# (Unwrapped) Food for Thought: 

# Exploring the Intersection of Waste and 

## Nutrition in Children's Lunchboxes

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A Thesis Submitted in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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## ACKNOWLEDGEMENT OF COUNTRY

I would like to acknowledge that during my candidature I have been honoured to live, learn, and work on the traditional lands of the Kaurna Peoples. I would like to take this opportunity to pay my respects to the Kaurna People, the Traditional Owners of these lands and recognise their continuing connection to the land, sea, sky, and waterways. Today and every day, I also pay respects to leaders and Elders, past and present, for they hold the memories, traditions, cultures, and hopes of all Kaurna Peoples. I express my gratitude in the sharing of these lands, my sorrow for the personal, spiritual, and cultural costs of that sharing, and my hope that we may walk forward together in harmony and in the spirit of healing.

## DECLARATION

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint award of this degree.

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Date: 24 March 2023

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"Diet-a choice we make every day, several times a day determines the size of our environmental footprint. "

- Lisa Kemmere


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#### Abstract

Although most children in Australia bring a packed lunch from home to school, research on the environmental impacts of children's lunchbox contents is limited. There is some recognition of the importance of addressing nutrition early in life, and many healthy eating interventions directed to preschools and primary schools. However, what seems to be missing is the attachment of environmental considerations to these healthy eating interventions, hence the importance and connection of both agendas are not realised for public and planetary health. This doctoral research employed a mixed methods research design to explore the connection between waste and nutrition in the context of school lunchboxes. This thesis is divided into eight chapters, including four research studies and five manuscripts.

Given the novelty of this research area, an initial scoping review was conducted to explore studies that considered children's lunchboxes in conjunction with their environmental outcomes. Results from this review of 10 articles globally from Australia, USA, Spain, New Zealand, and the UK, demonstrated the very limited research in this area, where packaging outcomes of lunchbox foods were understudied. It also highlighted the need to recognise socio-ecological influences driving sustainability practices for health co-benefits.


Next, a content analysis of websites of 18 pre- and primary schools in South Australia was conducted to identify the presence or absence of policies and programs focussed on healthy eating and environmentally friendly aspects of school food environments. This study also showed that a dual focus on these combined issues was lacking.

The flagship study of this doctoral research involved a quantitative audit of school lunchboxes through the development of a novel methodology encompassing food, waste, and packaging considerations. After a pilot demonstrating that the audit tool developed had excellent feasibility and reliability, the main lunchbox audit (including data from 673
lunchboxes) showed that, overall, there was a high proportion of single-use packaging in lunchboxes and considerable proportion of food waste (mostly vegetables), although lunchboxes of preschool children contained more unpackaged food compared with primary school children.

The final study involved interviews with families to understand (a) their lunchbox packing practices and choices, (b) the influencing factors and priorities when packing lunchboxes, and (c) what changes would support their lunchbox packing practices. Along with identification of barriers and facilitators to packing a low-waste nutritious lunchbox, there were several competing priorities influencing families, as well as school level factors that influence, and could support further changes in, lunchbox contents.

The ultimate goal of this PhD research was to investigate the relationship between the environmental agenda (in relation to waste) and children's food consumption patterns, in order to inform future discussions about ways to create change in both arenas, particularly in the school lunchbox context. In summary, despite the co-benefits of environmental agendas for children's health and planetary health, challenges remain in the school food environment and also at home. Packing a low-waste, nutritious lunchbox is not yet the norm, and families face competing priorities and complexities. However, this research shows there is scope for school level policies and programs to facilitate change and promote reducing waste as well improving children's nutrition, considering alignment with current familial structures without placing undue burden on families. Strengthening policies and programs at the preschool level and carrying them forward into primary schools can be an effective way to initiate change.

## RESEARCH OUTPUTS

The following research outputs were produced during the PhD Candidature.

The current thesis includes five research articles, out of which two are published, two have been submitted for publication consideration, and one has been drafted for submission.

## Published

> 1. Neha K Lalchandani, Shona Crabb, Caroline Miller, Clare Hume. Content analysis of school websites: policies and programs to support healthy eating and the environment, Health Education Research, Volume 37, Issue 1, February 2022, Pages 48-59, https://doi.org/10.1093/her/cyab040
2. Neha K Lalchandani, Brianna Poirier, Shona Crabb, Caroline Miller, Clare Hume, School lunchboxes as an opportunity for health and environmental considerations: a scoping review, Health Promotion International, Volume 38, Issue 1, February 2023, daac201, https://doi.org/10.1093/heapro/daac201

## Submitted

3. Neha K Lalchandani, Caroline Miller, Lynne Giles, Jo Hendrikx, Shona Crabb, Carly Moores, Clare Hume. Development of a novel methodology to examine the food, packaging, and waste in Australian school children's lunchboxes. (Submitted February 2023)
4. Neha K Lalchandani, Clare Hume, Lynne Giles, Jo Hendrikx, Shona Crabb, Caroline Miller. Sneak Peek: Food, waste, and packaging characteristics of South Australian preschool and primary school children's lunchboxes. (Submitted February 2023)

## Drafted for submission

5. Neha K Lalchandani, Caroline Miller, Clare Hume, Shona Crabb. Family Perspectives on Packing a Low-Waste and Nutritious School Lunchbox.

Other related outputs produced during the candidature period (but not appearing in the thesis):

## Published

6. Neha K Lalchandani, Danielle Proud, L. Suzanne Suggs. A renewed pedagogy for health co-benefit: Combining nutrition and sustainability education in school food learnings and practices. In Lalli, G.S., Turner, A., \& Rutland, M. (Eds.). (2023). Food Futures in Education and Society (1st ed.). Routledge. London.
https://doi.org/10.4324/9781003294962

## Accepted for publication

7. Lucía Aguirre Sánchez, Ronja Teschner, Neha K Lalchandani, Yassmeen El Maohub, L. Suzanne Suggs. Climate change mitigation potential in dietary guidelines: A global review, Sustainable Production and Consumption (Accepted for publication July 2023)

## PRESENTATIONS DURING CANDIDATURE

Nutrition Society of Australia 2022 Conference - Sustainable nutrition for a healthy life [Perth, Australia 29 November - 2 December 2022]

Oral Poster and E-Poster Presentation-Nutrition across the lifespan
Title: A snapshot of school children's lunchboxes in South Australia through a food and sustainability lens

International Congress on Obesity 2022 [Melbourne, Australia 18-22 October 2022] Oral Poster Presentation—Public Health: Food and Nutrition

Title: What's in South Australian school children's lunchboxes? A snapshot of food and packaging contents

Population Health Congress 2022 [Adelaide, Australia 21-23 September 2022]
Rapid Fire Presentation-Child \& Adolescent Health
Title: A scoping review exploring nutritional and environmental aspects of school lunchboxes

Florey Postgraduate Research Conference [Adelaide, Australia 21 September 2022]
Poster Presentation-Child and Adolescent Health
Title: Unpacking South Australian school children's lunchboxes
$5^{\text {th }}$ European Social Marketing Conference [Thessaloniki, Greece 23-24 June 2022]
Oral Presentation-Planetary health: Environment and sustainability
Title: Translating sustainable food consumption into target behaviours: A global comparison of sustainability communication in food-based dietary guidelines

Conference on School Meals [Bergen, Norway 8-10 June 2022]
Long Oral Presentation-Health and Nutrition
Title: Sneak Peek: Lunchbox contents of preschool and primary school children in South Australia

Food Futures Conference [Virtual 16-17 March 2022]
Long Oral Presentation - Nutritional ecology informing lifecourse food systems policy and actions

Title: A new school lunchbox audit tool to assess nutrition and waste

Florey Postgraduate Research Conference [Adelaide, Australia 22 September 2021]
Poster Presentation-Child and Adolescent Health

Title: School lunchbox audit tool: Using photography and REDCap to assess quality of school lunches from a health and environmental perspective

SA Population Health Conference [Virtual 25-26 November 2020]
Rapid Fire Presentation-Health \& Schools
Title: Health and sustainability policies and programs in South Australian public preschool and primary schools. Are they adequate?

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## LIST OF ABBREVIATIONS AND ACRONYMS

| ABS | Australian Bureau of Statistics |
| :---: | :---: |
| ADG | Australian Dietary Guidelines |
| AUSNUT | AUStralian Food and NUTrient |
| CDC | Centers for Disease Control and Prevention |
| IRSAD | Index of Relative Socioeconomic Advantage and Disadvantage |
| KESAB | Keep South Australia Beautiful |
| NHMRC | National Health and Medical Research Council |
| PRISMA | Preferred Reporting Items for Systematic Reviews and Meta-Analyses |
| REDCap | Research Electronic Data Capture |
| UPFs | Ultra-Processed Foods |
| WHO | World Health Organisation |
| SA | South Australia |
| SEIFA | Socio-Economic Indexes for Areas |
| SES | Socioeconomic Status |

"The lunchbox can be thought of as a 'portable shrine of home' that is carried into the hostile environment of school. Each of its components is a carefully thought-out metaphor that must also serve a practical purpose, such as providing unspoiled nourishment. - Artist Rich Gold

## CHAPTER 1: INTRODUCTION

### 1.1 Preface

This chapter outlines the background to the body of research comprising this thesis and summarises key aspects related to children's diet and health, the Australian school food setting, school-based nutrition research, along with ongoing environmental research and sustainability agendas in the context of schools and children. Relevant emerging literature on ultra-processed foods (UPFs) is discussed and definitions pertaining to this research program have been outlined. A more specific literature review scoping the extent of environmental considerations associated with lunchbox foods can be found in Chapter 3, but relevant research on nutrition and environment have been included here broadly. Although efforts have been made to minimise repetition between the content in this chapter and background outlined within each independent manuscript, some may still exist. The gaps in this research field are identified, and the chapter concludes with a description of the overarching aim of this thesis and objectives of this research program that combines nutritional and waste agendas in the school lunchbox context. An outline of the thesis is also included to help readers navigate the course of this thesis, which is presented in a publication model.

### 1.2 Background to the research

### 1.2.1 Diet and children's health

Overweight and obesity among Australian children and adolescents is a significant public health concern. According to the triennial 2017-18 National Health Survey conducted by the Australian Bureau of Statistics (ABS), one in four children and adolescents (aged 2-11 years) were overweight or obese (ABS, 2019a). In South Australia (where the research presented in this thesis was based), the National Health Survey reported that approximately $22.6 \%$ of South Australian preschool and primary school-aged children (2-11 years) were overweight or obese (ABS, 2019b).

International nutrition surveys conducted in USA (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015) and the UK (Bates et al., 2016) have identified that food consumption patterns of children and adolescents do not align with the recommended dietary guidelines. The same scenario appears in Australia as overall dietary quality among Australian primary school-aged children has been found to be poor (Manson et al., 2021). This trend has remained consistent for over a decade as discretionary foods and beverages, such as sugar-sweetened drinks, sweet baked goods, and savoury snacks, account for more than one-third of total energy intake among those aged 2-18 years (ABS, 2012). Khandpur et al. (2020) argued that consumption of UPFs among the paediatric population in Europe has links with population-level obesity, metabolic syndrome, and cardiovascular disease outcomes. Globally this is also relevant, as a multi-country study across 16 countries by Neri et al. (2022) found a significant association between UPFs consumption and obesity prevalence in children and adolescents. The authors also reported that higher UPF consumption was associated with lower intakes of important nutrients, such as fibre, calcium, and vitamin C, and higher intakes of sodium and added sugars (Neri et al., 2022).

Besides physical health, the impacts of diet on children's mental and cognitive development is also well established in the literature, with food insecurity and poverty (Jyoti et al., 2005; Shankar et al., 2020) impacting intellectual development and academic performance. A systematic review of the literature by Tandon et al. (2016) suggested positive associations between healthy dietary patterns (defined as diets high in fruits, vegetables, whole grains) before the age of five and later childhood cognitive outcomes. Another by Burrows et al. (2017) demonstrated moderate associations between lower consumption of 'junk' foods and regular breakfast consumption with academic achievement among schoolaged children (5-18 years). Although the lack of use of validated dietary assessment methods and standardised academic outcomes were cited as limitations, the evidence base of these
reviews generally point towards the persisting implications of early eating patterns on cognitive advancement and educational attainment in school settings.

### 1.2.2 School setting and children's health

Most young children and adolescents in Australia spend an average of $30-35$ hours per week either in preschools, primary schools, or high schools. One third of children's daily energy intake occurs in the school setting (Bell \& Swinburn, 2004) where they spend an average of six hours per day and consume up to two meals and snacks, for five days a week for a significant portion of the year. As a result, the school food environment has been recognised to have an influential role on children's dietary habits and their health outcomes (CDC, 2011; Clarke et al., 2013; Kubik et al., 2003; Rose et al., 2021; WHO, 2009).

Several studies conducted over a decade ago assessed the school food environment and eating patterns of Australian children, and concluded that there was a lack of nutrition policy in schools that supported and promoted healthy eating among school children (Brennan et al., 2010; Chellappah et al., 2012; Kelly et al., 2010). Investigations of school food environments to study policies and programs, and their impacts on dietary patterns of school children, have been conducted for gathering public health evidence to shape interventions (Nelson \& Breda, 2013). Moreover, health promoting schools can have a significant positive impact on children's health and wellbeing (Bennett \& Burns, 2020). This means that the need for strong policies and regulations while creating supportive environments that encourage healthy eating, implementation of nutrition education programs, working closely with parents and communities to create a culture of health and wellness, are all important ventures.

The current school food policy in Australia varies across states and territories, with some overarching national guidelines in place consistent with the 2013 Australian Dietary Guidelines (NHMRC, 2013a) and The Australian Guide to Healthy Eating (NHMRC, 2013b). These are mainly applicable to foods and drinks supplied at schools, such as in canteens or
tuckshops, whereby the guidelines include restrictions on sugary snacks, soft drinks, and high-fat or high-salt foods (Department of Health, 2014). The traffic light system to classify food and drinks into Green, Amber, and Red categories is also a long-standing tool used in Australian schools, but compliance was reportedly lacking where monitoring and enforcement was absent (Woods et al., 2014), despite its acceptance and engagement by school staff, parents, and children (Pettigrew et al., 2011). However, food and drinks brought from home for consumption at school are not covered by this guidance (Lucas et al., 2017).

### 1.2.3 School meals and lunchbox model

In Australia, the school lunchbox is an important part of the daily routine of many families as the school food model relies predominantly on it. It has been reported that 86$93.5 \%$ of children consume foods via a lunchbox packed from home (Bell \& Swinburn, 2004; Finch et al., 2006; Sanigorski et al., 2005; Zarnowiecki et al., 2018). The lunchbox serves as the main source of food for children during the entire school day where they get 2-3 occasions to eat including lunch, morning snack/brain food time and/or recess. Brain food time is a short break during the school day, usually lasting 10 minutes, where students are encouraged to consume only fruits or vegetables (Aydin et al., 2021). Brain food time has also taken the form of Crunch\&Sip® in Western Australia (Cancer Council Western Australia, n.d.), enabling students to hydrate and consume an extra serve of fruit or vegetables during school hours. Approximately half a million children in the early years of primary school access out-of-school hours care (DESE, 2021), which serves as an opportunity to consume an afternoon snack at school. Occasionally, children may have lunch orders or purchase lunch, snacks, and drinks directly from a school canteen or tuckshop, and as reported by Sanigorski et al. (2005) this constitutes of $10 \%$ of children.

The school lunchbox model is not only unique to Australia and can be found in New Zealand (Dresler-Hawke et al., 2009), Canada (Hawthorne et al., 2018), Norway and

Denmark (Kainulainen et al., 2012). The absence of a school meal provision model in Australia does not negate the influential role the school environment plays for health promotion and facilitating alignment of children's diets with national dietary recommendations, as evidenced globally (CDC, 1996; Kubik et al., 2003; Wechsler et al., 2000; WHO, 2009). Given the reliance of lunchboxes packed from home, the quality of foods brought in these lunchboxes are an important indicator of children's dietary patterns and health outcomes. Therefore, investigating school lunchbox contents is an important priority for driving public health initiatives and shaping targeted interventions.

### 1.2.4 Nutritional status of school lunchboxes

Previous research suggests that there has continuously been an overrepresentation of energy-dense, nutrient-poor foods in Australian children's school lunchboxes brought from home (Bell \& Swinburn, 2004; Brennan et al., 2010; Sanigorski et al., 2005). Typically, Australian lunchboxes were found to contain a sandwich, a piece of fruit, some packaged snacks (often non-core foods or extras), and a drink that was either fruit juice, cordial, or water (Bell \& Swinburn, 2004; Brennan et al., 2010; Sanigorski et al., 2005). Kelly et al. (2010) surveyed the lunchboxes of preschoolers based in New South Wales through a customised lunchbox audit tool and reported similar results. Recent data from early childhood education and care settings in the same state provides further confirmation of the prevalence of discretionary (energy-dense nutrient-poor) foods, and inadequate presence of and children's low preference for vegetables (Pearson et al., 2021). At the primary school level, presence of discretionary foods was notably high across $85 \%$ of lunchboxes, with only $10 \%$ of lunchbox contents in alignment with the Australian Dietary Guidelines (Sutherland et al., 2020). Nationally, Manson et al. (2021) reported that $44 \%$ of energy intake at school was attributed to the consumption of discretionary choices. Unfortunately, these updated studies demonstrate the limited improvements in school-level dietary patterns over the last two
decades, with the exception of fruits-potentially attributable to initiatives such as Crunch\&Sip® (Nathan et al., 2011) and sugar-sweetened drinks (Sutherland et al., 2020).

