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

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Food security is a complex, multifactorial[1] issue referring to reliable access to sufficient food,[2] incorporating food availability, access, utilisation and stability of the first three dimensions.[3-6] Food insecurity arises when access is restricted or uncertain.[7] Resulting personal and societal costs are *"felt as reduced physical, mental, spiritual and social health, and wellbeing."*[8] The issue is underestimated in high-income countries including Australia,[9] with slow political prioritisation,[10] largely due to a lack of understanding around its interrelated determinants.

Given Australia's vast geography, important food security determinants include reduced availability, especially of healthy food, in regional and remote areas. Freight costs[11,12] result in food being up to 200% more expensive than metropolitan areas.[8] Poor nutrition knowledge and skills[13-16] 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.[11,19] Environmental issues further disrupt deliveries and reduce availability.[11] 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.[11] Households in the most socioeconomically disadvantaged areas are particularly impacted by higher

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, storage facilities, preparation and cooking facilities and time to purchase food.

Conclusions: Key food availability recommendations include increasing local food supply options. Food access recommendations include ensuring equitable formal social support and empowering informal support options. Food 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

food costs.[12,17] This is yet another barrier for low-income households,[11] especially welfare recipients,[19] to buy foods essential for their family's health.[20,21]

In Australia, children from low-income families are vulnerable to food insecurity,[10,22] especially in remote areas.[23] 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.[25] 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.

Objective

This research aimed to explore the impact of food security determinants[5] on children in regional and remote WA, across food availability, access and utilisation dimensions.

Methods

Sample

'Key informants' were interviewed as 'expert sources of information'.[26] 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 for their roles related to food security determinants[5] across food availability (e.g. food supply workers managed/worked in food outlets), food access (e.g. youth workers provided food to children in after-school 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.[27] 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[28] and remoteness.[29-31] The sample from each WA region was closely representative of the population distribution.[32] 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 food security determinants in WA.

Instrument and data collection

Semi-structured interviews (SSI) were conducted. SSI facilitate in-depth conversation from participants around the study topic[33] and are appropriate for sensitive topics, such as food insecurity.[34] 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 use in the main study. 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[5] framework constructs.

Thirty people were invited to take part in an interview through an initial telephone call garnering interest and a follow-up email containing an information letter and consent form indicating study aims, approvals, anticipated interview length (60 minutes), example topics for discussion and details of data use. Twenty of the 30 provided written consent to participate. 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.

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 10.[35] A thematic analysis was the strategy employed to analyse themes. The initial coding framework was based on the Determinants of Food Security[5] 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.[36] Saturation was confirmed at 20 interviews when no more pertinent themes or concepts were identified[36] 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.

Results

Twenty key informants (eight health workers, six food supply workers, six school/youth workers) participated (response = 67%). Sixty per cent of interviewees discussed regional WA (n=12) and 40% discussed remote WA (n=8). The majority (80%) of interviewees were female (n=16) (Table 1). An in-depth analysis of the food security dimension themes investigated in this study, i.e. food availability, food access and food utilisation,[5,6] and their 16 sub-themes (determinants), are presented below. Figure 1 provides a graphical illustration of these food security dimension themes and sub-themes, while Table 2 illustrates the relative importance of each sub-theme based on the number of coded statements.

Food security determinants – six food availability sub-themes

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-focused 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

Table 1: Respondent and non-respondent demographics.			
Demographics	**Key Informant Types included**		
	Health Workers	**School/ Youth Workers**	**Food Supply Workers**
Respondents			
Remoteness			
Regional WA	4	2	6
Remote WA	4	4	
Gender			
Female	6	6	4
Male	2		2
Non-respondents			
Remoteness			
Regional WA	1		8
Remote WA			1
Gender			
Female	1		3
Male			6

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. Small population sizes also affected food availability 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)

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.:

> "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)

Promotion

Ten respondents described stores promoting locally sourced food and weekly specials. Promotional strategies included recipe cards at point-of-sale, fruit and vegetable posters and 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.

