc780c5ea4a

We will now make the final preparations for publication, then return it to you for your approval.

Kind regards,
Krystal Liu
Assistant Editor
Email: krystal.liu@mdpi.com
News: 2015 IF of IJERPH is 2.035

Evidence supporting republishing of this article in thesis

From: Krystal Liu [krystal.liu@mdpi.com]
Sent: Thursday, 29 December 2016 11:54 AM
To: Stephanie GODRICH
Cc: ijerph@mdpi.com; penny.gu@mdpi.com
Subject: Re: [IJERPH] Manuscript ID: ijerph-167995 - Accepted for Publication

Dear Mrs. Godrich,

Thank you very much for your message. We are an Open Access publication, **there is no problem if you want to include the manuscript in your thesis**. Just make sure that the article is properly cited. Now the final version is edited by the English editor and we will sent it to you for final check as soon as possible. Please keep well informed.

If you have any other questions, please feel free to contact us.

Good luck to your dissertation.

Kind regards,
Krystal Liu

Evidence of Peer-review for Conference Presentations

Australian Health Promotion Association National Conference (2016, June) Perth, Western Australia

From: AHPA 2016 <notifications@eorganiser.com.au>
Sent: Tuesday, 22 March 2016 3:15 PM
To: Stephanie GODRICH
Subject: AHPA 2016 - Abstract Notification

Dear STEPHANIE,

The 23rd National Conference of the Australian Health Promotion Association

Congratulations! On behalf of the Organising Committee, we are pleased to confirm that your abstract has been **accepted for Oral presentation** at the The 23rd National Conference of the Australian Health Promotion Association to be held at the Rendezvous Hotel Scarborough in Perth from 19 – 22 June 2016.

Please find details below regarding your accepted presentation/s:

Paper ID	Paper Title	Author(s)	Theme/Subtheme	Accepted Presentation Type
63	STORIES BEHIND THE STATISTICS: AN ECOLOGICAL MIXED-METHODS INVESTIGATION INTO DRIVERS OF WA CHILDREN'S FRUIT/VEGETABLE CONSUMPTION	**STEPHANIE GODRICH** Christina Davies Jill Darby Johnny Lo Amanda Devine	Create Supportive Environments	Oral

Speaker Briefing Notes will be provided to you in the coming weeks.

For each **oral presentation,** the Scientific and Program Committee is requesting the inclusion of ONE power point slide to describe the alignment of the presentation to the Conference Theme - Connecting the Dots, Tradition to Innovation, Making it Matter.

The support you have shown for the conference is greatly appreciated and we look forward to your involvement in the program. The program at a glance is available here.

To register for the AHPA 2016 Conference, please click here.

Please be advised that all presenters are required to register and pay to attend the conference by the **early bird registration date which is 4th April 2016.**

The conference is unable to offer any financial assistance for accommodation and travel expenses.

Should you have any questions regarding the above please do not hesitate to us.

AHPA 2016 Conference Managers
Arinex Pty Limited
3/110 Mounts Bay Road
Perth, WA 6000

From: AHPA 2016 <notifications@eorganiser.com.au>
Sent: Tuesday, 22 March 2016 3:15 PM
To: Stephanie GODRICH
Subject: AHPA 2016 - Abstract Notification

Dear STEPHANIE,

The 23rd National Conference of the Australian Health Promotion Association

Congratulations! On behalf of the Organising Committee, we are pleased to confirm that your abstract has been **accepted for Oral presentation** at the The 23rd National Conference of the Australian Health Promotion Association to be held at the Rendezvous Hotel Scarborough in Perth from 19 – 22 June 2016.

Please find details below regarding your accepted presentation/s:

Paper ID	Paper Title	Author(s)	Theme/Subtheme	Accepted Presentation Type
65	COMMUNITY INFORMANT STRATEGIES TO INCREASE FRUIT AND VEGETABLE CONSUMPTION AMONG REGIONAL AND REMOTE WA CHILDREN	**STEPHANIE GODRICH** Christina Davies Jill Darby Amanda Devine	Strengthen Community Action	Oral

Speaker Briefing Notes will be provided to you in the coming weeks.

For each **oral presentation,** the Scientific and Program Committee is requesting the inclusion of ONE power point slide to describe the alignment of the presentation to the Conference Theme - Connecting the Dots, Tradition to Innovation, Making it Matter.

The support you have shown for the conference is greatly appreciated and we look forward to your involvement in the program. The program at a glance is available here.

To register for the AHPA 2016 Conference, please click here.