In the USA, where almost $50 \%$ of students bring packed lunches from home, the contents of home-packed lunches of primary school children were found to be nutritionally inferior compared with school meals due to fewer fruits and vegetables (Taylor et al., 2019) and dairy products (Johnston et al., 2012). Evans et al. (2010) were the first to survey packed lunches brought by primary school children in the UK and reported that only $1 \%$ of the lunches met the country's school meal standards, despite parents considering packed lunches to be a healthier alternative to canteen foods. When Zarnowiecki et al. (2018) investigated eating patterns among UK children who received a school meal compared to South Australian children who brought a packed lunch from home, they found that the latter parents needed support to improve lunchbox content quality. This was due to their findings that confirmed the dominance of discretionary foods across all three meal events including recess, lunch, and after school.

A systematic review of nine studies predominantly based in the UK by Stanham et al. (2020) which examined the nutritional content and quality of home-packed lunches consumed by children aged 5-8 years, showed that most children consumed foods that were high in energy, saturated fat, sugar, and sodium, and low in protein, fibre and other micronutrients. Specifically, the most common lunchbox foods were white bread, processed meats, and discretionary items, while fruit and vegetable consumption were minimal. Two Brazilian studies (Barbosa et al., 2021; Nunes et al., 2019) analysed the presence of industriallyprocessed foods in children's lunchboxes and concluded that the majority of foods were ultraprocessed in nature ( $57 \%$ in the former study and $80 \%$ in the latter, possibly owing to sample size differences: 105 lunchboxes were assessed in the former and 380 in the latter). The most commonly included UPFs were sweet baked goods followed by industrialised sweet beverages. It appears that research on the occurrence of discretionary foods in lunchboxes is now shifting towards foods that are known to be ultra-processed.

### 1.2.5 Food waste and sustainability research in schools

Studying waste is environmentally important given its negative ecological impacts. Food in landfill is a significant source of methane (Adhikari et al., 2006) and waste reduction is an excellent opportunity to reduce greenhouse gas emissions (Dorward, 2012). Other implications of rising food costs and food insecurity (Abdulla et al., 2013) are also important societal impacts to consider. Plastic packaging imposes global threats including the contamination of oceans and biodiversity loss (MacLeod et al., 2021; Welden, 2020). Inadvertently, these negative environmental outcomes would also impact human health. While the focus of this research program is on food and packaging waste, it is also important to acknowledge that there are other sustainability aspects worthy of consideration with respect to lunchboxes, such as food miles and food production energy costs (Van Passel, 2013).

School-based environment-oriented food research has been limited to 'plate waste' (alias food waste) measurements, predominantly in the school meal provision space or canteens (Byker Shanks et al., 2017; Derqui et al., 2018; Garcia-Herrero et al., 2019; Niaki et al., 2017). Very few studies have investigated unconsumed or leftover food waste in the context of lunchboxes (Dresler-Hawke et al., 2009; Thomas et al., 2023). In relation to lunchbox food waste, it seems that parents are not always aware of what their children consume and, correspondingly, what is wasted. Hudson and Walley (2009) reported that primary school children in the UK were encouraged to keep their leftovers or uneaten foods in their lunchboxes. Instead of tipping the food into waste bins, children would bring it back home to their parents who can then assess the child's eating capacity and preferences, to help modulate food provision accordingly. Food waste can be considered a particularly significant issue in schools because it might suggest that children are not gaining the nutritional benefits of the edible yet wasted food. Moreover, there could also be economic implications for the school to dispose that waste (Papargyropoulou et al., 2014).

The Waste Wise School program in Western Australia, calculated that 3 kg of avoidable food waste is discarded per student per year; this is equivalent to 3 million whole
fruit pieces, 1.3 million packaged food items, and 3.5 million whole sandwiches thrown out each year across the state (Boulet et al., 2016). A 2018-2019 audit of 49 schools (including pre, primary and high schools) found an estimated 30 million litres ( 3,767 tonnes) of material is sent to landfill each year from South Australian state schools, at a cost of AU\$527,000 per annum; and only about $23 \%$ of that waste ( 630 tonnes) was identified as material which had no alternative to landfill; this means three-fourths of the waste was avoidable (KESAB environmental solutions, 2018).

Some food waste reduction interventions have been piloted in Australia recently. The Lunchbox Leftovers project in 2020, based in New South Wales (Grant, 2020), was a smallscale pilot program that utilised a behavioural approach via a three-fold intervention implemented in nine schools in the mid-coast region, involving a total of 1245 students. The interventions consisted of: 1) requiring students to take home uneaten food instead of disposing of them at school ( $\mathrm{n}=2$ ); 2) promoting children's involvement in the lunchbox packing process ( $\mathrm{n}=5$ ); and 3) restructuring eating times at schools to allow for longer food consumption opportunities after play time ( $n=2$ ). Evaluation of the interventions, conducted through pre- and post-intervention photo audits of school bins, as well as surveys and interviews with students, parents, and teachers showed changes in behavioural outcomes. Although there were some dropouts among participants, the interventions reportedly resulted in reductions in packaging waste in some schools and improvements in the nutritional quality of food. The interventions also had a positive impact on food waste at schools and showed potential for changes at home due to increased student involvement in lunchbox preparation. An exploratory case study by Boulet et al. (2019) surveyed 620 parents and 570 primary and high school children across Western Australia regarding two behaviours namely involving children in the lunchbox packing process and sending lunchbox leftovers home. The study found that the success of these behaviours was dependent on parents' ability to plan and prepare lunchbox foods, and highlighted the need for school-level support to encourage
children to bring leftovers back home, either through teacher involvement or reducing the availability of bins at schools. A systematic review conducted by Heiges et al. (2022), which included 24 studies ( $67 \%$ based in the USA), fourteen observational and ten experimental, aimed to assess food packaging waste in school food service programs. The review identified a lack of standardised instrument for packaging audits and noted the omission of reusable containers audit within the WASTE instrument developed by the authors (Heiges et al., 2022). Overall, sustainability research in the school lunchbox context is lacking, and packaging outcomes of lunchbox food choices is an avenue that has been largely untapped in the Australian context. Hence, furthering the understanding on how overlaps can be identified and studied between health promotion and eco-friendly behaviours is warranted.

### 1.3 Intersectionality of nutrition and environment

The importance of waste-free lunches as a way to promote environmental stewardship and reduce the amount of waste produced in schools has been reported before by Hemmert (2004), who argued that waste-free lunches not only benefit the environment, but also promote healthier eating habits and foster a sense of community and responsibility among students. The concept of litterless lunches exists as 'nude foods' in Australia where children's lunchboxes are encouraged to be devoid of packaging waste (Green Industries, 2021). This initiative focusses on increasing nutrition and decreasing waste, but it is difficult to find a formal evaluation of 'nude foods' in Australian context.

A cluster-randomised trial conducted by Goldberg et al. (2015) targeted 582 primary school children in USA. The trial examined the effectiveness of a school-based communications campaign called 'Great Taste, Less Waste' across 12 schools, which aimed to improve the quality of lunch and snack items brought from home by third and fourth grade students while promoting eco-friendly behaviour through reduction of food packaging. However, the campaign did not result in significant changes. More recently, a secondary
analysis of the original trial (Goldberg et al., 2015) conducted by Blondin et al. (2021), categorised lunchbox foods of 502 children at 10 primary schools based on degree of processing. The results showed that $70 \%$ of the foods were highly processed, and snacks were more processed in nature than lunch items ( $78 \%$ vs $61 \%$ ). However, these studies did not analyse packaging types to associate that with foods found in lunchboxes and, overall, this area of study has further remained unexplored in the literature.

Exploring the avenue of food and packaging waste reduction could be part of an intersectoral approach to improve dietary habits of school children-a strategy that can potentially be complementary and synergistic (Moore et al., 2013). This approach will be in line with the principles established by the National Health and Medical Research Council (NHMRC) that emphasises provision of foods and drinks in an environmentally sustainable way (NHMRC, 2013a). The World Health Organization's (WHO's) Health Promoting Schools framework part of the Global School Health Initiative is based on the principles of the Ottawa Charter for Health Promotion (WHO, 1986) that strengthens the capacity of schools to promote health through education and foster a healthy eating environment. Strategies of the initiative include applying a holistic, settings-based approach that fosters healthy school environments (WHO, 2019) and ecological sustainability (Talbot \& Verrinder, 2018, p. 98). Furthermore, the success of socio-ecological measures to improve diets of school children via comprehensive and effective actions has been reported (Moore et al., 2013).

The combination of environmental and nutritional objectives for optimising diets is part of the literature (Donati et al., 2016; Kjærgård et al., 2013), but research in the school environment context is lacking. The relationship between ultra-processed diets lies not just with the global obesity epidemic but also with their detrimental impact to the environment, which has been highlighted more recently (Leite et al., 2022; Seferidi et al., 2020). Ridgway et al. (2015) raised the challenges imposed by Australia's dominant neoliberal agendas, which impede the efficient integration of environmental sustainability framing into food and nutrition policies. This issue is also difficult if the majority of packaged products in the

Australian retail food market falls in the discretionary/ultra-processed category compared to the fewer core/minimally processed foods (Spiteri et al., 2018).

### 1.4 Definitions

The discourse surrounding nutrition and its construction is part of a constantly shifting social process consisting of scientific findings, cultural norms, economic forces, and political agendas. Thus, it is a challenging endeavour to define foods, whether they are healthy (or not), determining what qualifies as a meal, how food should be prepared, combined with, and consumed, and even identifying sustainable food in an era of evolving ecological priorities and trends. Broadly, the Australian Dietary Guidelines (ADG) provide a distinction between core and discretionary foods, the latter being of little nutritional value and often high in saturated fats, sugars, salt and/or alcohol (NHMRC, 2013a).

Monteiro et al. (2019) have pioneered the definitions of UPFs and proposed the NOVA (a name, not an acronym) classification system, which categorises foods into four groups: unprocessed or minimally processed foods; processed culinary ingredients; processed foods; and ultra-processed foods. UPFs are industrially produced and formulated food products that typically contain high levels of added sugars, fats, salt, additives and preservatives (Gibney, 2019; Monteiro et al., 2013). However, limitations of the term, including the lack of a clear definition and the potential for stigmatising certain foods and populations have also been highlighted by Lacy-Nichols and Freudenberg (2022). The term, though, has been successful in raising awareness about the negative health impacts of highly processed foods and the need for policies to address this issue. The NOVA classification system has also been critiqued as it categorises foods based on the degree and purpose of processing and this oversimplified system fails to account for the diversity of food products and processing methods (Knorr \& Augustin, 2021). More importantly, it fails to consider the nutritional and health implications of food processing and that some processed foods can be
part of a healthy diet (Petrus et al., 2021). Therefore, using the NOVA system in conjunction with other classification systems, and not as a substitute, for promoting the consumption of whole and minimally processed foods has been recommended by Astrup and Monteiro (2022). Gibney (2019) highlighted that there is little consistency either in the definition of UPFs or in examples of foods within this category. If they are 'foods to limit', then a clearer definition is required which needs to be integrated with other disciplines and easily understood by consumers (Anastasiou et al., 2022). Hence, the term needs improvement by emphasising the importance of policies that support whole, unprocessed foods instead of solely demonising processed foods

There are different nutrition classification schemes used in Australia to inform nutrition policy, including nutrient-based, food-based, and dietary-based schemes. Each scheme has its own advantages and disadvantages; however, choosing the most appropriate scheme depends on the policy goals and context (Dickie et al., 2022). Nutrient-based schemes target specific nutrient deficiencies and excesses, while food-based schemes encourage consumption of a variety of foods from different groups for overall health and wellbeing. Dietary-based schemes consider the complex interactions between nutrients and overall dietary quality and promote specific foods or food groups for their health benefits. Lobstein and Davies (2009) have also raised the difficulties involved in distinguishing 'healthy' and 'unhealthy' foods and suggested 'nutrient-profiling' as a model to objectively define the nutritional characteristics of foods. However, it is important to consider that children would not have the advanced capability to use complex nutritional indicators to assess the quality of foods for their health and wellbeing. As a result, to situate this PhD research within the current landscape of variable and conflicting meanings of food, its health properties, what is eco-friendly, connotations of good and bad, health-promoting or health-damaging (Coveney, 2006), this program of research did not characterise foods based on its health properties from a nutrition-reductionism lens; rather implications were made based on the idea of health-
promoting foods interlaced with environment-preserving attributes, particularly using packaging as an indicator and what children did not prefer to eat by leaving the food in the lunchbox uneaten (waste).

### 1.5 Research gap

There is more research focussed on the nutritional quality of school lunches in comparison with the environmental impacts of lunchbox foods. However, it is worth noting that the effectiveness of lunchbox interventions for health outcomes is under-researched, with very few evaluation studies existing. A systematic review conducted by Nathan et al. (2019) identified less than ten studies globally that investigated lunchbox interventions in the school and childcare settings. Additionally, as previously discussed in this chapter, lunchbox food waste and packaging studies are sparse in the literature. Recent eating patterns based on food being brought from home in the form of packed lunchboxes, and the associated waste and packaging characteristics have also not been investigated in Australia and globally. Therefore, besides assessing school lunchbox contents to understand current dietary trends among children and adolescents, the possibility of merging nutritional and environmental agendas was a key area of exploration in this PhD program. There is potential for both these facets to contribute to sustainability while achieving public health goals.

### 1.6 Research aims and objectives

As discussed, most studies in the literature relating to school lunchboxes have focussed on nutritional outcomes, and evaluation studies are few. There is limited evidence on the environmental impacts of school lunchboxes, or on the combined focus of food waste and nutrition. Thus, considering the novelty of this topic, this PhD research sought to address the research gap stated above, in an exploratory manner, and Figure 1.1 demonstrates where in the field this research program is situated. Given the exploratory threads involved, the
overarching aim of this research program was to explore the intersection of waste and nutrition in school children's lunchboxes. In particular, the research aimed to explore the existing research and policy/programme context of school lunchboxes, the actual contents of lunchboxes, and finally the experiences of packing lunchboxes. The aim of this thesis was fulfilled through the following objectives and respective studies:

Objective 1: To examine the existing literature relating to health and environment in the context of school lunchboxes (Study 1)

Objective 2: To understand the current publicly-available school policies relating to healthy eating and environmentally friendly practices (Study 2)

Objective 3: To develop a lunchbox audit methodology to enable Objective 4 (Study 3)

Objective 4: To quantify the food and packaging contents of children's lunchboxes, as well as the waste resulting from these contents (Study 3)

Objective 5: To capture the perspectives of children and parents relating to lunchbox packing, in order to understand the barriers and facilitators to packing a nutritious and low-waste lunchbox (Study 4)


Figure 1.1 Visual demonstration of where in the field this PhD research lies

### 1.7 Thesis outline

The research presented here has been prepared as a collection of five manuscripts (two published; two under review; one drafted for submission). Figure 1.2 depicts the outline of this thesis pictographically, with the associated chapters, objectives, studies, and manuscripts specified.

This current chapter (Chapter 1) has started the thesis by providing a summary of background information and existing literature regarding nutrition and sustainability in the school context. Chapter 2 provides the methodological foundation of the whole research program (further details of each study's methods are presented in the relevant chapters/manuscripts). Chapter 3 presents Study 1, a scoping review of existing studies that investigated the extent of representation of food and environmental considerations in the context of school lunchboxes. Chapter 4 presents Study 2, a qualitative analysis that examined contents of school policies and programs available on their websites with regards to healthy eating and environmentally friendly practices in the school food context. These two studies
provided an understanding of the context in which children's actual lunchbox contents can be understood.

The next step in this program of research was to capture the contents of lunchboxes that children bring from home (Study 3). In order to do this, a lunchbox audit methodology was developed, which is presented in Chapter 5. Chapter 6 then describes the quantitative audit of lunchboxes that captured contents of food, packaging, and waste prevalence (using the methodology outlined in Chapter 5).

While quantitative characteristics of lunchbox contents provided a snapshot of current dietary trends among children during school hours (as discussed in Chapter 6), it was important to round out the research by examining how children and their parents navigate food decisions in the context of their lived social, economic, and psychological realities at home, where lunchboxes are packed for school. Therefore, Study 4 (Chapter 7) aimed to investigate perspectives of parents and children about drivers and barriers to children consuming a nutritious and low-waste school lunchbox, as well as the packing behaviours involved.

Finally, Chapter 8 synthesises the findings from all the research studies included in the thesis, and presents recommendations for public health policy and practice, as well as suggestions for future research.


Figure 1.2 Pictographical demonstration of the outline of this PhD research program

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### 2.1 Preface

This chapter describes an overview of the methodological approach drawn on in the whole program of this PhD to investigate the research questions outlined in Chapter 1. Detailed descriptions of the methods and analytic approach for each of the individual studies conducted are in their respective chapters. Thus, to minimise repetition, this chapter will more broadly introduce the mixed methods research design of this program of work. It will also discuss how the methods of the various studies fit together, the study setting and study population, theoretical frameworks and underpinnings used, my reflexivity and positionality statement as a researcher, and approval processes involved to conduct this research.

### 2.2 Research design

As discussed in Chapter 1, previous literature has typically been limited to examining lunchbox contents' nutritional status and alignment with dietary guidelines, rather than considering children's actual food intake and converging that with waste outcomes at the same time. Since a dual lens in the context of school lunchbox assessments intertwining food and environmental agendas is an untapped avenue, the program of work presented in this thesis aimed to fill these gaps with a mixed methods exploratory design using qualitative and quantitative methods. In order to address the overarching aims, four studies were conducted.

Study 1 was a scoping review of the literature to discover what had been published previously in this area of interest. Study 2 was a qualitative content analysis of school policies and programs to capture the presence or absence of both nutrition and sustainability considerations at the school level. School websites were a focus for this study, as they serve as one of the key platforms to communicate information to existing and prospective parents ( $\mathrm{Gu}, 2017$ ). Study 3 was a quantitative audit of lunchboxes that aimed to understand preschoolers' and primary schoolers' food and beverage consumption patterns, and the
prevalence of packaging and waste in children's lunchboxes associated with the individual food types. Because no previous method existed to assess lunchbox contents for food, waste, and packaging collectively, a unique instrument was developed to enable this assessment, and is therefore presented as Chapter 5, separate to the outcomes of the study (presented in Chapter 6). Study 4 was a qualitative study exploring familial perspectives. Interviews with families (parent-child dyads) were thematically analysed to assess their perspectives of packing a low-waste and nutritious lunchbox, and what structural factors support or hinder them to satisfy both agendas.