Figure 1: 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).
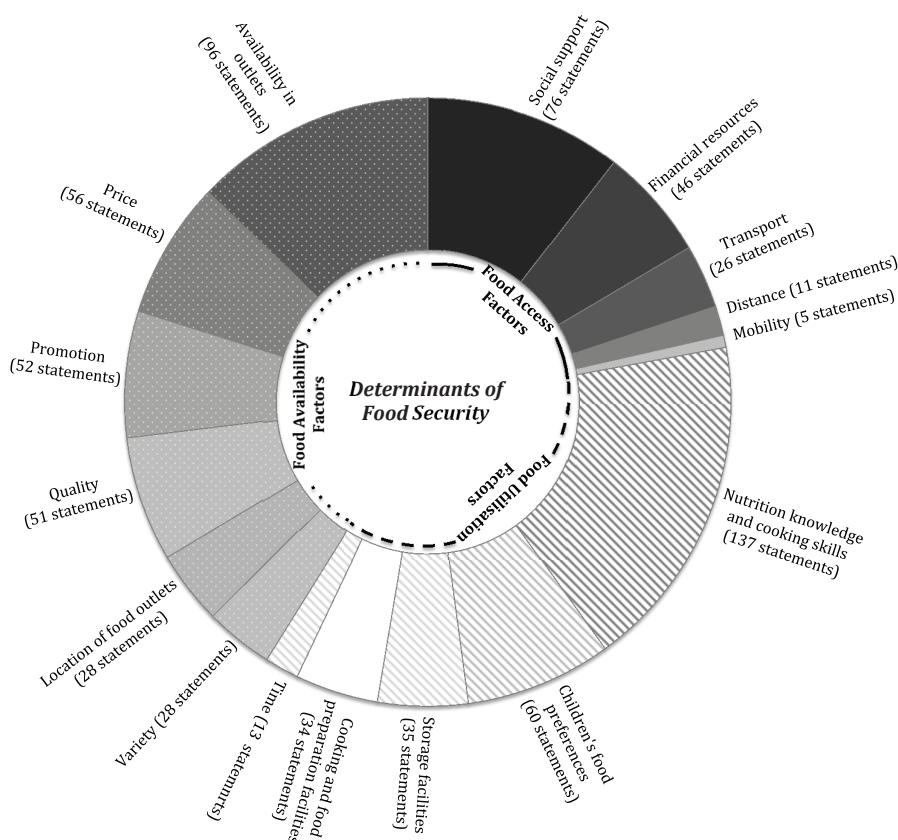
Table 2: Key recommendations to improve regional and remote children's food security across food availability, access and utilisation dimensions. Recommendations and implementation strategies are based on major sub-themes determined in this study and support previous research.

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

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)

Location of food outlets

Small towns usually had a main supermarket and 'peripheral' food outlet/s, e.g. roadhouses selling snacks. 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)

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)

Food Security Determinants – five food access sub-themes

Social support

Clear inequities in formal social support existed across WA. Schools played substantial roles in mediating the effects of food insecurity 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.

Financial resources

Household finances varied across WA. 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)

Transport to food outlets

Smaller, centralised towns facilitated active transport, e.g. children walking and cycling to buy 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)

Distance to food outlets

Disparities in distance to outlets were apparent. Some families travelled to other towns to buy food due to a limited range in their own town. Families close to town centres easily accessed food from centrally located outlets; families 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)

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.

Food Security Determinants – five food utilisation sub-themes

Nutrition knowledge and cooking skills

Parental knowledge and skills was a polarising issue and is important to discuss within the context of children's food security. Seven informants indicated that many parents possessed sufficient nutrition and cooking skills, with peer-to-peer knowledge and recipe sharing. However, this did not necessarily result in healthy food 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)

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 dictated 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)

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 affected 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 being supplied for lunches because of food safety concerns.

Cooking and food preparation facilities

Many families possessed adequate cooking facilities, while inadequate facilities resulted in children buying 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)

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)

Discussion

This research explored factors influencing WA children's food security, guided by the Determinants of Food Security framework.[5] 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.[11,17,19,21,37,38] Elevated cost in towns due to low competition, increasing remoteness and freight costs supported previous research.[17,21,39] The importance of informal support networks where insufficient formal options existed has also been previously reported.[11,40] Limited food literacy, particularly among disadvantaged groups, reduced purchasing of nutritious foods like fruit and vegetables. This finding supports the literature that suggests lower socio-economic groups possessing lower food literacy are less likely to buy foods that align with dietary recommendations.[11,20,41] 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.[42,43]

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 food security determinants. Limitations include a lack of parent and child perspectives. This study presents an overall perspective of food security 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 food security in WA and answers the call of previous research to investigate how food insecurity may impact WA children.[11] Key recommendations based on prominent themes discussed in this study are summarised in Table 2. At a food availability level, recommendations include increased support for local food supply options.[15,44-46] For example, land use management that facilitates locally controlled food production,[45] markets and/or community-driven gardens.[6,45] Where this is impractical, state and local government facilitation of core-food freight subsidies[6,17,46,47] or discounts at the store level.[6,12,15,44] Recommendations at a food access level include: equitable distribution of and support for agencies to work in partnership,[44,45] such as conducting 'food security assessments' and implementing programs including 'giving and receiving' to increase valuing of support and retain dignity;[6,15,45] and support for social networks (i.e. food growing/trading groups) to develop additional community-based food security options,[44,45] particularly in 'food deserts'[45] where food availability, access, cost and quality are issues. This may increase community empowerment, which can improve financial and social development and health outcomes.[48] Key food utilisation dimension recommendations include: increased funding for and focus of experiential food literacy programs[6,45] on quick, healthy food preparation,[42] budgeting skills targeting disadvantaged families;[44,47] and experiential food literacy education programs that increase children's nutrition knowledge, preferences and requests for healthy food.[6,44] Key program components should include growing and tasting food,[45] quick recipe ideas and be delivered in school and community settings.[44]

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 food security determinants are most influential on food security status and its resulting dietary outcomes. In a high-income country like Australia, child food insecurity

is inexcusable and could be appeased if stakeholders collaborate to implement key recommendations such as those highlighted in this study.

Acknowledgements

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