Please be advised that all presenters are required to register and pay to attend the conference by the **early bird registration date which is 4th April 2016.**

The conference is unable to offer any financial assistance for accommodation and travel expenses.

Should you have any questions regarding the above please do not hesitate to us.

AHPA 2016 Conference Managers
Arinex Pty Limited
3/110 Mounts Bay Road
Perth, WA 6000
T: +61 8 9486 2000
F: +61 2 9267 5443
E: ahpa2016@arinex.com.au

Dietitians Association of Australia National Conference (2016, May) Melbourne, Victoria

From: DAA 2016 <notifications@eorganiser.com.au>
Sent: Wednesday, 16 December 2015 2:24 PM
To: Stephanie GODRICH
Subject: DAA 2016 - Notification of Abstract Submission

Dear STEPHANIE,
Congratulations! On behalf of the DAA Scientific and Social Program Committee, we are pleased to confirm that your abstract submission has been **accepted as a Poster Presentation** into the Conference program for the DAA 2016 Conference to be held in Melbourne 19-21 May 2016.
Please find details below regarding your accepted submission:

Paper ID	Paper Title	Author(s)	Abstract Stream	Accepted Presentation Type
143	INVESTIGATING INDIVIDUAL AND INTERPERSONAL DETERMINANTS OF FRUIT AND VEGETABLE CONSUMPTION AMONG REGIONAL AND REMOTE WA CHILDREN	**STEPHANIE GODRICH** Christina Davies Jill Darby Amanda Devine	CLOSED - Research	CLOSED - Poster

Detailed briefing notes are attached to assist with the preparation of your poster and will also be available on the Conference website.
To confirm your acceptance of this offer, please fill in the attached disclosure form and return to the Conference Managers via uploading the form here by 22 March 2016.
All presenting authors are **required to register and pay** for their Conference registration by **22 March 2016.**
Please click here to register or visit the conference website via www.daa2016.com.au.
As you can appreciate we have received more abstracts than our program can incorporate, and as such any authors who have not paid their conference registration by **22 March 2016** risk being removed from the program and their abstract will not be included in the journal supplement.
The support you have shown for the Conference is greatly appreciated and we look forward to your involvement.
Should you have any questions regarding the above please do not hesitate to contact us.
We look forward to welcoming you to Melbourne.
Kind Regards,
Dietitians Association of Australia 33rd National Conference Managers
Level 10, 51 Druitt Street
Sydney NSW 2000, Australia
Phone: +61 2 9265 0700
Fax: +61 2 9267 5443
Email: dietitians@arinex.com.au
Website: http://daa2016.com.au

National Rural Health Conference (2015, May)
May, Darwin, Northern Territory

30 January 2015

Ref: 417

Mrs Stephanie Godrich
Regional Strategy Coordinator
Foodbank WA
2/4 Wesley Street
BALCATTA WA 6021

Dear Stephanie

13th National Rural Health Conference - Abstract Update

Thank you for submitting one or more abstracts for presentation at the 13th National Rural Health Conference in Darwin, 24-27 May 2015.

Over 400 abstracts were received, very many of them of real interest and quality. Unfortunately this means there will be many worthy papers that we are not able to place in the program. In order to fit as much as possible into the Conference, we have asked some people to consider a 10-minute 'soapbox' presentation rather than a 20-minute presentation. In a few cases we are offering a spot for a poster to someone who sought a spot for a presentation.

Below we have listed the title of the abstract(s) submitted in your name, their current status (Successful, Unsuccessful or Under Consideration) and, if successful, the type of presentation you are being offered.

Abstract Details	
Paper Title:	**What Prevents or Facilitates Fruit/Vegetable Intake Among Rural Western Australian Children?**
Paper Status:	Successful
Presentation type:	General paper (20 mins)

Paper Status
Successful: Subject to confirmation of your acceptance, abstracts in the 'Successful' category will be allocated a spot on the program in one of the presentation types (a general paper, a peer reviewed paper, a soapbox paper or a poster).
Unsuccessful: Abstracts in this category have not been allocated a place on the program.
Under consideration: Abstracts in this category are still being considered and we will contact you about these as soon as possible.