The four sequential studies of varying methodological approaches captured various aspects related to lunchbox contents; from current literature about this topic, and present school level policies and programs focussed on healthy eating and environmental practices, to capturing actual lunchbox contents on a standard school day, and finally understanding familial contexts and experiences. As a whole, the studies stitched together in this thesis have created an evidence base that is well-rounded and diverse, yet strongly interwoven and scaffolded to support each other.

### 2.3 Study setting and population

This program of research was conducted in metropolitan Adelaide, South Australia, where the school food model is reliant on home-packed lunchboxes. Across the studies, the inclusion of school type varied as outlined below; but in particular the rationale for predominantly including government schools was because it is considered mandatory for Australian government schools to adhere to the Right Bite strategy-South Australia's local dietary guideline (SA Health, 2008). In contrast, adherence is encouraged but voluntary for private schools including Catholic and Independent. In Australia, preschool is also called kindergarten.

- Study 2 (Chapter 3): Government preschools (children's age ranged between 3-5) and primary schools (children's age ranged between 6-13)
- Study 3 (Chapter 4 and 5): Government preschools (children's age ranged between 35) and primary schools (children's age ranged between 6-13)
- Study 4: Government and Private (Independent and Catholic) primary schools (children's age ranged between 6-13)

Government schools located in a range of socioeconomic strata were part of the lunchbox audit study, as determined using Socio-Economic Indexes for Areas (SEIFA) data based on the ABS ranking of areas according to the relative socio-economic advantage and disadvantage (ABS, 2018). For Study 4, primary school children and their parents, regardless of school type and socioeconomic position, were invited to participate in an interview. Note that, at the time of writing, primary school included Reception to Year 6 (ages approximately 5-12). However, prior to 2022, Year 7 was part of primary schooling in South Australia.

### 2.4 Theoretical foundations and researcher positionality

In this section, I provide some background to the theoretical frameworks and research perspectives implemented across the studies presented in this thesis. In particular, concepts from the Ottawa Charter for Health Promotion and the socio-ecological model were central in shaping the research, as was a critical realist perspective. I also provide my positionality statement as a researcher.

### 2.4.1 Health promotion frameworks

This research program was informed by models and theories of health promotion, such as the Ottawa Charter (WHO, 1986), which recognises the importance of creating healthsupporting environments, policies that promote health, and equipping individuals with the
knowledge, skills, and resources to maximise community health and wellbeing. In the thesis presented here, understanding the policies and programs (or lack thereof) that shape the school food and waste environment was the focus of Study 2 (Chapter 4). These were also of interest in Study 4 (Chapter 7). The holistic characteristics of the Ottawa Charter involving not just individuals but also communities, governments, and health care providers is worth highlighting.

Inspired by the Ottawa Charter, the WHO's Health Promoting Schools framework (WHO, 1997) to prevent obesity among school children was also considered a promising approach to promoting healthy behaviours. Using a whole-school approach, involving all stakeholders including students, parents, teachers, and the wider community, and integrating health education into the curriculum were essential components of the Health Promoting Schools framework. Besides just health education, the framework encourages the creation of school environments that promote health behaviours (Jones et al., 1998). It is worth noting that its effectiveness and success are contingent upon its implementation and adaptation to the local context, adequate funding, and adequate training and support for teachers (Langford et al., 2015).

### 2.4.2 Socio-ecological model

Along with the underpinnings of the Ottawa Charter and the Health Promoting Schools framework, the socio-ecological model is central in conceptualising the overall research design of this program. The socio-ecological model, according to Bronfenbrenner (1979), is an interplay between several systems that drive health behaviours namely microsystems (immediate factors/environment impacting the individual), mesosystems (interaction/link between microsystems), exosystems (non-immediate factors/environment involved that still impacts the individual), and macrosystems (larger societal structures and
values including cultural, social, political, and regulatory norms). The application of a socioecological model to promote healthy eating in schools using a multilevel approach has been studied by Townsend and Foster (2013), who suggested that interventions targeting multiple levels of the socio-ecological model are necessary for effective promotion of healthy eating behaviours in schools.

To understand lunchbox food packing and consumption patterns, and to potentially influence health and sustainability behavioural changes, consideration of wider systems rather than solely mobilising individual-level determinants is an important theoretical facet to consider. The socio-ecological model in the context of this research program considers various factors that influence children's food choices, including individual factors such as knowledge and attitudes, social factors such as peer influence and family dynamics, and environmental factors such as school food policies/systems and availability of healthy foods. These factors are considered across the various studies presented in this thesis.

### 2.4.3 Critical realism

Critical realism understands social phenomena as constituted by and consisting of layers of reality that are stratified into domains of the real, the actual, and the empirical (Bhaskar, 1998). From this understanding, causality must be explored beyond the observable and empirical layers of reality to build an understanding of the underlying complexities and mechanisms that contribute to them (Danermark et al., 2005). As an ontology, critical realism is a reality that exists independent of people's ideas about and descriptions of it (McEvoy \& Richards, 2003). As an epistemology, critical realism acknowledges the role of subjective knowledge of social actors in a given situation as well as the existence of independent social structures that shape and constrain those actions (Wynn \& Williams, 2012). A mixed methods research design is highly valuable when applying a critical realism lens to understand reality
and its complexities (Sobh \& Perry, 2006). As a result, the meta-theoretical perspective of critical realism informed the whole body of this research interlaced with the health promotion frameworks and the socio-ecological model. This approach enabled critique of assumptions and normalised behaviours around children's food and waste behaviours at multiple levels of influence (i.e., policy, schools, families) using a combination of qualitative and quantitative research methods.

### 2.4.4 Positionality statement

As a researcher, I am aware that I am part of the world I want to understand and cannot stand outside of the human and social reality I am observing through my research. Being conscious of the fact that packed lunches (and also school-provided meals) have been the object of societal 'scrutiny', I maintained an explicitly exploratory stance for data collection and analysis to draw parallels between health and environment. Thus, while taking lunchbox photos at school, I shared no expectations of what a lunchbox should look like. During the interviews with families, I ensured I did not imply anything about 'the perfect lunchbox'. It was important to be sensitive to the potential implications of 'moralising' or 'policing' lunchbox contents with associations around the nutritional value of certain food items and food practices. Parents are trying their best, while also being shaped by different socio-economic statuses and contextual circumstances which influence their ability to pack (or not pack) certain foods. From a socio-ecological lens, I was also cognisant of the limited personal influence most individuals have over external structural contexts outside of their control, particularly the current mechanisms of global food production and the availability of food in retail environments, which predominantly operate outside of an individual's sphere of influence.

Reflexivity was integrated throughout the research program to ensure that I remained aware of how my background and interest in nutrition and health might shape my interpretation and elicitation of findings. I was mindful that my exploration of policies and programs, lunchbox contents, and familial practices should not involve judging the policies and practices using a nutritional lens, but focussed on conducting research that is explorative (what is out there?), descriptive (what is it that is being found?), and interpretive (what does it possibly tell us about the aspect being studied?), seeing foods as whole, packaged or not, and consumed or not. I was also cognisant of the challenges faced by schools in promoting healthy eating, including children and parental preferences that supersede most dietary guidelines, and the heavy influence of the ultra-processed food industry on personal food consumption behaviours.

### 2.5 Industry partner involvement

KESAB (Keep South Australia Beautiful) environmental solutions, a non-government organisation was an industry partner for this research program. Their pre-existing relationships with schools owing to their routine bin audits at various South Australian preschools and primary schools was the linking factor for collaboration with my PhD program. KESAB's focus has been to 'create sustainable communities', and their initiatives centre around emerging environmental issues of waste reduction, community capacity building and training, resource recovery and reuse, rolling out school level environmental sustainability education, and providing environmental solutions while driving community action and participation. Personal correspondence with the Industry Partner representative suggested that KESAB's reach extends to approximately $85 \%$ of schools in South Australia through the programs they offer and deliver, which include incursions, school-based educational activities, and newsletters. KESAB also partners with a number of local councils
throughout South Australia to develop and deliver waste and recycling education programs and resources for schools, and they organise waste tours and workshops at waste management centres and recycling facilities for educators. Their educational resources on local kerbside bin collection systems and experienced education officer provided me with insights on the segregation of food and beverage packaging into the local bin classification systems (red or blue for landfill, yellow for recycling, and green for organics/composting). This was key for the development of the lunchbox coding instrument described in Chapter 5. Moreover, given KESAB's delivery of the 'Wipe Out Waste' program (https://www.wow.sa.gov.au/) funded by Green Industries SA at schools-a whole-school community approach to waste management and learning to encourage schools to reduce waste to landfill-their pre-existing connections with schools through this program facilitated my site visits for the lunchbox audit data collection (Study 3).

### 2.6 Impacts on the research program

Two of four studies of this PhD program experienced effects of COVID-19, as the studies involved accessing preschools and primary schools in South Australia for lunchbox contents data collection (Study 3) and engaging with various school level stakeholders for inperson interviews and focus groups (Study 4). At the onset of the pandemic in March 2020, as well as having to set up for working at home due to statewide lockdown measures, and experiencing inevitable stress and worry associated with the virus, I had to engage with my supervisory panel and stakeholders (KESAB environmental solutions and Department for Education, South Australia) to redesign the PhD program timelines and the various projects that were pre-planned. Given the uncertainty about when and whether I would be able to conduct Study 3 (originally planned for 2020), I had to design and commence work on a different study which took the form of school websites content analysis (Study 2). It was only
in 2021 when a window for a scattered data collection in schools opened, lasting for seven months between March and September. This was also interrupted by a local fruit fly outbreak (https://fruitfly.sa.gov.au/). Fruit fly is a biosecurity threat in Australia and restrictions were put in place that prevented movement of many fruits and vegetables, including from homes to schools in some instances.

While planning the final study of this research program, there were still ongoing COVID-19 related restrictions. Nevertheless, an ethics application was prepared in November 2021, in anticipation of restrictions to ease which would allow me to conduct interviews and focus groups with various school level stakeholders on site. The University ethics approval came through in January 2022 with a recommendation to consider online means of data collection for Study 4. This meant that a change in the data collection method for Study 4 was instigated, due to the barriers and uncertainty imposed by the pandemic, since lifting of restrictions was intertwined with limits imposed on visitors at school sites during Term 1 of 2022. As a result, the original ethics application submitted to the University Human Research Ethics Committee and a separate approval request submitted to the Department for Education, were both retracted.

After reconsidering, the aim of this research program and planning alternate study options, it was decided that instead of visiting school sites to interview multiple school-based stakeholders in person, this program of work would be rounded by interviewing families that pack the lunchboxes at home, and this would take place online via Microsoft Teams. Consequently, a whole new ethics application was submitted accommodating the new protocol in June 2022, and approval was received for commencement of interviews in August 2022. Between this period of unpredictability and research re-design, also while waiting for ethics approval and coding lunchbox photos collected from Study 3, I decided to work on scoping the literature systematically between October 2021 and May 2022, in preparation for
the thesis (which took the form of Study 1). This study was undertaken to further my understanding of the current literature relevant to the topic of interest of this PhD research. Overall, these strings of events caused notable restructuring of the research program, and the inadvertent increased workload that the supervision panel had to experience associated with the effects of COVID-19 compounded delays in this program of work. However, productive outputs were yielded when fieldwork and data collection were halted.

### 2.7 Ethics and project approval

Two of four studies for this PhD research program required ethics committee approval. The approvals and corresponding recruitment materials are outlined below.

Study 3: The Human Research Ethics Committee at the University of Adelaide granted approval to conduct the lunchbox audit study (Approval number H-2020-167). The first approval letter can be found in Appendix B.1, which approved the parental opt-out arrangement.

However, at the pilot stage of Study 3, a preschool indicated its preference for obtaining individual consent from parents instead of implementing the opt-out method. Therefore, an amendment request was made to accommodate the addition of a consent approach for that preschool (and any other schools anticipated in the future of the data collection phase-but there were none). The approval of this amendment can be found in Appendix B.2.

A third amendment was put in place to ask for independent data collection, instead of the originally planned fully conjoined data collection with KESAB environmental solutions as part of their routine bin audit schedules at schools. This need for independent data collection was due to KESAB's exclusion of schools in fruit fly outbreak areas in their bin audit
schedule, as all the leftover food on school grounds was requested by the Department of Primary Industries and Regions (PIRSA) to go to landfill (instead of the regular organics composting). Requesting independent data collection ensured the desired sample size was attained, and avoided further delays in the project's progress. The third and final approval for this amendment request can be found in Appendix B.3.

The Department for Education, South Australia also granted approval to conduct this research project and access Department for Education sites (Reference No: 2020-0036) [Appendix B. 4 and B.5].

The recruitment materials for Study 3 included:

- project information flyers (Appendix B. 6 and B.7)
- project information sheets and consent forms for preschools (Appendix B. 8 and B.9)
- project information sheets and consent forms for primary schools (Appendix B. 10 and B.11)
- participant information sheets for parents based on active consent (Appendix B.12)
- consent form for participating parents (Appendix B.13)
- participant information sheets for parents based on opt-out (Appendix B.14)
- opt-out forms for preschool parents (Appendix B.15)
- opt-out forms for primary school parents (Appendix B.16)

Study 4: The Human Research Ethics Committee at the University of Adelaide granted approval to conduct the lunchbox interview study (Approval number H-2022-127) [Appendix C.2].

The recruitment materials for Study 4 included:

- project flyer for children (Appendix C.3)
- project flyer for parents (Appendix C.4)
- participant information sheet for parents and consent form (Appendix C. 5 and C.6)
- third-party consent form for participating children (Appendix C.7)

At the conclusion of this research program, all schools that participated in Study 3 will be provided with an overall summary of results for the lunchbox audit study. This information will be provided in lay terms for inclusion in the school newsletter if the school prefers to disseminate to the school community. Additionally, schools will also be sent the published manuscript. Parents who participated in the interview as part of Study 4 will be sent the manuscript when published.

### 2.8 Chapter summary

This chapter has provided an overview of the research design and methodology. It also described the theoretical perspectives drawn on, the ethical approaches employed, and delays encountered during the program. The following four chapters will present the five research manuscripts that resulted from the four studies conducted, describing the methods and study design in further detail, along with the study results. Finally, Chapter 8 will synthesise all the results of the four studies and explain the policy and practical implications of this research program broadly, as well as directions for future research.

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## CHAPTER 3: SCOPING REVIEW OF THE LITERATURE

## STUDY 1

School lunchboxes as an opportunity for health and environmental considerations:
a scoping review

### 3.1 Preface

This scoping review synthesises the findings of existing research within the literature relevant to considerations of health and environment in the context of school lunchboxes. This is an important component of the thesis as it contributes to the evidence base regarding the ways in which health and environment has already been considered together, particularly in the context of school lunchboxes, which is the primary focus of this research program. This review explored a novel research question and demonstrated the very limited research in this area, thus establishing the context for the subsequent chapters. It also confirmed the lack of analysis of packaging waste in school lunchbox research, which constitutes the primary focus of this PhD research.

### 3.2 Highlights

- There has been very little research on the topic of children's school lunchboxes, particularly considering the connection between the nutritional quality and sustainability characteristics of school lunchboxes.
- Ten studies were included in the review, with articles from Australia, USA, Spain, New Zealand, and the UK. Half of these studies were intervention-based, aiming to educate teachers, parents, and children on reducing packaged food choices and food waste, as well as improving dietary habits.
- There is scope for furthering the combination of nutrition and sustainability concepts as part of school education.
- The involvement of various stakeholders including school staff, parents, and children, as well as reforming current school level practices and policies, is key to potentially mobilising the health and environmental agendas in the school food context.
- There is merit in harnessing children's agency when promoting eco-friendly and health interventions, and they can be further supported through pragmatic strategies that enhance their understanding food, nutrition, and health.
- Finally, the interconnectedness of nutrition and sustainability in the context of school lunchboxes is an understudied phenomenon, but one with promising potential to promote and improve public health and planetary wellbeing.

Note: Appendix 1 and 2 in the published manuscript correspond to Appendix A. 1 and A. 2 respectively within this thesis.

### 3.3 Statement of authorship

| Title of Paper | School lunchboxes as an opportunity for health and <br> environmental considerations: a scoping review |
| :--- | :--- |
| Publication Status | Published |
| Publication Details | Neha Kishan Lalchandani, Brianna Poirier, Shona Crabb, <br> Caroline Miller, Clare Hume, School lunchboxes as an <br> opportunity for health and environmental considerations: a <br> scoping review, Health Promotion International, Volume <br> 38, Issue 1, February 2023, daac201, <br> https://doi.org/10.1093/heapro/daac201 |

## Principal Author

| Name of Principal Author (Candidate) | Neha Kishan Lalchandani |  |
| :---: | :---: | :---: |
| Contribution to the Paper | Conception and design of the study <br> Conceptualisation of research questions <br> Search strategy development <br> Databases search and import of results <br> Data analysis <br> Data interpretation <br> Manuscript writing <br> Editing and revisions <br> Corresponding author for publication process |  |
| Overall percentage (\%) | 70\% |  |
| Certification: | This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper. |  |
| Signature | Date | 10 February 2023 |

## Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:
i. the candidate's stated contribution to the publication is accurate (as detailed above);
ii. permission is granted for the candidate in include the publication in the thesis; and
iii. the sum of all co-author contributions is equal to $100 \%$ less the candidate's stated contribution.

| Name of Co-Author | Brianna Poirier |  |  |  |
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| :--- | :--- | :--- | :--- |
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# School lunchboxes as an opportunity for health and environmental considerations: a scoping review 

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#### Abstract

Summary Very little research has focussed on children's school lunchboxes from both a health and environment standpoint. This scoping review explores studies that considered children's lunchbox food consumption trends at school and the environmental impacts of lunchbox contents. We conducted a scoping review of peer-reviewed literature with a focus on lunchboxes of children in preschool or primary school settings that contained food packed from home, through the lens of food and nutrition in combination with environmental outcomes-particularly food and/or packaging waste. The review included 10 studies, with articles from Australia, USA, Spain, New Zealand and the UK. Half of them were intervention studies aiming to shift knowledge levels and attitudes of teachers, parents and children with regard to reducing packaged food choices and food waste, and improving dietary habits. Acknowledging the complexity of lunchbox packing and consumption practices, this review recommends the consideration of socio-ecological influences on children's health and sustainability behaviour, and mobilizing their pro-environmental agency.


## Lay summary

School food environments play a key role in children's health and behaviour development. However, there are environmental implications of school food and this is not often considered in conjunction with schoolchildren's health based on their food consumption patterns. While wider environmental impacts of school food provision models have been studied, the more immediate and child-relevant outcomes (such as food and packaging waste) are also worth considering, especially in the context of school lunchboxes. This scoping review explored the existing literature for studies that focussed on school children's lunchbox contents and considered health attributes along with packaging and waste characteristics. Results from this review of 10 articles, which also describes the five interventions identified, pointed towards the merit of tapping into children's agency of change while also recognizing socio-ecological influences to drive sustainability practices for health co-benefits. The interconnectedness of nutritional quality and sustainability characteristics of school lunchboxes is an understudied phenomenon, but one with promising potential to promote and improve public health and planetary wellbeing.
Keywords: scoping review, school lunchboxes, child, nutrition, environment

## INTRODUCTION

School food environments are critical to influencing children's eating behaviours and childhood obesity (Driessen et al., 2014; Welker et al., 2016; Micha et al., 2018). School food models vary globally, from school
meal provision and canteen purchases to lunches packed from home. The latter model is common in Australia, where the current research was conducted, and is often compared with other approaches in the literature (Johnston et al., 2012; Taylor et al., 2019;

[^0]Taher et al., 2020). The literature is saturated with studies focussed on energy density measurements and nutritional quality assessments of children's lunchboxes (Bell and Swinburn, 2004; Sanigorski et al., 2005; Brennan et al., 2010; Evans et al., 2010; Sutherland et al., 2020). These studies describe the commonality of energy-dense home-packed lunches containing foods high in fat, sodium and sugar, and low in fibre. The lack of fruits and vegetables in lunchboxes (Brennan et al., 2010; Johnston et al., 2012; Taylor et al., 2019) and higher prevalence of discretionary foods and beverages (Bell and Swinburn, 2004; Sanigorski et al., 2005; Sutherland et al., 2020) is cause for concern from a health perspective. As a result, many interventions focus on increasing children's consumptions of fruit and vegetables in preschools (Hodder et al., 2017) and primary schools (Evans et al., 2012), while simultaneously reducing intake of discretionary foods and sugar-sweetened beverages (SSBs) (Nathan et al., 2019). Outcomes of school-based policies (Micha et al., 2018) and interventions (Nathan et al., 2019) to date have had mixed results, with mostly small to moderate effects lasting short term, with no significant impact on calorie intake or adiposity.

The importance of nutrition and nourishment for children's health, academic performance, in-class focus and attentiveness (Taras, 2005; Burrows et al., 2017), in combination with unsuccessful attempts to modify child eating behaviours, calls for innovative school-based strategies. One approach worthy of consideration is the marriage of environmental considerations with dietary behaviours to improve children's health and environmental consciousness (Skouteris et al., 2013; Friel et al., 2014). Broader environmental impacts of school meals such as greenhouse gas emissions (GHGE) have been considered in the USA and some European countries (De Laurentiis et al., 2017; Eustachio Colombo et al., 2020; Poole et al., 2020; Rossi et al., 2021). Numerous studies have focussed on food or plate waste in school meal provision models to improve dietary intake and reduce food waste (Byker Shanks et al., 2017; Metcalfe et al., 2020; Kaur et al., 2021). While environmental implications of ultra-processed foods are gaining prominence (Seferidi et al., 2020), the child-proximal and potentially child-relevant outcomes of food waste and packaging waste from home-packed school lunches are yet to be investigated.

A recent review by O'Rourke et al. (O'Rourke et al., 2020), which focussed on parental perceptions, experiences and habits with respect to home-packed school lunches, concluded that decisions influencing lunchbox packing behaviours are complex. Familial contexts and parental influence shape children's dietary behaviours based on cultural, social and emotional norms (Savage et al., 2007; Yee et al., 2017), rather than the nutritional
quality of food alone. Household income also influences access to high-quality healthy and unprocessed foods (French et al., 2019). However, the presence of industrial or ultra-processed foods is becoming increasingly common in children's lunchboxes as per recent reports (Nunes et al., 2019; Barbosa et al., 2021), regardless of socio-economic status.

Evidence has highlighted the importance of promoting behaviour change in children and adolescents, as habits developed in childhood are more likely to be sustained through adulthood (Kelder et al., 1994; Lytle et al., 2000). Hence, an environmental agenda could also be employed as an enabler of health and pro-environmental behaviours when parents or children themselves are packing school lunchboxes. The quality of lunchbox foods along with the packaging and waste outcomes is worth exploring in synergy as part of an interdisciplinary approach, as currently there are no explicit policies and programmes in school settings encompassing both aspects, despite plenty of latent activities existing already (Lalchandani et al., 2022). Therefore, this scoping review aimed to explore studies that considered both food present in children's lunchboxes and the environmental impacts of lunchbox food contents. It focussed on children's lunchboxes in preschool and primary school settings.

## METHODS

Systematic reviews are considered the highest level of evidence and often inform policy and practice (Munn et al., 2018b). Scoping reviews, a sub-set of systematic reviews, are useful when determining the coverage of existing literature on a topic, particularly for emerging fields of inquiry (Arksey and O'Malley, 2005; Levac et al., 2010; Munn et al., 2018a). This scoping review was conducted to identify key characteristics of research that considers both children's food consumption patterns and the environmental impacts of lunchbox foods. Considering these topics together is a new area of research, and hence we found conducting a scoping review useful to explore studies that encapsulate this overlap.

An initial search of PubMed, PROSPERO and the Joanna Briggs Systematic Reviews registry revealed no similar studies currently underway. In accordance with scoping review methodology (Peters et al., 2020), the protocol was published with the Centre for Open Science (Foster and Deardorff, 2017) (https://osf.io) prior to the commencement of the systematic search (Lalchandani, 2022). This review was conducted and is reported in alignment with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) scoping review extension guidelines (Appendix 1).

## Information sources

Five databases were searched in October 2021 using index terms and keywords related to 'children', 'preschool or primary/elementary school', 'lunchbox', 'food choice' and 'environment' and 'sustainability'. The search string was initially developed for PubMed and then adapted for each of EMBASE, SCOPUS, Web of Science and PsycINFO (Appendix 2). Literature published from database inception until October 2021 was considered for inclusion in this review. The search was not restricted by language or geographic location. After performing the search, all identified citations were collated and uploaded into Covidence (Veritas Health Innovation, Melbourne, Australia) and duplicates removed.

## Eligibility criteria and selection of sources

Two independent reviewers (N.K.L. and B.P.) conducted title and abstract screening, with articles considered potentially relevant by either reviewer advancing to full text review. Following full text retrieval, articles were independently screened by the reviewers against the predefined inclusion criteria:

- Children in preschool or primary school settings
- Food brought from home (alias packed lunches)
- Consideration of lunchbox nutrition or healthy eating in combination with environmental outcomes, food or packaging waste

The review team defined packed lunches as a lunch i.e. packed at home, either by parents or children themselves, and brought to school by the child to be consumed during snack or lunch break times. It is important to note that no federal regulations exist that instruct parents what can or cannot be packed, but there may be school-level policies that provide standards for packed lunches based on broader dietary guidelines available locally in their respective jurisdictions (Lucas et al., 2017; Spence et al., 2020).

Studies related to school meal provisions or canteen programmes were excluded. Any disagreements that arose during the screening processes were resolved through discussion or by a third reviewer (C.H.). The reference lists of all included studies were hand searched to identify any other relevant articles not captured by the systematic search.

## Data extraction and synthesis

Data were extracted into a piloted extraction form in Covidence by two reviewers (N.K.L. and B.P.). To ensure inter-reviewer reliability, extraction of three articles was performed by both reviewers. The data
extracted included details about the study location, school type, study design, study aim, study methods, participants' description, sample size, theoretical framework, definition of healthy food/healthy eating/ healthy choices, definition of environmentally friendly/ eco-friendly/sustainability, aspects of consideration (nutrition, food waste, packaging waste, broader environmental impacts), description of intervention (where applicable) and the main findings of the study. Extracted data were tabulated, categorically synthesized and narratively described. Interactions between child, parent and teacher stakeholders were synthesized considering the involvement of targeted populations in each study, along with study interventions and considerations discussed.

## RESULTS

The systematic search identified 7456 studies, of which 2187 were duplicates, leaving 5269 unique records. During title and abstract screening, a further 5255 studies were excluded as they did not meet inclusion criteria, and the full text of 14 studies were then screened against inclusion and exclusion criteria. Seven studies satisfied the inclusion criteria and a further three studies were identified through reference searching; therefore, a total of 10 studies were included in this systematic scoping review (Figure 1).

Seven of the included studies took place in primary schools (Dresler-Hawke et al., 2009; Goldberg et al., 2015; Wickramasinghe et al., 2016; Folta et al., 2018; Boulet et al., 2019; Antón-Peset et al., 2021; Karpouzis et al., 2021) and three of the studies were in preschools or early childhood centres (Edwards et al., 2013; Boyd, 2015; Morris et al., 2018). Authors of included studies utilized a range of methods to achieve their aims including direct observation for quantification of food waste or food packaging (Dresler-Hawke et al., 2009; Goldberg et al., 2015; Antón-Peset et al., 2021), questionnaires (Morris et al., 2018; Boulet et al., 2019; Antón-Peset et al., 2021; Karpouzis et al., 2021), interviews (Boyd, 2015) and focus groups (Edwards et al., 2013; Folta et al., 2018; Morris et al., 2018). Some of the included studies utilized a theoretical framework, including the socio-ecological model (Edwards et al., 2013; Boyd, 2015), social cognitive theory (Goldberg et al., 2015; Wickramasinghe et al., 2016), the theory of reasoned action (Karpouzis et al., 2021) and funds of knowledge (Morris et al., 2018); others considered various approaches including behavioural (Boulet et al., 2019) and social marketing practices (Folta et al., 2018). Study characteristics based on extrapolation of data has been tabulated in Table 1 which also includes aims and main findings.

## Identification of studies via databases and registers



Fig. 1: PRISMA diagram of the literature search process and article yield (Page et al., 2021).

Synthesis of evidence
This scoping review mapped literature in the area of the environmental impacts of school lunchbox food, particularly the more immediate food and packaging
waste attributes. The synthesis of evidence is described below, relating to the definitions used in the included studies, as well as the stakeholder interactions and outcomes of both intervention and observational studies.

Table 1: Summary of identified studies focussing on health and environment aspects of school lunchboxes

| First author name, year published, country (reference) | Study aim | Study design; methodology/ intervention measures | Intervention design; duration | Participants | Main outcomes |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Dresler-Hawke, 2009, New Zealand (DreslerHawke et al., 2009) | To represent a snapshot of children's food consumption behaviour at lowand high-socioeconomic schools | Cross-sectional; direct observation that examined nutritional quality and food waste of lunchboxes | n/a | Primary school children aged 5-11 (lunchboxes $n=927$ ) | Over $80 \%$ of unconsumed food items were sandwiches, fruit and dairy, compared with $20 \%$ that were energy-dense nutrientpoor snacks 'junk food' |
| Edwards, 2013, Australia (Edwards et al., 2013) | To develop a brief educational statement to support teachers in thinking about the relationship between children's play, and curriculum with healthy eating, digital media/ technology use and sustainability | Formative research; focus groups with children and parents to provide insights for subsequent teacher discussions | $\mathrm{n} / \mathrm{a}$ | 16 preschool children aged 4-5, 18 preparatory children aged 5-6, 34 mothers, and 6 preschool and primary school teachers | Influence of digital media and popular characters on children's food preferences, the nutritional value of packaged food items and the sustainability issues associated with excess packaging of branded foods |
| Boyd, 2015, Australia (Boyd, 2015) | To investigate how educators implement healthy eating policies while promoting sustainable practices | Exploratory; qualitative interviews one-onone with parents and teachers, and in small groups of three to four children | n/a | 5 early childhood directors and 7 educators, 7 parents and 20 children | Contrasting perspectives of educators, parents and children is a barrier to healthy food choices and sustainable practices; a holistic approach is needed beyond the EC setting, improved educators' knowledge and pedagogical practices, and empowerment of children to enact agency to be environmentally responsible |
| Goldberg, 2015, USA (Goldberg et al., 2015) | To evaluate a communications campaign to motivate children to bring more fruits and vegetables and fewer SSBs to school | Cluster-randomized trial; direct observation that examined food and packaging | Multi-component, school-based intervention through classroom curriculum with variety of supplementary activities and parent communications; 7 months | 582 primary school children in grades 3-4, mean age 9.1 years | Campaign was well received but no significant changes were observed in the quality of food brought to school and packaging type |
| Wickramasinghe, 2016, UK (Wickramasinghe et al., 2016) | To quantify the nutritional quality and carbon footprint of school lunches and packed lunches | Retrospective cohort; quantification of GHGE of selfreported student lunchbox contents | n/a | Primary school children (lunchboxes $n=$ 3488) | The mean GHGE of healthy packed lunches ( $0.39 \mathrm{kgCO}_{2}$ e) was lower than the mean GHGE of unhealthy packed lunches ( 0.72 $\mathrm{kgCO}_{2} \mathrm{e}$ ) |

Table 1. Continued

| First author name, year published, country (reference) | Study aim | Study design; methodology/ intervention measures | Intervention design; duration | Participants | Main outcomes |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Folta, 2018, USA (Folta et al., 2018) | To develop a branding strategy to improve the quality of foods children bring from home to school, using a combined healthy eating and ecofriendly approach | Formative research; focus groups with parents and children | Two-phase branding strategy including development and testing of branding concepts; 4 months | 73 primary school children in grades 3-4 and 17 parents | Environmental benefits of food choices were appealing for both parents and children, and they were receptive to the nutrition-eco concept through a brand that was simple, engaging, catered to various food preferences, and involved an element of mystery |
| Morris, 2018, Australia (Morris et al., 2018) | To investigate the effect of teacher-designed play-based learning on children's knowledge about wellbeing and sustainability | Randomized trial; questionnaires about eating and physical activity and qualitative analyses of visual art diaries and focus groups with children | Two professional learning sessions held with intervention group teachers, one session held with waitlist control teachers, supported with learning materials (Pedagogical Communication Strategy) and orientated to the concept of funds of knowledge to implement play-based learning experiences for preschool children; 8 weeks | 25 early childhood teachers, 300 child-parent dyads | No increased knowledge connections immediately after intervention; but knowledge was sustained 3 months post intervention Intervention group ate more healthy foods and less packaged foods |
| Boulet, 2019, Australia (Boulet et al., 2019) | To identify and prioritize food waste reduction behaviours | Exploratory case study; questionnaires for parents and children targeting behaviours related to food waste | $\mathrm{n} / \mathrm{a}$ | 110 primary school children aged 9-12 years and their parents (Note: high school children and parents not included in this review analysis) | Parents involved children in choosing, making and packing lunchbox food only sometimes or never; students only sometimes brought leftover food back home |
| Antón-Peset, 2021, Spain (Antón-Peset et al., 2021) | To analyse whether a didactic intervention changes the level of knowledge and attitude towards food waste, and ultimately decreases quantity of food waste during midmorning breaks (from home) and canteen lunches (not considered in this review context) | Single-case (embedded) design; questionnaires to analyse teacher and student knowledge, teaching and participatory activities and direct observation of food waste | Didactic intervention involving teaching sessions and activities, through active and participatory methodologies, and peer-based dissemination of information through posters to increase awareness and recognition of their role and responsibility as citizens; 3 months | One primary school teacher and 25 primary school children in grade 4 aged 9-10 years | Subtle changes in the level of knowledge and attitude towards food waste; decrease of almost half of the average weight ( kg ) of food waste per day in the rest of the primary school students' cohort |

Table 1. Continued

| First author name, year published, country (reference) | Study aim | Study design; methodology/ intervention measures | Intervention design; duration | Participants | Main outcomes |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Karpouzis, 2021, Australia <br> (Karpouzis et al., 2021) | To report the protocol for impact and process evaluation of a school-based FEAST programme | Parallel, cluster non-randomized controlled trial; curriculum delivery, online questionnaire with quantitative and qualitative components for school administrators | FEAST-ecological intervention through curriculum-aligned classroom education and cooking activities facilitated by teachers, parents, community volunteers; 10 weeks | 20 primary schools (10 intervention vs. 10 wait-listcontrol); children in grades 5-6 aged $10-12$ years | Results from this trial will provide valuable information on the value of adding environmental sustainability strategies to nutrition education in schools |

## Definitions

Three varying definitions relating to content of lunchboxes were used across the included studies: (i) Natural/whole/unprocessed vs. packaged/junk/ processed foods (Boyd, 2015; Goldberg et al., 2015; Folta et al., 2018; Morris et al., 2018; Karpouzis et al., 2021); (ii) Food choices that follow advice based on guidelines and policies (Dresler-Hawke et al., 2009; Boyd, 2015); (iii) Nutrient-rich vs. nutrient-poor quality of lunchbox foods (mainly saturated fats, salt and sugar) (Dresler-Hawke et al., 2009; Edwards et al., 2013; Goldberg et al., 2015; Wickramasinghe et al., 2016; Folta et al., 2018). Two studies (Boulet et al., 2019; Antón-Peset et al., 2021) had neither an explicit definition or an indirect reference to one for healthy foods or healthy eating as they were food waste focussed. As a result of definitions employed, comparisons were often made between whole foods such as fruits, vegetables, whole grains, water and junk foods such as discretionary snacks, SSBs, confectionery and desserts. Similarly, included studies defined environmental or sustainable aspects based on three characteristics: (i) Reducing or avoiding food waste (Boulet et al., 2019; Antón-Peset et al., 2021; Karpouzis et al., 2021); (ii) Environmental impacts of excess packaging and highly processed foods (Edwards et al., 2013; Boyd, 2015; Goldberg et al., 2015; Folta et al., 2018; Morris et al., 2018); (iii) Greenhouse gas emissions (Wickramasinghe et al., 2016). One study did not have a definition (or indirect reference to one) for environmental or sustainable considerations even though it was food waste focussed (Dresler-Hawke et al., 2009).