International Conference on Public Health (2016, July)
Colombo, Sri Lanka

ICOPH 2016

2nd International Conference on Public Health – 2016

28th – 29th July 2016, Sri Lanka

Author	: Ms. Stephanie Godrich
Co- Author	: Dr. Johnny Lo, Dr. Christina Davies, Jill Darby, Dr. Amanda Devine
Address	: Edith Cowan University, Western Australia.
Paper ID	: ICOPH - A - 448
Paper Title	: **WHICH FOOD SECURITY DETERMINANTS ARE ASSOCIATED WITH REMOTENESS IN WESTERN AUSTRALIA?**
Date	: 15th June, 2016

NOTIFICATION OF ABSTRACT ACCEPTANCE ICOPH 2016 - A - 448

Dear Ms. Stephanie Godrich,

Congratulations on the acceptance of your abstract for an oral presentation and thank you for your interest in the International Conference on Public Health. On behalf of the Conference Organizing Committee, I would like to formally invite you to attend the TIIKM's 2nd Annual International Conference on Public Health to present your paper in Sri Lanka on 28th – 29th July 2016. The conference is being organized by The International Institute of Knowledge Management (TIIKM).

The aim of this international conference is to provide a comprehensive dialog for the scholars and practitioners to share and explore new heights in Public Health as the theme implies in overall. While researchers and academics have the opportunity to present their current and on-going studies at this conference, practitioners also have the opportunity to share their experiences from the world of practice.

All submissions will be peer reviewed and acceptance will be based on quality, relevance, and originality. Presenters will be given the opportunity to have their submissions included in the on-line conference proceedings with ISSN and ISBN. Conference proceedings of ICOPH 2016 will be sent for evaluation into major indexing and abstracting databases (e.g. Google Scholar, SCOPUS, THOMSON REUTERS - Conference Proceedings Citation Index). The best selected papers presented at the conference will be invited to extend their papers for their publication in supporting Journals.

Please view the ICOPH website at www.publichealthconference.co regarding information about travel, accommodations, awards, registration, presentations, and procedures on how to participate.

You can also register through our website. An invitation for the registration will be sent to you separately. Get early bird registration rate by completing your registration on or before 15th June, 2016.

More details and instructions will be announced closer to the event.

We look forward to meeting you on July 28 – 29, 2016.

Yours sincerely,

Isanka P. Gamage
Convener ICOPH 2016

Conference Secretariat
International Conference on Public Health 2016, No; 288/1/1, Old Kottawa road, Embuldeniya, Nugegoda 10250, Sri Lanka.
Tel: +94 113 098 521/2, Fax: +94 112 835 571 Hotline: +94 715 589 870
Email: info@publichealthconference.co

MONASH University Malaysia

TIIKM The International Institute of Knowledge Management

2nd Annual International Conference on Public Health – 2016

28th – 29th July 2016, Sri Lanka

Author	: Ms. Stephanie Godrich
Co- Author	:
Address	Edith Cowan University, Western Australia
Paper ID	: ICOPH – A- 129
Paper Title	**: HOW DO SOCIAL AND ECONOMIC FACTORS INFLUENCE FRUIT AND VEGETABLE CONSUMPTION AMONGST REGIONAL AND REMOTE WESTERN AUSTRALIAN CHILDREN?**
Date	: 30th March, 2016

NOTIFICATION OF ABSTRACT ACCEPTANCE ICOPH 2015 – A - 129

Dear Ms. Stephanie Godrich,

Congratulations on the acceptance of your abstract for an oral presentation and thank you for your interest in the International Conference on Public Health. On behalf of the Conference Organizing Committee, I would like to formally invite you to attend the TIIKM's 2nd Annual International Conference on Public Health to present your paper in Sri Lanka on 28th – 29th July 2016. The conference is being organized by The International Institute of Knowledge Management (TIIKM).

The aim of this international conference is to provide a comprehensive dialog for the scholars and practitioners to share and explore new heights in Public Health as the theme implies in overall. While researchers and academics have the opportunity to present their current and on-going studies at this conference, practitioners also have the opportunity to share their experiences from the world of practice. All submissions will be peer reviewed and acceptance will be based on quality, relevance, and originality. Presenters will be given the opportunity to have their submissions included in the on-line conference proceedings with ISSN and ISBN. Conference proceedings of ICOPH 2016 will be sent for evaluation into major indexing and abstracting databases (e.g. Google Scholar, SCOPUS, THOMSON REUTERS - Conference Proceedings Citation Index). The best selected papers presented at the conference will be invited to extend their papers for their publication in supporting Journals.
Please view the ICOPH website at http://publichealthconference.co/2016/ regarding information about travel, accommodations, awards, registration, presentations, and procedures on how to participate.
You can also register through our website. An invitation for the registration will be sent to you separately.
Get early bird registration rate by completing your registration on or before 15th February 2016.
More details and instructions will be announced closer to the event.
We look forward to meeting you on July28 – 29, 2016.
Yours sincerely,

Isanka P. Gamage
Convener
International Conference on Public Health - 2016

Conference Secretariat
International Conference on Public Health 2016, No; 288/1/1, Old Kottawa road, Embuldeniya,
Nugegoda 10250, Sri Lanka.
Tel: +94 113 098 521/2, Fax: +94 112 848 654 Hotline: +94 77 2241493
Email: info@publichealthconference.co

World Nutrition Congress (2016, September)
Cape Town, South Africa

World Nutrition Cape Town 2016
Knowledge Policy Action

University of The Western Cape
Private Bag X17, Belville
Republic of South Africa
Telephone: +27 21 683 5106
Email: info@wncapetown2016.com

Dear Stephanie Godrich,

Congratulations!! Your late breaking abstract, ***Using Mixed-Methods to Create a Picture of Food Security among Western Australian Children***, has been accepted as a POSTER PRESENTATION for the upcoming World Nutrition Cape Town 2016, under the topic: ***Food and Nutrition Security***, which will be held in Cape Town on the 30 August to 02 September 2016.

Each of the abstract was reviewed by several experts in the field and no recommendations for enhancements to your abstract have been suggested.

The World Nutrition Congress will be contacting you shortly as to the date, time, and location of your presentation. They will also be giving you instructions as to the format of your presentation. Remember to follow these directions carefully.

Please note that you are responsible for the arrangements and costs of your registration, travel and accommodation. For your convenience, Please use the following promo code to qualify for the early bird rate: WNCTABSDIS.

Again, congratulations and I look forward to seeing you at the conference.

Sincerely

Local Conference Organisers
World Nutrition Cape Town 2016
+ 27 21 683 5106
speak@wncapetown2016.com
http://wwww.wncapetown2016.com

Public Health Association of Australia and Chronic Diseases Network Conference (2016, September)
Alice Springs, Northern Territory

Speaker Presentations

Title	Are knowledge and preferences associated with adequate child fruit and vegetable consumption?
Paper Status	Accepted - Oral Presentation
Presentation Type	Oral Presentation
Theme	Promotion
Session Details	3B - Childhood Nutrition Sep 19, 2016 3:30 PM - 5:00 PM
Presenting Author	Mrs Stephanie Godrich
Biography	Stephanie is a nutritionist with 10 years experience in industry sectors including not-for-profit, research, evaluation and consultancy. She is also a Co-Vice President of the Public Health Association of Australia (Western Australian branch). Stephanie's aspiration to advocate for equitable health opportunities for regional and remote communities began with her work through Foodbank WA. It been continued through her current PhD which focuses on the relationship between food security determinants and fruit and vegetable intake among regional and remote WA children.

Title	Top fruit and vegetable messages recalled in regional and remote Western Australia.
Paper Status	Poster Presentation Offer
Presentation Type	Oral Presentation
Theme	Promotion
Session Details	Poster Displays P2 Sep 20, 2016 12:45 PM - 1:00 PM
Presenting Author	Mrs Stephanie Godrich
Biography	Stephanie is a nutritionist with 10 years' experience in industry sectors including not-for-profit, research, evaluation and consultancy. She is also a Co-Vice President of the Public Health Association of Australia (Western Australian branch). Stephanie's aspiration to advocate for equitable health opportunities for regional and remote communities began with her work through Foodbank WA. It been continued through her current PhD which focuses on the relationship between food security determinants and fruit and vegetable intake among regional and remote WA children.

Statement of PhD Candidate's contribution to peer reviewed journal articles included in this thesis

Manuscript 1:

Godrich, S.L., Davies, C.R., Darby, J., Devine, A. (2016). Which ecological determinants influence Australian children's fruit and vegetable consumption? *Health Promotion International*. Advance Access. 1-10. doi: 10.1093/heapro/daw063.

To Whom It May Concern,

I, *Stephanie Louise Godrich*, collected the data, led the analysis and drafted the paper under supervision from *Christina R. Davies, Jill Darby* and *Amanda Devine*. All authors contributed to the critical review, saw and approved the final version of the publication entitled "Which Ecological Determinants Influence Australian Children's Fruit and Vegetable Consumption?"

Stephanie L. Godrich

I, as a Co-Author, endorse that this level of contribution by the Candidate indicated above is appropriate.

Christina R. Davies	*The University of Western Australia*
Jill Darby	*Edith Cowan University*
Amanda Devine	*Edith Cowan University*

Manuscript 2:

Godrich, S.L., Lo, J., Davies, C.R., Darby, J., Devine, A. (2017). Are regional and remote Western Australian children eating for good health? An investigation into fruit and vegetable consumption. *Health Promotion Journal of Australia.* Advance Online Publication. doi: 10.1071/HE16090.