## Intervention studies: stakeholder interactions

Five of the included studies described interventions (Goldberg et al., 2015; Folta et al., 2018; Morris et al., 2018; Antón-Peset et al., 2021; Karpouzis et al.,
2021), which largely focussed on increasing healthy food consumption while decreasing packaged foods (Goldberg et al., 2015; Folta et al., 2018; Morris et al., 2018), as well as food waste awareness (Karpouzis et al., 2021) and reduction (Antón-Peset et al., 2021). The nature of the interventions varied across three primary stakeholder groups-teachers, parents and children.

Teachers were provided training and informative resources (Goldberg et al., 2015; Morris et al., 2018; Antón-Peset et al., 2021; Karpouzis et al., 2021), and this allowed for knowledge transfer to children via curriculum and inquiry-based learning (Goldberg et al., 2015; Antón-Peset et al., 2021; Karpouzis et al., 2021), play-based learning (Morris et al., 2018) and experiential activities such as cooking (Karpouzis et al., 2021). Interventions that were integrated into school lessons aimed to teach children actionable ways to packing and consuming healthy foods (Goldberg et al., 2015; Morris et al., 2018), increase food waste awareness and knowledge (Antón-Peset et al., 2021; Karpouzis et al., 2021) and improve food literacy in context of nutrition, food preparation and cooking (Karpouzis et al., 2021). Two studies had poster creation activities for children: one aimed to raise food waste awareness via peer-to-peer cascade learning process (Antón-Peset et al., 2021) and the other sought to capture a campaign's impact on students across the school (Goldberg et al., 2015). The latter provided campaign information via par-ent-teaching meetings and other school events, however knowledge transfer in this project was expected to occur via children who relayed their food requests to parents at home (Goldberg et al., 2015; AntónPeset et al., 2021). Parents and children were also directly involved in another study that aimed to gauge their receptiveness to a nutrition-eco campaign (Folta et al., 2018).

## Intervention studies: outcomes

Intervention outcomes largely focussed on decreased food waste and increased consumption of healthy foods, although none of the outcomes were the same across the included studies. However, few comparisons can be made across the five studies. Antón-Peset's multi-component intervention based in Spain (AntónPeset et al., 2021) was 3 months in duration and resulted in a decrease in food waste from mid-morning break snacks by almost half in the group of students not exposed to the intervention directly. This was a result of the didactic intervention sequence and peer-learning process whereby intervention group students showed and explained the informative food waste themed posters to their peers. By contrast, Goldberg et al.'s American school-based nutrition-eco communications campaign called Great Taste, Less Waste (Goldberg et al., 2015) which lasted 7 months and aimed to increase fruit and vegetable content in lunchboxes and reduce SSBs along with single-serve packaged food items, resulted in negligible changes in the quality of lunches and packaging reduction. Subsequently, a 4 -month formative research study by Folta et al. also based in America (Folta et al., 2018) had more favourable attributes, highlighting the importance of simple intervention designs and the direct involvement of children and parents in campaign development. Similarly, another study (AntónPeset et al., 2021) acknowledged the advantages of directly targeting children in interventions rather than relying on knowledge transfer to children by teachers and parents.
Findings from Morris et al. (Morris et al., 2018), 3 months post an 8 -week intervention, demonstrated a significantly higher knowledge connection between health and the environment, and children ate more healthy foods and less packaged foods among the intervention group. Their findings suggest moving away from the health promotion approach i.e. topdown in nature and instead encourage a shift towards a ground-up approach connecting play-based learning experience with health and sustainability knowledge (Morris et al., 2018). Although the Australian OZHarvest Food Education and Sustainability Training (FEAST) programme study was a protocol for a 10 -week intervention and did not report any trial outcomes (at the time of this review) (Karpouzis et al., 2021), building children's skills and capabilities alongside their knowledge were shared recommendations from Morris et al. (Morris et al., 2018).

## Observational studies: stakeholder interactions

Five of the included studies were not interventions (Dresler-Hawke et al., 2009; Edwards et al., 2013;

Boyd, 2015; Wickramasinghe et al., 2016; Boulet et al., 2019); two focussed on food waste (Dresler-Hawke et al., 2009; Boulet et al., 2019), one considered the broader environmental impact of school lunchboxes by measuring GHGE (Wickramasinghe et al., 2016), and two were exploratory studies that examined the overlap between healthy eating and environment (Edwards et al., 2013; Boyd, 2015).
Two Australian studies considered stakeholders in all three categories: in one of these studies, parent and children perspectives were shared with educators to help develop educational statements (Edwards et al., 2013) and the other study considered all perspectives concurrently (Boyd, 2015). Despite these differences, both studies had similar findings. At the parent level, food choices and sustainability practices varied widely from the school's healthy food policies. Both research groups identified the importance of increasing educator capacity and providing support to encourage teachers to navigate their role towards children's health and wellbeing, respecting and valuing parents' food choices for their children, and understanding the social and cultural aspects of environments beyond school settings. At the school level, the importance of embedding food and sustainability connections in the curriculum and pedagogical practices was described as central to enabling children to enact agency, develop social responsibility and pave the path to healthy and sustainable eating practices (Koch, 2016).

## Observational studies: outcomes

The five studies that were not intervention based had shared considerations of lunchbox nutrition quality and environmental outputs. Both Boulet et al. (Boulet et al., 2019) and Dresler-Hawke et al. (Dresler-Hawke et al., 2009) had a food waste focus and to reduce it suggested solutions that relied on modification of school environments, such as restructuring timetables to increase eating time or scheduling eating time after play time. They also recommended curriculum-based educational reforms to fulfil health and environmental agendas and develop children's self-efficacy in school. Dresler-Hawke et al. went further and advocated for partnerships between school and home environments to increase parental awareness of children's food eating and waste behaviours (Dresler-Hawke et al., 2009). Dissimilar to other studies included in this review, Wickramasinghe's study (Wickramasinghe et al., 2016) considered nutritional aspects of lunchbox food in terms of nutrient and micronutrient content and associated GHGE of lunchbox items in England. The findings of this study were conflicting due to the complexity of defining healthy and unhealthy packed lunches; e.g. when accounting for micronutrients (iron, calcium, zinc and folate) the GHGE of healthy
packed lunches was larger than unhealthy lunches but when accounting for salt, fat and sugar, the GHGE of unhealthy packed lunches was larger.

## DISCUSSION

This scoping review explored existing literature that considered school children's lunchbox contents from both health and environmental perspectives. A total of 10 articles were included and half of them were intervention studies, intending to change behaviour via knowledge levels and attitudes of teachers, parents and children with regard to healthy eating and sustainability practices. Although four of five interventions discussed in this review were between 2 and 4 months in duration, Goldberg et al.'s intervention which was the longest in duration (7 months) and also the most complex did not work as well. There was more inclination towards simpler interventions through active participatory approaches, and motivating children to recognize their role and responsibility to be drivers of change in the environmental landscape.

Metcalfe et al. very aptly described the lunchbox as 'a space or "container" into which various aspects of the school and the home-the public and the pri-vate-may be packed' (Metcalfe et al., 2008). This was also reflected in interventions discussed in this review encompassing complex and multifaceted pathways involving teacher training, raising children's awareness, knowledge and skills, and influencing parent decision making. In particular, Morris et al. (Morris et al., 2018) highlighted the importance of active educator and parental involvement in children's health outcomes and the influence of children's home life on their food choices and sustainability behaviours. Holistic educational approaches encompassing all stakeholders and moving beyond silo approaches were deemed necessary by two studies included in this review (Edwards et al., 2013; Boyd, 2015). This is especially relevant when recognizing the relationships between individuals and the ever-changing environments of multi-level systems (Bronfenbrenner, 1992).

Although lunchboxes draw the involvement of children, parents, educators and the broader socio-ecological systems within which the aforementioned stakeholders are embedded, there is merit for the argument that interventions should directly target children and turn away from regulating their food choices during school time. Lunchbox surveillance by teachers has transformed into supposed pedagogical opportunities, mainly through the way they respond or react to certain lunchbox contents often hinting towards judgement (Pluim et al., 2018). Two of the studies in this review also shed light on the tensions between educators and parents as both parties have differing perspectives and
priorities (Edwards et al., 2013; Boyd, 2015). Reliance on parental involvement in interventions is not without its own set of complications, sensitivities and concerns (Edwards et al., 2013; Boyd, 2015; Folta et al., 2018; Boulet et al., 2019; O'Rourke et al., 2020). There may also be food accessibility and availability differences across households as differing circumstances and financial abilities would impact what parents can or cannot provide as food in lunchboxes. Although food insecurity is likely to be an important influence on children's school lunchbox contents, several of the studies reviewed performed direct observation of lunchboxes only; thus, there was no opportunity to gather or account for data such as food security. Household income, while a good indicator of individual-level socio-economic status, is not necessarily a good proxy for food security either (Kleve et al., 2018). Therefore, future research can explore how household food security influences what's packed in lunchboxes. Moreover, given this review focussed on studies examining school lunchboxes, it is not surprising that most studies took educative approaches, either around healthy food, or skill-based studies such as cooking and food preparation. Studies examining the use of income supports and the effects on school lunchboxes would be a very interesting avenue for future research as this appears to be currently understudied.

The integral role that parents play in children's lives and their food consumption behaviours cannot be understated as they remain 'gatekeepers'. However, children's preferences and food requests often take greater precedence regardless of socio-economic positions (Johnson et al., 2020) and hence, future interventions could target children to increase their food literacy. Particularly, it would be worthwhile to focus on foods as whole and pragmatically linking those choices to environmental impacts, as Ronto et al.'s study findings showed that adolescents had limited knowledge connecting food consumption with environmental sustainability (Ronto et al., 2016).

This review, among other literature, highlights the power of children's voices in making food requests before the lunchbox is packed and then making food decisions within the lunchbox itself after it is packed (Bathgate and Begley, 2011; Ensaff et al., 2018). Creating child-focussed interventions aligns with the United Nations Convention on the Rights of the Child and the 'new' sociology of childhood (UNICEF, 1989) that honours the autonomy and power that children hold as agents of change (James, 2010). Young children have demonstrated the capability to internalize complex environmental issues and this awareness has the potential to motivate children to make 'healthier' and sustainable food choices (Cutter-Mackenzie, 2010; Skouteris et al., 2013; Kos et al., 2016); this
phenomenon was evident in three of the primary year level interventions discussed in this review (Goldberg et al., 2015; Folta et al., 2018; Antón-Peset et al., 2021). Hence, we propose future interventions focus on developing children's self-efficacy and encourage their active participation and involvement as agents of change. Conducting formative and exploratory research is necessary to better understand the perceptions and requirements of this target group and will make desired intervention outcomes more achievable (Folta et al., 2018; Morris et al., 2018; Karpouzis et al., 2021).
The variation in definitions of healthy eating employed across the included studies reflects the purely 'conceptual simplicity' (Neufeld et al., 2021) of nutritious foods. Understandings of nutrition and 'healthy' foods are dependent on specific contexts, which also means that characterization of healthy diets is influenced by a range of external determinants. While some of the definitions converged with broader definitions utilized by the United Nations (Neufeld et al., 2021) and World Health Organization (World Health Organization, 2019), there is no formal or universal guide for school lunchbox contents. Moreover, environmental agendas and behavioural priorities are not uniform across schools; however, the Sustainable Development Goals (Resolution, 2015) in areas of education, health and wellbeing and environment underpinned the development of one intervention included in this review (Antón-Peset et al., 2021). Similarly, Australian based interventions were embedded into curriculum via pre-existing National Quality Standard and Early Years Learning Framework (Boyd, 2015; Morris et al., 2018; Karpouzis et al., 2021). We recommend aligning intervention aims and objectives in future programming with international policies and guidelines to ensure relevance and garner international support and understanding of interventions. The development of a realistic and achievable health definition specifically for lunchbox foods that also considers sustainability would be transformative for this area of research.

## Strengths and limitations

To our knowledge, this is the first review to consider programmes incorporating an environmental focus when reviewing lunchbox studies alongside health and nutrition characteristics. Given this novel and emerging area of research, this scoping review provides a basis for future work in this field. Additionally, this review was conducted in alignment with the PRISMA extension for scoping reviews and a protocol was published and made publicly available prior to conducting the review. The robust method involved searching a range of databases and two researchers who reviewed
the included and excluded studies. This review was limited to peer-reviewed articles in English and as a result some studies may have been omitted that were published in different languages. Despite best efforts to include all relevant terminologies pertinent to the research question, due to the variation in definitions and terms for both healthy foods and environmental considerations, some studies eligible for inclusion may not have been captured by the search strategy.

## CONCLUSIONS

This review provides insights relevant for school food settings that rely on a packed lunch from home model. Lunchbox packing and consumption is complex, and it involves input from various sources. Even though the various stakeholders involved are not always working towards the same goal, a handful of studies showed intervention successes and even those without significant changes provided useful recommendations for future interventions. Future efforts that consider both the food and environmental aspects of packed lunchboxes should consider the socio-ecological influences on children's health and sustainability behaviour. Schools can consider changing their food settings so they can be more conducive to children's healthy and sustainable eating patterns. Teachers can integrate synergistic ideas that combine nutrition and sustainability into their curriculum. Parents can be supported by schools and policies to provide children with nutritious and environmentally friendly foods when packing lunchboxes. Children have the power to request foods based on their preferences, and often make choices before and after their lunchboxes are packed. In line with the studies reviewed in this article, there was a strong consideration of children's agency, and we recommend mobilizing this avenue to drive behaviour change for their health and environmental sustainability.

## Supplementary Material

Supplementary material is available at Health Promotion International online.

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## Ethical Approval

This study is a scoping review of the literature. Ethical approval was not necessary.

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CHAPTER 4: SCHOOL POLICY AND PROGRAM CONTEXT

## STUDY 2

Content analysis of school websites: policies
and programs to support healthy eating
and the environment

### 4.1 Preface

This study was conducted to analyse the existing policies and programs within preschools and primary schools, and determine whether they encompassed health and environmental agendas, together or not. All pages and sections of 18 preschools' and primary schools' websites were viewed and searched for formal policies and any informal content (including newsletters, enrolment packs, canteen menus, programs, activities), for healthy eating, environmentally friendly aspects of food choice, and the combination of both (since less is known about the extent to which schools focus on this overlap). A deductive analysis was conducted using three a priori categories of interest: 1) healthy eating, 2) environmentally friendly practices, and 3) low-waste healthy foods. For each category, interrelated patterns were identified which comprised of presence/absence of formal policy, promotional strategies, and implementation. This chapter serves as a scene-setter, as school level policies, to some extent, can guide lunchbox packing practices occurring at home and children's food consumption practices at school. The socio-ecological framework employed in this study guided the structure for analysing the policy and program contents, considering multiple levels of influence on individuals within the school setting, and was complemented by a critical realism perspective.

### 4.2 Highlights

- Within preschools, their policies had a strong emphasis on healthy eating but limited considerations of sustainability, while policies of primary schools lacked both aspects.
- The combination of healthy eating and sustainability policy level foci was missing in policy documents of both school types.
- Expectations that preschool children would bring healthy 'nude foods' that were also waste free were mentioned informally on the websites but not as part of formal policy documents.
- There were informal and ad hoc activities that encompassed both considerations, which warrants exploring the potential to mobilise this nexus at a more formal level, especially with regards to 'nude foods'.
- This policy and program level content analysis was a first step in understanding the school context within which South Australian school lunchboxes exist.


### 4.3 Statement of authorship

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| Contribution to the Paper | Conception and design of the study <br> Conceptualisation of research questions <br> Data collection <br> Data analysis <br> Manuscript writing <br> Editing and revisions <br> Corresponding author for publication process |  |
| Overall percentage (\%) | 85\% |  |
| Certification: | This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper. |  |
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# Content analysis of school websites: policies and programs to support healthy eating and the environment 

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#### Abstract

Preschools and primary schools are important settings for the development of healthy eating habits and awareness of environmentally friendly practices. This study explored South Australian government schools' policies and programs in relation to healthy eating and environmentally friendly aspects of food choice (such as packaging), and whether any schools approached these issues in combination. Websites of $\mathbf{1 8}$ government preschools and primary schools in the Greater Adelaide region, stratified by low, medium and high socioeconomic status were reviewed for publicly available policies and other relevant content. A content analysis was undertaken, with policies and programs analysed deductively and thematically. Healthy eating ( $n=8$ ) and environment $(n=3)$ related policies were found on preschool websites only. The main themes observed across the three categories of interest (healthy eating, environmentally friendly practices and low-waste healthy foods) included the presence/absence of formal policy, promotional strategies and implementation. Expectations of children bringing healthy 'nude' foods that were environmentally friendly were mentioned informally on the websites but were not part of policy documents. Policies and programs around healthy eating and environmentally friendly practices (in combination)


were lacking. There is scope to address this gap to improve health and sustainable outcomes within the school environment context.