To Whom It May Concern,

I, *Stephanie Louise Godrich*, collected the data, led the analysis and drafted the paper under supervision from *Johnny Lo, Christina R. Davies, Jill Darby* and *Amanda Devine*. All authors contributed to the critical review, saw and approved the final version of the publication entitled "Are regional and remote Western Australian children eating for good health? An investigation into fruit and vegetable consumption."

Stephanie L. Godrich

I, as a Co-Author, endorse that this level of contribution by the Candidate indicated above is appropriate.

Johnny Lo	*Edith Cowan University*
Christina R. Davies	*The University of Western Australia*
Jill Darby	*Edith Cowan University*
Amanda Devine	*Edith Cowan University*

Manuscript 3:

Godrich, S.L., Davies, C.R., Darby, J., Devine, A. (2017). What are the determinants of food security among regional and remote Western Australian children? *Australian and New Zealand Journal of Public Health.* Advance Online Publication. doi: 10.1111/1753-6405.12636.

To Whom It May Concern,

I, *Stephanie Louise Godrich*, collected the data, led the analysis and drafted the paper under supervision from *Christina R. Davies, Jill Darby* and *Amanda Devine*. All authors contributed to the critical review, saw and approved the final version of the publication entitled "What are the determinants of food security among regional and remote Western Australian children?"

Stephanie L. Godrich

I, as a Co-Author, endorse that this level of contribution by the Candidate indicated above is appropriate.

Christina R. Davies	*The University of Western Australia*
Jill Darby	*Edith Cowan University*
Amanda Devine	*Edith Cowan University*

Manuscript 4:

Godrich, S.L., Lo, J., Davies, C.R., Darby, J., Devine, A. (2016). Prevalence and socio-demographic predictors of food insecurity among regional and remote Western Australian children. Manuscript under review (*Australian and New Zealand Journal of Public Health*).

To Whom It May Concern,

I, *Stephanie Louise Godrich*, collected the data, led the analysis and drafted the paper under supervision from *Johnny Lo*, *Christina R. Davies*, *Jill Darby* and *Amanda Devine*. All authors contributed to the critical review, saw and approved the final version of the publication entitled "Prevalence and socio-demographic predictors of food insecurity among regional and remote Western Australian children."

Stephanie L. Godrich

I, as a Co-Author, endorse that this level of contribution by the Candidate indicated above is appropriate.

Johnny Lo	*Edith Cowan University*
Christina R. Davies	*The University of Western Australia*
Jill Darby	*Edith Cowan University*
Amanda Devine	*Edith Cowan University*

Manuscript 5:

Godrich, S.L., Lo, J., Davies, C.R., Darby, J., Devine, A. (2016). Do food security determinants predict adequate fruit consumption among regional and remote Western Australian children? Manuscript in preparation.

To Whom It May Concern,

I, *Stephanie Louise Godrich*, collected the data, analysed the data with *Johnny Lo* and drafted the paper under supervision from *Johnny Lo, Christina R. Davies, Jill Darby* and *Amanda Devine*. All authors contributed to the critical review, saw and approved the final version of the publication entitled "Do food security determinants predict adequate fruit consumption among regional and remote Western Australian children?"

Stephanie L. Godrich

I, as a Co-Author, endorse that this level of contribution by the Candidate indicated above is appropriate.

Johnny Lo	*Edith Cowan University*
Christina R. Davies	*The University of Western Australia*
Jill Darby	*Edith Cowan University*
Amanda Devine	*Edith Cowan University*

Manuscript 6:

Godrich, S.L., Lo, J., Davies, C.R., Darby, J., Devine, A. (2017). Which food security determinants predict adequate vegetable consumption among rural Western Australian children? *International Journal of Environmental Research and Public Health*. 14 (40), pp 1-15. doi:10.3390/ijerph14010040. Copyright © 2017 by the authors. licensee MDPI, Basel, Switzerland.

To Whom It May Concern,

I, *Stephanie Louise Godrich*, collected the data, analysed the data with *Johnny Lo* and drafted the paper under supervision from *Johnny Lo, Christina R. Davies, Jill Darby* and *Amanda Devine*. All authors contributed to the critical review, saw and approved the final version of the publication entitled "Which food security determinants predict adequate vegetable consumption among rural Western Australian children?"

Stephanie L. Godrich

I, as a Co-Author, endorse that this level of contribution by the Candidate indicated above is appropriate.

Johnny Lo	*Edith Cowan University*
Christina R. Davies	*The University of Western Australia*
Jill Darby	*Edith Cowan University*
Amanda Devine	*Edith Cowan University*

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