## Introduction

The school environment has been recognized as an important setting for influencing eating behaviours and nutrition-related health outcomes of children and adolescents [1, 2]. Research investigating school food environments has found that policies and programs can have considerable impact on dietary patterns of school children [3]. The Australian school food environment is significantly reliant on food brought from home in the form of packed lunchboxes. This model is also found in Canada [4], unlike other school food models prevalent in the United States and United Kingdom [5], where paid school meal provision or government subsidized meals are often the norm, or in Sweden and Finland where free school lunches are provided [6]. Moreover, one-third of children's daily energy intake occurs in the school setting [7] where they spend an average of 6 h per day and consume a packed lunch including a snack(s), for 5 days a week for a significant portion of the year. As a result, school food environments are an important setting for shaping children's dietary habits [8].
Over a decade ago, several studies were conducted assessing the school food environment and

[^1]eating patterns of Australian children, concluding that there was a lack of nutrition policy in schools that supported and promoted healthy eating among school children [9-11]. Given the availability of well-established evidence confirming the fundamental role of school food provision and policies in influencing children's dietary behaviours [12, 13], improvements in lunchbox contents may be driven and sustained by school policies and programs [14]. Further, systematic reviews have shown that multicomponent and multi-level interventions encompassing diet and physical activity, and involving parental engagement, along with environmental and policy components (such as healthy food policies that continually support behaviour change) were found to be beneficial in the context of obesity prevention in early care and education settings [15] and schools [16]. Thus, there is merit in exploring policies and programs around nutrition and health within the school food environment context.

Environmental concerns and their influence on dietary choices are of great interest given how overlaps have been identified and studied between health promotion and eco-friendly behaviours [17, 18]. Links between planetary health and dietary health, particularly those attributed to consumption patterns, have shaped recent public health agendas [19] and can be informed by the examination of the amount of food packaging and food waste generated in schools [20]. The concept of 'litterless lunches' has been translated to 'Nude Food Day' (for example) in Australia [21], an initiative strongly supported by Nutrition Australia [22] (an education and advisory service), where children's lunchboxes are encouraged to be nutritious (not high in energy, saturated fat, added sugars and/or sodium or discretionary choices) [23] and devoid of packaging waste.

Evidence suggests that young children are able to learn and act on environmental issues through the guidance and influence of teachers [24, 25] and parents or guardians [25]. Elliott et al. [26] further affirmed that 'Education for Sustainability' approaches and pedagogies in early
childhood communities will yield environmentally favourable outcomes. However, it is worth noting that although sustainability pedagogies do exist, they seem to be more ad hoc at a local level than systemic at a state or federal level in Australia [26]. Hence, it is worth exploring to what extent schools have policies and programs focusing on environmental attention and food consumption.

In this context, 'policies' refer to clearly defined and consistently informed requirements around nutrition and healthy eating for children, in line with the Australian Dietary Guidelines [23], National Quality Framework [27], the local guidelines such as the Right Bite strategy [28], and the Department for Education guidelines [29]. The Right Bite Healthy Food and Drink Supply Strategy is a guide developed to support South Australian preschools and school to not only supply healthy food and beverages, but also enable children to make better consumption choices [28]. A traffic light spectrum is used to categorize food and beverages into 'Green category-choose plenty', 'Amber category-select carefully' and 'Red category-occasionally'.

While the causes of overweight and obesity conditions may be multi-factorial, environmental (public health strategies) and behavioural changes (individual health choices and actions) are important for the management and prevention of childhood obesity [30-32]. Exploring the avenue of food and packaging waste reduction could be part of an inter-sectoral approach to improve dietary habits of school children-a strategy that can potentially be complementary and synergistic [33]. Therefore, with a setting-based approach also in consideration, this study aimed to conduct a content analysis of the websites of preschools and primary schools to explore publicly available policies and programs around health and sustainability. This study sought to answer the research question: What is currently included in the policies and programs related to healthy eating and environmentally friendly practices (respectively or combined) in pre- and primary schools?

## Method

## Study design

A content analysis approach was used to identify policies and programs in relation to healthy eating, environmentally friendly practices and any combination of the two (what we will refer to hereafter as low-waste healthy foods). Data were collected from March to June 2020. The sampling frame for this study was publicly available information on the websites of selected preschools and primary schools, which included formal policy documents and any informal content available on the websites-including newsletters, enrolment packs, canteen menus, and information about programs that included educational and activity-based approaches that are part of the school curriculum or extra-curricular agenda.

## School selection

In South Australia, children can study in a government school (also referred to as public schools) or private schools (which are nongovernment schools comprising Independent and Catholic schools) [34]. For this study, data were extracted from publicly available websites of public preschools (kindergarten; children aged approximately $3-5$ years) and primary schools (elementary level; children aged approximately 5-12 years) in the Greater Adelaide region [35] of South Australia. At the time of writing, primary school includes Reception to Grade 7. Only government preschools and primary schools were included in this study, as it is considered mandatory for government schools to adhere to the local-level policies and guidelines and encouraged but voluntary for Catholic or Independent private schools [36].
According to the Australian Bureau of Statistics [37], there are 219 preschools and 234 primary schools in the Greater Adelaide region of South Australia, which includes the Metro and Hills. Purposive sampling was adopted to ensure we captured a variety of schools in our sample that had information-rich websites related to the phenomenon of interest. In particular, since
an important predictor of childhood overweight and obesity is socioeconomic status (SES) [38], schools of varying SES were sampled for demographic and socioeconomic diversity. Geographical location data in the form of postcodes of the schools (pre/primary) were used to determine the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) score, which gave information about the broader socioeconomic context of the schools. The SES of the school was derived from the Socioeconomic Index for Australia sourced from the Australian Bureau of Statistics [37]. Postcode data were accessed from the Australian Urban Research Infrastructure Network, and the respective schools in various postcodes were assigned the IRSAD score [39, 40]. Using the IRSAD deciles, schools were categorized into low (IRSAD score 743-889), medium (IRSAD score 942-1005) and high SES (IRSAD score 1009-1127) groups.

## Procedure

All pages and sections of the schools' websites were viewed and searched for all formal policies and any informal content around healthy eating, environmentally friendly aspects of food choice and the combination of both. Screenshots of relevant content from each preschool or primary school were taken and stored. This snapshot approach prevails over the variable nature of websites by taking a 'static slice of a dynamic medium' and examining that 'slice' at a certain point in time [41]. Data coding and analysis commenced while data were being collected, enabling us to determine when data saturation had been achieved and no new findings were emerging [42, 43].

## Data analysis

A content analysis was then undertaken whereby websites were reviewed and coded based on pre- eating, (ii) environmentally friendly practices and (iii) low-waste healthy foods. Pre-determined categories initially guided the study, but themes and subthemes were identified and reanalysed
throughout study progression. The researcher analysed the content for each category represented and not the extent of the representation. Our approach took a critical realist epistemology and followed the 'ethnographic content analysis' used by Altheide [41, 42] drawing in a recursive and reflexive movement between concept development-sampling-data, collection-data, coding-data and analysis interpretation. Analysis of content within each pre-determined category gave rise to three interrelated and repeated patterns across the school website content: 'Policy', 'Promotion' and 'Implementation'.
In this study, Human Research Ethics Approval was not required as school websites are in the public domain. Furthermore, no identifying information is included in the data presented in this paper.

## Results

## Characteristics of the sample

The websites from a total of 18 preschools and primary schools were included in the analysis of this study. There were nine preschools and nine primary schools; with an equal number of each school type $(n=3)$ in each of the SES groups.
Descriptive statistics relating to the website content and included below were calculated for formal policies, excluding allergen management policies (since that was outside the scope of this study) and other content on implementation or promotional activities relating to nutrition, environment and the overlap between the two. Table I shows the percentage of the presence of nutrition- and environment-related policies within the sampled dataset of schools. Overall, $44 \%$ had publicly available nutrition policies, including $89 \%$ of the preschools and none of the primary schools. Most ( $83 \%$ ) did not have an environment-related policy in place; the only policies observed were in preschools ( $n=3,33.3 \%$ ). Table I also shows the presence of nutrition- and environment-related policies in preschools and primary schools, respectively, with SES segregation. There were no formal

Table I. Overall presence of nutrition and environment-related policies by type of school $(N=18)$

|  | Policy |  |
| :--- | :--- | :--- |
| Type of school | Nutrition | Environment |
| Preschool $(n=9)$ | $8(88.9 \%)$ | $3(33.3 \%)$ |
| Low $(n=3)$ | $2(66.7 \%)$ | $0(0 \%)$ |
| Medium $(n=3)$ | $3(100 \%)$ | $1(33.0 \%)$ |
| High $(n=3)$ | $3(100 \%)$ | $2(66.7 \%)$ |
| Primary school $(n=9)$ | $0(0 \%)$ | $0(0 \%)$ |

policies encompassing low-waste healthy foods in either preschools or primary schools.
Table II shows the percentage of preschool and primary school websites that contained promotional or implementation content on nutritionand/or environment-related activities, other than the policy content. Overall, $88.9 \%$ had nutritionrelated content, while $100 \%$ had environmentrelated content, and in $27.8 \%$ there was an overlap of nutrition and environment. While primary schools did not have formal policies (Table I) on either nutrition or environment, the majority of their websites depicted the promotion and implementation of healthy eating activities (77.8\%) via curriculum, newsletters or websites, and a health advocacy group. All primary school websites $(100 \%)$ contained environmental content, with promotion and implementation seen through

Table II. Overall presence of at least one nutrition and environment-related promotional activities and implementation content by type of school ( $N=18$ )

|  | Promotion and implementation |  |  |
| :--- | :--- | :--- | :--- |
| Type of school | Nutrition | Environment | Overlap |
| Preschool $(n=9)$ | $9(100 \%)$ | $9(100 \%)$ | $3(33.3 \%)$ |
| Low $(n=3)$ | $3(100 \%)$ | $3(100 \%)$ | $2(66.7 \%)$ |
| Medium $(n=3)$ | $3(100 \%)$ | $3(100 \%)$ | $1(33.3 \%)$ |
| High $(n=3)$ | $3(100 \%)$ | $3(100 \%)$ | $1(33.3 \%)$ |
| Primary school | $7(77.8 \%)$ | $9(100 \%)$ | $2(22.2 \%)$ |
| $\quad(n=9)$ |  |  |  |
| Low $(n=3)$ | $2(66.7 \%)$ | $3(100 \%)$ | $0(0 \%)$ |
| Medium $(n=3)$ | $3(100 \%)$ | $3(100 \%)$ | $1(33.3 \%)$ |
| High $(n=3)$ | $2(66.7 \%)$ | $3(100 \%)$ | $1(33.3 \%)$ |

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educational practices, school values and philosophy, newsletter correspondence and community gardens.

## Thematic findings

The analysis presented here is structured according to the pre-determined categories of interest, and the patterns identified within and across them (policy; promotion; implementation).

## Healthy eating

## Policy

It was common for content to refer explicitly to overarching policies and guidelines (such as the Right Bite strategy, National Dietary Guidelines or the Department for Education healthy eating guidelines) and to use them as rationale for justifying advice to parents. Preschools had different names for their food and health policies, such as 'Healthy Food Policy', 'Healthy Food Guideline', 'Healthy Eating Policy' and 'Healthy Food Supply and Nutrition Policy'. Policies were present to inform parents that children were expected to bring a drink bottle containing water, two healthy snacks (such as two pieces of fruit or vegetable)
and a healthy packed lunch that included 'a balanced intake of nutritious foods from the five recommended food groups'. Schools referred to processed energy-dense, nutrient-poor food items that were considered not healthy as 'junk food' or 'unsuitable foods'; hence children were asked not to bring such foods to schools within policy documents. One kindergarten informed parents via the newsletter- 'As per our Healthy Food Policy, unsuitable foods such as cakes, chips, chocolates and sweet biscuits will be returned to the child's bag to be eaten at home'. This insinuated that the school environment should be devoid of 'unhealthy' foods.

Certain healthy eating policies comprehensively mentioned 'food items containing preservatives and artificial colourings should be limited as much as possible'. Some policies included the 'traffic light' categories of the Right Bite strategy with examples of foods, to recommend more food items from the Green category, only one item from the Amber category, and no foods or have occasionally from the Red category. These guidelines also helped set limits on 'special events' food to twice a term to avoid or limit the consumption of unhealthy foods during celebrations in preschools. Moreover, as Right Bite guidelines and the service's nutrition policy. There is an ongoing educative approach with children in relation to healthy eating which is supported by educator discussion and program focus throughout the year.

Standard 2.2 is rated

Fig. 1. A preschool's National Quality Standard Report on healthy eating.
much like the limits on special foods, fundraising activities involving food were expected to follow the healthy eating guidelines. One preschool displayed their National Quality Standard report on their website whereby they exceeded standards in the domain of healthy eating for children and provided parents with information about the Right Bite guidelines (see Fig. 1).

## Promotion

Preschools and primary schools demonstrated their commitment to healthy eating through different promotion strategies. Healthy food guidance or lunchbox expectations were communicated to parents or guardians through various mediums such as the school website, newsletters, enrolment packs and school communication applications, as the responsibility to provide healthy snacks and lunches as per guidelines falls on them. For instance, when fewer fruits were being brought by children in one preschool, this information was conveyed via the newsletter to improve fruit consumption in schools.

There was the presence of healthy eating curriculum in some schools with examples including the 'Eat a Rainbow' lesson plan (eating fruits and vegetables of different colours), lunchbox investigations to promote healthy eating or the presence of a lunch care supervisor to teach children about food and nutrition. Health-oriented activities were also available for children such as preparing and cooking healthy foods in class. There was also an instance whereby one school supported the formation of a health and nutrition advocacy group that was led by parents, students and teachers, which helped address concerns of 'junk food' coming into school or acknowledging good nutritional choices. Parents or guardians were also welcomed to join the Governing Council in schools to be involved in schools' activities and subsequently children's health and well-being development.

## Implementation

Despite the general representation of schools to support healthy eating, there were instances where


Fig. 2. A school canteen running in line with the Right Bite Healthy Eating Guidelines-what is on offer includes fruit bowls (banana and grapes), potato chips (back) and sweet biscuits (left).
practices deviated from policy. For example, in some schools, celebrations and activities were linked to unhealthy foods, as well as unhealthy canteen specials. Certain primary schools had unhealthy food items in their canteen menu, despite aiming to provide healthy and nutritious foods in line with the overarching policies. As a result, often both healthy and non-healthy choices were found in canteens, as shown in Fig. 2. A selection of canteen menus were colour coded in green, amber and red, in line with the Right Bite strategy to reflect the healthy and non-healthy choices available. Some school canteens claimed that they offer 'healthy choices that are delicious and affordable', and 'aimed' to provide nutritious food and serve healthy foods as specials; these schools clearly identified their healthy food and snacks options in addition to the regular items and promoted this via canteen menus or newsletters. The influence of policy on canteen foods was also seen as one primary school mentioned 'Reduced or low fat products are used throughout the menu where possible'.

## Environmentally friendly practices Policy

Three preschools had formal policies encompassing their respective environmentally friendly practices. One preschool had a 'Sustainable Procedure' and another had an 'Environment Management Plan'. The third preschool's website showed the
'Wipe Out Waste' program and policy through engagement with KESAB (Keep South Australia Beautiful) 'environmental solutions', a not-forprofit organization delivering environmental sustainability programs to schools. The content of these policies included schools' vision and/or values including an environmental agenda, schools' efforts to promote environmental awareness and education. Focus on environmentally friendly practices comprised reducing waste and packaging, the 'Nude Food' philosophy, recycling, gardening, composting and conservation of energy/resources.

## Promotion

Preschools and primary schools that were sustainability oriented had values that included consideration for the environment, such as 'Responsible towards nature', 'Environmentally aware', 'Sustainability' and 'Respectful interactions with our environments'. School philosophies which considered that the environment were in the form of slogans such as 'better future for the planet' and 'providing an environment to understand sustainable practices'. School values also shaped the outcomes shared in school reports including current and future environment-related actions that were part of the schools' agenda (such as the National Quality Standard report), which was publicly available in one preschool website. Schools often relayed information about sustainability and environmental activities via newsletters. Parental involvement in the schools' sustainable actions was also welcomed.

## Implementation

Various environment-oriented programs and activities within the school setting were found on websites of preschools and primary schools. In some instances, there were lunch waste and bin audits for waste minimization, encouraging 'Nude Food' through the use of washable containers, promoting less waste to landfill by minimizing or reducing packaging, and switching to environmentally friendly cutlery within the canteen. Moreover,
some sustainable activities were carried out in collaboration with other members of the school and society. Other school activities that promoted environmental awareness included emphasis on recycling and upcycling through education, teaching waste and bin management, taking the children to the beach for cleaning or promoting the use of sustainable library bags. The presence of a community garden in schools to grow fruits and vegetables was also common in some preschools and primary schools, as emphasis was laid on gardening, composting and food scrap handling. Furthermore, the inclusion of environmental awareness events into the school's calendar such as 'Earth Hour' or 'Earth Day' was captured within this domain.

## Low-waste healthy foods

## Policy

We found no formal policies encapsulating the combination of healthy eating and environmentally friendly practices. However, 'Nude Food' information was briefly mentioned in the healthy food policies/guidelines of three preschools and one preschool's sustainability procedure. There was also an occurrence where parents were asked to be mindful about portion sizes to minimize uneaten foods being wasted, and this information was conveyed in the 'Healthy Food Guideline' of a preschool.

## Promotion

Various examples of encouragement of healthy foods and less landfill waste were found in the informal content analysed. Although not driven by a formal policy, there was emphasis on healthy foods and 'naked foods' that were not wrapped up, and these expectations were conveyed on websites, Parent Information Booklet and newsletters (see Fig. 3). This was also integrated into the curriculum in one preschool. Tips on healthy and waste-free lunches were shared on some websites, and certain preschools implemented KESAB's 'Wipe Out Waste' program.


Fig. 3. Example of 'healthy foods not wrapped up' information relayed via a school newsletter.

## Implementation

Implementation within the overlapping domains of healthy eating and environmentally friendly practices was not particularly apparent from the content analysis process. However, there was an instance where one preschool's newsletter informed parents about healthy and waste-free lunchboxes found at the start of term, the rate of which declined the following month with more processed and plastic wrapped foods observed in lunchboxes (see Fig. 4).

## Discussion

This study explored policies and programs around healthy eating, environmentally friendly practices and low-waste healthy foods, among a sample of preschools and primary schools across different socioeconomic areas, as evidenced by their
public facing websites. We found that healthy eating policies and programs were more common compared to those encouraging environmentally friendly practices; the combination of both aspects were lacking within documented policies and programs. Our interest in examining school websites for the prevalence of policies and programs stemmed from the view that this digital platform is used by respective institutions to provide relevant information regarding the operations of the pre/primary school. Advocacy efforts and information are often portrayed on the websites for the parents or guardians of students both prospective and currently enrolled [45].

Preschools and primary schools are important settings for the development of healthy eating and eco-friendly habits. The involvement of various stakeholders including children, parents, teachers and the school community for childhood development and well-being is vital for the long-term success of policies and programs created in the school environment context. Some preschools also acknowledged their role to support families to ensure optimal health and nutritional outcomes of their children. There was a clear acknowledgement of the roles and responsibilities of parents or guardians in providing their children with a packed lunchbox. The presence of healthy eating policies and guidelines tends to shape parental responsibilities in the provision of snacks and lunches for their children. Hence, lunchbox expectations were also often communicated to parents or guardians through various mediums such as the school website, newsletters, enrolment packs and school communication applications. The mention of unhealthy food items being sent back home, notably in the preschool context, took the role of guidance and policy further by refusing to allow the consumption of products that were not aligned with policy. Preschools had policies in place, and there was evidence of these policies being enforced, whereas primary schools did not. Additionally, parental involvement encouraged through the Governing Council to be involved in the review of the healthy eating policies/guidelines and other school matters further underlines their key role in influencing what
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Fig. 4. Newsletter update across 2 months regarding lunchbox contents in a preschool.
children bring in their lunchbox. This parental or familial role to influence children's food consumption behaviour has been well established in the literature [46, 47]. Hence, engagement with parents and their support towards the school's healthy food and sustainability policies and programs are crucial.

Canteens play an integral role in providing food, as well as educating and modelling a healthy food environment [48]. The Right Bite strategy guides the food and drink supply in canteens, to ensure that healthy choices are available in South Australian schools and preschools [28]. While a mix of healthy and unhealthy foods items were found in canteen menus, it is worth noting that the biggest effect of the Right Bite guidelines was visible in the design of lunch menus where green, amber and red foods were clearly identified based on colour coded text and is also a positive educational tool for students and families. Moreover, the healthy eating guidelines and policies found in preschools were elaborate and in line with the national and local guidelines, which involves grouping foods into the categories of the 'traffic light' system [49] (green, amber and red), to convey the expectation of more green (healthy and minimally processed) foods to be included in lunchboxes. Hence, this 'traffic light' guidance can be useful beyond the canteen setting, although lunchboxes coming from
home is currently not covered by the aforementioned guidance [12].
Although only three preschools had a formal sustainability procedure or policy in place, the majority of the preschools and primary schools that were devoid of policies and/or guides had various programs and activities that promoted environmental awareness and sustainable practices. Children were supported and enabled to carry out environmentally friendly practices. The promotion of the 'Nude Food' program for healthy eating and reduction of landfill waste in some schools also opened the avenue of providing education around waste management and conducting routine waste audits to minimize lunchbox and packaging waste. Some schools' engagement with a local environmental agency and encouragement to families to provide nutritious and waste-free lunchboxes suggested that there is scope to develop stakeholder engagement to improve outcomes in the context of environmentally friendly practices. This suggests that there is a basis on which policy could be developed in primary schools in particular to support schools to achieve improved nutritional and environmental outcomes.

The challenges of packing and consuming a nutritious and low-waste lunchbox are an underrated public and planetary health concern. The responsibility of healthy eating behaviour
development and encouraging environmentally friendly actions was found to be diffused across multiple stakeholders (i.e. schools, environmental agencies, policymakers, education department, school staff members, parents and schoolchildren). Where the responsibility of the intersection of healthy eating and environmentally conscious practices lies is unclear and is possibly an idea worth future consideration. Finally, although the nexus of the intersection of healthy eating and environmentally friendly practices was underdeveloped, it could certainly be mobilized to increase the prevalence of low-waste healthy foods within the school setting. Thus, there seems to be scope for the development of formal policies that merge the nutritional and sustainable aspects for better health and environmental outcomes through schoolchildren's eating behaviour.

## Limitations

In considering the analysis presented here, it should be noted that the desktop review of published materials on school websites does not capture other aspects of the school environment, unpublished policies/guidelines or programs and the results of policy implementation. Moreover, we have only reviewed websites of schools in the Greater Adelaide region not including schools in the regional areas. Therefore, generalizability of findings is a limitation worth noting in a geographical context, and the school environment context where the food consumption models may vary. Nevertheless, the sample of schools included in this study represents the majority of the population residing in South Australia [50].

## Conclusions

In this study, preschools had a strong presence of healthy eating policies, limited environment/sustainability policies and no policies around the overlap of both aspects. Formal policies around healthy eating, environmentally friendly practices and the combination of both were not found on the websites of primary schools. Initiatives or activities through school programs around healthy eating
were guided by policies and/or guidelines. Government and local-level authorities serve as a reference point for schools to base their decisions on how to structure policies. However, environmentally friendly practices were mentioned as activities that were being promoted or encouraged and therefore seemed to be more ad hoc in nature. Similarly, expectations of bringing healthy and ecofriendly foods were mentioned, but they were not part of formal policy documents. Hence, clearer and well-defined policies are warranted, especially those that suit the Australian packed lunchbox model managed by parents and particularly those that involve the overlap of nutrition and sustainability. We therefore call for actions to re-think food consumption in school, incorporating an environmental agenda onto the well-established nutrition policies and guidelines.

## Implications for health and sustainability

This study provided an examination of the context of the existing school food environment in South Australian preschools and primary schools, and what aspects were considered important and subsequently shared on public domains. Given that there were no policies in place around the 'co-benefits' of healthy eating and environmentally friendly actions, but plenty of encouragement by the schools, this is an avenue worth developing within the school environment. Furthermore, this study can inform future research that could analyse 'lived experiences', such as auditing children's consumptions patterns within the school setting. These outcomes combined will help shape the scope of new policies and programs that could merge the nutrition and environment lens together as part of an inter-sectoral approach to improve children's dietary habits and sustainability outcomes.

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## Conflict of interest statement

None declared.

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CHAPTER 5: LUNCHBOX AUDIT METHODOLOGY

## STUDY 3

Development of a novel methodology to examine the food, packaging, and waste in Australian school children's lunchboxes

### 5.1 Preface

Several methods have been developed and implemented to assess children's food consumption patterns at school and their lunchbox contents for health evidence and intervention development purposes. However, there was no existing methodology to assess lunchbox contents for nutrition along with waste and packaging characteristics altogether. Hence, a methodology was developed to make this investigation possible, and is described within this chapter, after an in-depth rationale for the instrument development is explained. The manuscript presented in this chapter adhered to the formatting style as required by the target journal, including the reference list of the manuscript.

### 5.2 Rationale for new lunchbox audit instrument development

Although the development of the lunchbox audit tool is described in Chapter 5, I would like to augment the description of the rationale for its development here. Guided by the focus of this research program, which is lunchbox contents assessment from a nutritional and environmental lens, an audit tool to examine lunchbox foods, waste, and packaging was not available. However, the feasibility and reliability of digital photography to evaluate the contents of lunchboxes is well established in the literature (Elliott et al., 2021; Hawkins et al., 2017; Taylor et al., 2018), overcoming issues pertaining to measurement error and participant burden. Some studies have also reported the possibility measuring food waste using the photographic method at an individual level, such as children taking the photographs of the food trays in a French school (Giboreau et al., 2019). Others have combined digital photography, specifically in the lunchbox context, with other data capture methods such as food weighing (Pearson et al., 2021) and dietary log sheets (Gauthier et al., 2013), particularly to determine specific compositions of food items such as a ham sandwich, where each individual component was identified and logged separately (i.e., 2 slices of white bread, 50
grams of ham, 1 tablespoon of mustard, 1 slice of Kraft Single Slice cheese) (Gauthier et al., 2013).

However, given the public health focus of this research program, and the addition of the waste and packaging assessment to broad food-based data collection methodology, it was predetermined that the fragmented nature of micro-level nutritional data collection was not useful to meet the aims of this exploratory research program. Hence, a more pragmatic food level method of data collection would be practical. As a result, lunchbox photographs were used as a supplement to a new audit tool develop using REDCap (stands for Research Electronic Data Capture) to code the lunchbox photographs for food, waste, and packaging indexes.

### 5.3 Highlights

- An audit tool was developed using REDCap, including coding attributes for food, waste, and packaging.
- The Australian Guide to Healthy Eating and AUStralian Food and NUTrient (AUSNUT) database guided the development of the food and beverage categories.
- The local South Australian bin system guided the packaging waste categories.
- Lunchbox photographs were taken at two school sites for the pilot study, and dual coding of lunchbox contents into REDCap guided improvement measures of the designed audit tool.
- Dual coding of photographs also enabled inter-rater reliability estimation reported using intraclass correlation coefficients which mostly indicated excellent agreement between two coders.
- Feasibility of this tool for lunchbox contents and waste assessment suggests its applicability in other contexts for dietary and health evidence generation.

Note: Supplementary File 1 and File 2 in the submitted manuscript correspond to Appendix
B. 17 and B. 18 respectively within this thesis.

### 5.4 Statement of authorship

| Title of Paper | Development of a novel methodology to examine the food, <br> packaging, and waste in Australian school children's <br> lunchboxes |
| :--- | :--- |
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| Publication Details | Neha K Lalchandani, Caroline Miller, Lynne Giles, Jo <br> Hendrikx, Shona Crabb, Carly Moores, Clare Hume. <br> Development of a novel methodology to examine the food, <br> packaging, and waste in Australian school children's <br> lunchboxes. Health Promotion Journal of Australia. <br> (Submitted February 2023) |

## Principal Author

| Name of Principal Author <br> (Candidate) | Neha Kishan Lalchandani |  |  |  |
| :--- | :--- | :---: | :---: | :---: |
| Contribution to the Paper | Conception and design of the study <br> Conceptualisation of research questions <br> Pilot data collection <br> Data analysis <br> Manuscript writing <br> Editing and revisions <br> Corresponding author for publication process |  |  |  |
| Overall percentage (\%) | $60 \%$ |  |  |  |
| Certification: | This paper reports on original research I conducted during <br> the period of my Higher Degree by Research candidature <br> and is not subject to any obligations or contractual <br> agreements with a third party that would constrain its <br> inclusion in this thesis. I am the primary author of this <br> paper. |  |  |  |
| Signature | Date |  |  | 10 February 2023 |

## Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:
i. the candidate's stated contribution to the publication is accurate (as detailed above);
ii. permission is granted for the candidate in include the publication in the thesis; and
iii. the sum of all co-author contributions is equal to $100 \%$ less the candidate's stated contribution.

| Name of Co-Author | Caroline Miller |  |  |
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| Name of Co-Author | Jo Hendrikx |  |  |  |
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| Contribution to the Paper | Design of the study <br> Assistance with site recruitment <br> Assistance with pilot data collection <br> Assistance with coding protocol development <br> Input regarding interpretation of results <br> Revision of manuscript |  |  |  |
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| Name of Co-Author | Shona Crabb |  |  |  |
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| Contribution to the Paper | Conception and design of the study <br> Input regarding interpretation of results <br> Assistance with data synthesis <br> Revision of manuscript |  |  |  |
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| Contribution to the Paper | Conception and design of the study <br> Second coder for lunchbox audit tool testing <br> Assistance with coding protocol development <br> Revision of manuscript |  |  |
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| Name of Co-Author | Clare Hume |  |  |  |  |  |
| :--- | :--- | :--- | :---: | :---: | :---: | :---: |
| Contribution to the Paper | Conception and design of the study <br> Third coder for lunchbox audit tool testing <br> Assistance with coding protocol development <br> Second coder for inter-coder reliability testing <br> Input regarding interpretation of results <br> Assistance with data synthesis <br> Revision of manuscript |  |  |  |  |  |
| Signature | \begin{tabular}{\|l|l|l|}
\hline
\end{tabular} |  |  |  | Date | 13 February 2023 |

### 5.5 Publication under review


#### Abstract

Issue addressed: Most children in Australia bring a packed lunchbox from home to school. Multiple studies have examined lunchbox contents from a nutrition perspective but none have examined food, waste, and packaging concurrently. This paper reports on a novel audit methodology designed to pragmatically assess the contents of children's lunchboxes, capturing both food and waste, in Australian preschool and primary school settings.


Methods: 24 preschool children ( 3 to 5 years) and 25 Grade 5 primary school children (9 to 11 years) participated. Lunchbox photographs were captured at two time points on a single day (before and after consumption), and contents were coded into a bespoke audit tool, complemented by a coding guide. Two pilot lunchbox audits were conducted; one by the student researcher at a preschool and another by a teacher at a primary school. Coding was conducted by two researchers independently and inter-coder reliability was assessed.

Results: There were, on average, one vegetable, one to two fruits, one to three grains or cereals, one dairy, and one to two snack items in children's lunchboxes. Intraclass correlation coefficient (ICC) estimates mostly indicated excellent agreement between two coders. 87.6\% of ICC estimates derived for presence/absence of food and beverage items were greater than 0.9 , while ICC values for food waste and packaging were 0.94 ( $95 \%$ CI $0.89-0.97$ ) and 0.94 (95\% CI 0.89-0.97), respectively.

Conclusions: Food photography is a viable methodology to document food and packaging/waste outcomes in home-packed school lunchboxes. This methodology provides an objective data collection technique and minimal burden on participants.

So what? Lunchbox foods have health and sustainability implications. Obtaining a reliable snapshot of lunchbox contents can support intervention development for health promotion.

Keywords: child, lunch, schools, photography, lunchbox, data collection, Australia

## INTRODUCTION

Children in Australia consume one-third of their daily energy intake at school, and more than 85\% of children bring a packed lunchbox from home (Bell \& Swinburn, 2004). International studies comparing school meals and home-packed lunches have identified nutritional inadequacies in the latter (Evans et al., 2010a; Johnston et al., 2012), warranting further research and potential interventions. Previous studies have assessed school children's lunchbox food intake through 24-hour dietary recall data (Bell \& Swinburn, 2004), checklists or questionnaires completed by fieldworkers or dietitians based on observations (Brennan et al., 2010; Farris et al., 2015; Sanigorski et al., 2005), self-reported questionnaires by children (Zarnowiecki et al., 2018), photographs of lunchboxes (Dresler-Hawke et al., 2009; Elliott et al., 2021), combinations of photographs and checklists or dietary log sheets (Gauthier et al., 2013; Hubbard et al., 2014; Mitchell et al., 2009) or a combination of photographs and food weighing (Evans et al., 2010b; Kelly et al., 2010). Most Australian-based school lunchbox audits are over 10 years old (Bell \& Swinburn, 2004; Brennan et al., 2010; Kelly et al., 2010; Sanigorski et al., 2005); with the exception of more recently published studies based in early childhood (Barnes et al., 2021; Pearson et al., 2021) and primary school settings (Sutherland et al., 2020); however, most of these studies did not explore sustainability (e.g. food packaging) or food waste.

A direct and pragmatic measure of lunchbox contents (where foods are seen as whole rather than a sum of micronutrients and macronutrients) that avoids the conventionally dominant
reductionist approach in nutrition research (Hoffmann, 2003) could be a useful technique. Additionally, although many previous studies assess children's school food consumption patterns, including through photography-based methods, there is limited data detailing the packaging in children's school lunchboxes. Excessive food packaging linked with ultraprocessed foods along with food waste, have negative environmental implications (Seferidi et al., 2020). Reducing food and packaging waste may dovetail with public health nutrition goals, especially in relation to observed increased consumption of discretionary ("junk") foods by Australian children during school hours (Manson et al., 2021).

Assessing lunchbox contents from both a food and environmental lens is an untapped avenue of investigation, highlighting the need for development of this methodology. The aim of this paper is to describe the development, feasibility, and reliability of a novel photography-based method to assess food, packaging, and waste in school lunchboxes.

## METHODS

## Study setting

The methodology was first tested using pilot data collected from two sites (a preschool and a primary school) in Metropolitan Adelaide, South Australia.

## Recruitment

The two sites were sampled through convenience sampling and facilitated by KESAB environmental solutions (industry partner of this project) based on their existing relationships with preschools and schools in South Australia. Consenting schools were sent an information package that included an overview of the study and consent form for the head of school to sign. Additionally, a project flyer was sent to parents by the school staff, to inform them of the study taking place on site, along with a consent form for preschool parents and an opt-out
form for any primary school parent who did not wish for their child's lunchbox to be photographed. Verbal assent from the students prior to taking photographs was requested. Staff were aware of the audit date, but parents and students were unaware which day the audit would occur to reduce/minimise social desirability and/or response bias.

## Data collection procedure

Lunchbox photographs were taken at the preschool in December 2020. A subsequent COVID19 outbreak in South Australia resulted in restriction of visitors on school sites, which led to a primary school class teacher taking lunchbox photographs in August 2021. Lunchbox photographs were captured at two time points on a single day-before any food consumption occurred at recess or morning break (Time 1) and after lunch break when children had finished eating (Time 2). School staff decided where they wanted the lunchbox photographs to be taken: either in class or outdoors on the ground. Lunchbox contents remained in lunchboxes and were not touched by the student researcher or teacher who photographed the lunchboxes. Children were asked to open their lunchboxes and any containers with lids or food items with opaque packaging. If they struggled to open certain containers or boxes, they were aided by the teacher or student researcher, if requested. Children were asked not to dispose of uneaten food throughout the day.

A digital camera (Olympus OM-D E-M10 Mark II, Olympus Corporation, Tokyo, Japan) was used to take the photographs. It took approximately 10 minutes to photograph all lunchboxes at each time at each site. The Time 1 and Time 2 photographs for each lunchbox were paired in a combined image file, and any identifiers (e.g., labels containing children's names) were blurred to maintain anonymity. The process of pairing Time 1 and 2 photographs was done manually and was relatively straightforward, as lunchboxes were unique and easily distinguishable.

## Database development

A database was designed in REDCap (a secure, web-based application for building and managing online surveys and databases with unique tools and functionality for research purposes) (Harris et al., 2009; Harris et al., 2019), drawing inspiration from the methodology developed by Kelly et al. (2010), although their methodology involved weighing food and did not code for packaging and waste. This database was designed to allow the entry and coding of lunchbox food and beverage contents and the type of packaging that accompanied them (Time 1 photograph); additional packaging not visible in Time 1 photograph and the food remaining (Time 2 photograph) from which approximate waste could be observed. The shell of the database is provided as Supplementary File 1. An extensive coding manual was also created to complement development of this database to assist coders with the coding process [see Supplementary File 2].

## Data coding and entry

## Food and Beverage Categories

Eight food and beverage categories were used, based on the five core food groups from the Australian Guide to Healthy Eating (NHMRC, 2013) with an additional three categories for common lunchbox food items mainly snacks, mixed meals such as leftovers, and other beverages. They were 1) Vegetables (excludes mature form of peas and beans); 2) Fruits; 3) Grains or Cereals; 4) Protein and alternatives (includes meat, seafood, poultry, eggs, and mature types of legumes, beans and pulses); 5) Dairy and alternatives (includes milk, yoghurt, cheese and their alternatives); 6) Snacks (or extras) i.e., light foods eaten between regular meals, including many pre-packaged discretionary items; 7) Mixed meals i.e., items or dishes that contain multiple core food ingredients; and 8) Drinks (excluding reusable water bottle from home). The list of food items that constituted these eight broad categories were created based on the AUSNUT food nutrient database, prepared to support the 2011-13 Australian

Health Survey (FSANZ, 2014). This categorisation system was adopted because foods in the AUSNUT database have a unique code and are hierarchically clustered which made the development of the items list systematic for this methodology. The number of distinct food items in the lunchbox was recorded (e.g. strawberries and apples were coded as two separate fruit items), but counts of multiples of an individual food item were not recorded (e.g. the number of blueberries).

## Food Waste Categories

Lunchbox waste in all eight food categories was coded into three broad categories, namely 1) No waste; 2) Some waste; 3) All waste. Additionally, two options were included namely 'Unidentifiable' (for items present but hidden or in an opaque container) and 'Missing Data' (for items missing in Photograph 2 unless food was in a packaging that was discarded by the child as most packets were empty and thrown into the bins). For analysis, scores were designated for every food item if waste was none $($ score $=0)$, some $(0.5)$, or all waste $(1)$, or unidentifiable/missing (0) for analysis purposes. Higher scores indicated more waste.

## Packaging Categories

Three categories were established for the packaging aspect of lunchbox contents based on the current kerbside waste bin system in South Australia which correspond to Organics (green bins), Recycling (yellow bins), and General waste/single-use/landfill bin (red or blue bins depending on Local Government Area). An additional category called Reusables was included, noting that children may bring certain food items in smaller boxes or containers (in addition or separate to main compartmentalised lunchboxes). There was an option of No packaging for unpackaged food items. The presence and absence of organic waste (e.g. peels or cores) was also recorded. For analysis, scores were designated for every food item if they had no packaging (score $=0$ ), reusable packaging (0.25), organic packaging (0.5), recyclable
packaging (0.75), or single-use packaging (1). Higher scores indicated less desirable packaging (such as more prevalent single-use packaging).

The database underwent two main version updates because of two initial pilot coding rounds;

1) Preschool photographs were independently coded in duplicate by NKL and CJM and 2) Primary school photographs were independently coded in duplicate by NKL and CH. Disagreements in coding were discussed and where appropriate additional rules, categories or instructions were added to the tool and coding manual as required. Once the REDCap database was finalised, NKL and CH independently coded all photographs again.

## Statistical Analysis

Descriptive statistics were used to characterise lunchbox contents. Intraclass correlation coefficients (ICC) and $95 \%$ confidence intervals (CI) estimated inter-rater reliability measure for two coders comparing food items, food waste, and food packaging. Indicator variables were derived for presence or absence of individual food and beverage items. For each of those indicator variables, ICCs were calculated. For each waste and packaging variable, assigned scores were summed and then divided by the number of those food and beverage category items that were in the lunchbox to obtain an average score for waste and packaging respectively. Total waste and packaging scores across all eight major food and beverage categories were then calculated by adding together the component scores, before deriving an ICC estimates and 95\% CIs for waste and for packaging, respectively.

ICC values greater than 0.90 , between 0.75 and 0.9 , between 0.5 and 0.75 , and less than 0.5 were indicative of excellent, good, moderate, and poor reliability, respectively, according to previously published criteria (Koo \& Li, 2016) as per lower bound 95\% CI values. Statistical analyses were carried out using STATA/MP version 17 (StataCorp, College Station, TX, USA).

## RESULTS

Table 5.1 shows characteristics of the sample. Preschool children were 3 to 5 years of age while primary school (Year 5) children were aged between 9 to 11 years of age. A total of 49 children were present on the day of the audit ( $\mathrm{n}=24$ [49\%] preschool and $\mathrm{n}=25$ [51\%] primary school) and all of them brought a lunchbox to school. However, four parents opted out or did not consent to the study ( $8.2 \%$ non-participation rate). A total of 45 lunchboxes were photographed, but only 40 were included in the analysis because 5 lunchboxes were missing Time 1 photographs (either because of child non-attendance in the morning or children had consumed all their food prior to the audit), which meant the original contents of the lunchbox were not available for coding. There were no lunch orders made on the day of the audit at the primary school.

Table 5.1 Characteristics of the sample of the pilot lunchbox audit conducted in a preschool and primary school

| Characteristic | Preschool | Primary school |
| :--- | :---: | :---: |
| Age range (years) | 3 to 5 | 9 to 11 |
| Total children enrolled in class (n) | 30 | 29 |
| Children present (n) | 24 | 25 |
| Lunchbox photographs captured at Time 1 and Time 2 (n) | 17 | 20 |
| Lunchbox photographs captured at Time 1 only (n) | 3 | - |
| Lunchbox photographs captured at Time 2 only (n) | $3^{*}$ | $2^{*}$ |
| *Excluded from analysis |  |  |

On average, children had one vegetable, one to two fruits, one to three grains or cereals item, one dairy, and one to two snacks. Grains or cereals were the most dominant category as $92.5 \%$ of lunchboxes had at least one food items from this category. This was followed by fruits ( $67.5 \%$ ), snacks ( $55 \%$ ), and dairy food items ( $40 \%$ ). Vegetables were present in $37.5 \%$ of lunchboxes. The most common foods items within each food and beverage category were as follows: Vegetables (cucumbers, cherry tomatoes and carrots); Fruits (apples and strawberries); Grains or cereals (sandwiches, savoury biscuits, sweet biscuits and baked
products such as cakes); Protein (processed meats such as ham and sausage); Dairy (flavoured yoghurt and cheese); Snacks or extras (potato/grain/legume-based chips, crisps or popcorn and grains/cereal/fruit bars). There were very few mixed meals and drinks in this sample. Snacks or extras were the least frequently wasted foods (i.e., most consumed) compared to vegetables and fruits. Most dairy items and snacks came in single-use packaging, particularly squeeze pouches and single-use soft-plastics. Across the 40 lunchboxes that were coded in duplicate, 153 ICC estimates were derived for presence/absence of food and beverage items. Of the 153 ICC estimates, 134 were greater than 0.9 (excellent reliability), 7 were between 0.75 and 0.9 (good reliability), 6 were between 0.5 and 0.75 (moderate reliability), none were less than 0.5 (poor reliability), and 6 were not calculable due to insufficient observations ( $\mathrm{n}=0-1$ ) for the specific item. For both food waste and packaging, ICC was indicative of excellent reliability, 0.94 ( $95 \%$ CI $0.89-0.97$ ) and 0.94 ( $95 \%$ CI $0.89-0.97$ ), respectively. For calculable observations, Table 5.2 shows the range of ICC estimates with $95 \%$ confidence intervals (CI) for food, waste, and packaging categories.

Table 5.2 Ranges of intraclass correlation coefficients (ICC) for food, waste, and packaging categories

| Category | ICC Range |
| :--- | :---: |
| Food and beverages |  |
| $\quad$ Vegetables $(\mathrm{n}=28)$ | $0.88-1.00$ |
| Fruits $(\mathrm{n}=27)$ | $0.94-1.00$ |
| Grains or cereals $(\mathrm{n}=34)$ | $0.80-1.00$ |
| Protein $(\mathrm{n}=14)$ | $0.87-1.00$ |
| Dairy $(\mathrm{n}=14)$ | $0.92-1.00$ |
| Snacks or extras $(\mathrm{n}=24)$ | $0.80-1.00$ |
| Mixed meals $(\mathrm{n}=4)$ | $1.00-1.00$ |
| Drinks $(\mathrm{n}=8)$ | $1.00-1.00$ |
| Waste | $\mathbf{0 . 9 4}$ |
| Packaging | $\mathbf{0 . 9 4}$ |

## DISCUSSION

Very few studies have applied both a food and an environmental lens to school lunchboxes, and food packaging outcomes have not been previously reported. This study demonstrates the
feasibility of previously applied objective and observational methodology of food photography (Elliott et al., 2021; Gauthier et al., 2013; Hubbard et al., 2014; Mitchell et al., 2009; Sabinsky et al., 2013), with additional consideration of waste in terms of food waste and packaging. Unlike other methods that involved transferring lunchbox contents on to a placemat for visual examination (Hubbard et al., 2014; Taylor et al., 2018) or placing food items on a weighing scale (Evans et al., 2010b; Kelly et al., 2010), this photographic method was straightforward, quick to execute and simply involved children opening their lunchboxes. This was intentional, to minimise intrusion during eating times or cause any logistical burden on participants, based on similar reasons cited by Mitchell et al. (2009) who incorporated the advice of the ethics committee, school personnel, and local community dietitian. Food items were not touched or deconstructed and micro-level detail: for example, the type of bread (whether white, wholemeal, wholegrain/multigrain), fillings of sandwiches, or the kind of dairy item (whether full cream or low-fat/light) were not recorded, and meant that coding of food, packaging, and waste could be done later, rather than a lengthy and cumbersome process when recording the contents in school (Kelly et al., 2010). In addition to the pragmatic benefits of this methodology, ICC estimates were indicative of excellent agreement between coders who made consistent observations when coding the lunchbox photographs. The food-based rather than a nutrient-based approach in the current study means that this methodology is translatable to other contexts. Limitations include the lack of serving and portion size data or energy density measurements, but the benefits of this pragmatic approach outweigh such limitations.

## CONCLUSIONS

School lunchboxes make up a significant part of Australian children's food consumption. Packaging and waste are public health concerns just as is optimal nutrition, and there is merit to study these factors in combination. The tool described here captured food, packaging, and
waste in school lunchboxes, without being intrusive or placing undue burden and scrutiny on children, parents, and school staff. Importantly, this study adds to the literature by providing a well-tested and reliable data collection method that is easily applied to common lunchbox contexts. This is an important first step towards informing interventions to improve the nutritional quality of school lunchboxes and subsequent environmental outcomes of food choices.

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Conflicts of Interest: Authors declare there are no conflicts of interest.

Ethics Approval: This study was conducted according to the guidelines laid down in the National Statement on Ethical Conduct in Human Research (2007) in accordance with the National Health and Medical Research Council Act 1992. All procedures involving research study participants were approved by the Human Research Ethics Committee at the University of Adelaide (Approval Number H-2020-167). The Department for Education, South Australia also granted approval to conduct this research project and access Department for Education
sites (Reference No: 2020-0036). An opt-out approach was utilised in the primary school because of the low risk associated with the research, and the study aligns with all opt-out consent requirements as outlined in Chapter 2.3 within the National Statement on Ethical Conduct in Human Research. Parents who did not wish for their child(ren) to participate signed an opt-out form and returned it to the school, and the student researcher was informed. The preschool indicated they preferred an opt-in consent approach; so, a consent form was sent to parents to sign to confirm their children's participation. Additionally, verbal consent from children in class was witnessed by the class teacher and formally recorded by the student researcher prior to data collection.

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## CHAPTER 6: SCHOOL LUNCHBOX CONTENT

## STUDY 3

Sneak Peek: Food, waste, and packaging characteristics of South Australian preschool and primary school children's lunchboxes

### 6.1 Preface

This chapter describes the results of the lunchbox observation study conducted at preschools and primary schools in Adelaide, which captured the food as well as the packaging and waste characteristics of lunchbox contents using the audit tool developed and described in Chapter 5. This flagship study of the research program is the first to assess lunchboxes in Australia using a novel tool specifically developed to capture the food and waste characteristics of school lunchboxes. It also includes an additional component focussed on identifying and quantifying packaging. The manuscript presented in this chapter adhered to the formatting style as required by the target journal, including the reference list of the manuscript.

### 6.2 Highlights

- An observational survey of 673 lunchboxes across preschools and primary schools in a range of socioeconomic areas provided updated school lunchbox assessment data for the Australian context, reporting not only school-based dietary trends, but also waste and packaging attributes of lunchbox foods.
- Preschool lunchboxes were nutritionally superior, supported by the strong policy influence identified in Chapter 4; however, food waste measures were high in this cohort in comparison to primary school children.
- High prevalence of single-use packaging in lunchboxes was broadly attributed to ultra-processed foods.
- The preference for UPFs superseded vegetables which was found to be the least preferred food group, as indicated by higher food waste measures.


### 6.3 Statement of authorship

| Title of Paper | Sneak Peek: Food, Waste, and Packaging Characteristics of <br> South Australian School Children's Lunchboxes |
| :--- | :--- |
| Publication Status | Submitted for publication |
| Publication Details | Neha K Lalchandani, Clare Hume, Lynne Giles, Jo <br> Hendrikx, Shona Crabb, Caroline Miller. Sneak Peek: <br> Food, waste, and packaging characteristics of South <br> Australian school children's lunchboxes. Public Health <br> Nutrition. (Submitted February 2023) |

## Principal Author

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| Contribution to the Paper | Conception and design of the study <br> Conceptualisation of research questions <br> Data collection <br> Data analysis <br> Manuscript writing <br> Editing and revisions <br> Corresponding author for publication process |
| Overall percentage (\%) | 65\% |
| Certification: | This paper reports on original research I conducted during <br> the period of my Higher Degree by Research candidature <br> and is not subject to any obligations or contractual <br> agreements with a third party that would constrain its <br> inclusion in this thesis. I am the primary author of this <br> paper. |
| Signature | Date |

## Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:
i. the candidate's stated contribution to the publication is accurate (as detailed above);
ii. permission is granted for the candidate in include the publication in the thesis; and
iii. the sum of all co-author contributions is equal to $100 \%$ less the candidate's stated contribution.

| Name of Co-Author | Clare Hume |  |
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| Contribution to the Paper | Conception and design of the study <br> Input regarding interpretation of results <br> Assistance with data synthesis <br> Revision of manuscript |  |
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| Contribution to the Paper | Design of the study <br> Assistance with site recruitment <br> Assistance with data collection <br> Second coder for inter-coder reliability testing <br> Input regarding interpretation of results <br> Revision of manuscript |  |  |  |
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| Name of Co-Author | Shona Crabb |  |  |
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| Contribution to the Paper | Conception and design of the study <br> Input regarding interpretation of results <br> Assistance with data synthesis <br> Revision of manuscript |  |  |
| Signature |  | Date | 10 February 2023 |

### 6.4 Publication under review


#### Abstract

Objective: This study characterizes the contents of school children's lunchboxes for food, waste, and packaging.

Design and Methods: A cross-sectional study was conducted. Lunchboxes were photographed at two time points on the same day: pre-morning/snack break to capture food and packaging, and post-lunch break to capture food waste. Contents were coded using an audit tool developed using REDCap, which captured unique food and packaging characteristics, as well as approximate food waste.


Setting: 23 sites across metropolitan Adelaide, South Australia including 14 preschools and 9 primary schools in low ( $\mathrm{n}=8$ ), medium ( $\mathrm{n}=7$ ), and high $(\mathrm{n}=8)$ socioeconomic areas.

Participants: Preschool (3-5 years) to Grade 7 (6-13 years) school students.

Results: 673 lunchboxes were analysed. Grain foods dominated, with $92 \%$ of lunchboxes having at least one item from that category, followed by fruits (78\%), snacks (62\%), dairy (32\%), and vegetables (26\%). Lunchboxes of preschool children contained more fruits (92\% vs $65 \% ; \chi 2(1)=73.3, \mathrm{P}<0.01)$, vegetables ( $36 \%$ vs $16 \% ; \chi 2(1)=34.0, \mathrm{P}<0.01$ ), and dairy items ( $45 \%$ vs $19 \% ; \chi 2(1)=53.6, \mathrm{P}<0.01$ ), compared to lunchboxes of primary school children. Snack foods were more prevalent in primary school children's lunchboxes (68\%) than preschool children's $(55 \% ; \chi 2(1)=11.2, \mathrm{P}<0.01)$. Half ( $53 \%$ ) of all packaging in lunchboxes was single-use packaging, commonly from snacks and grain foods. Preschool children had less single-use packaging and more food waste than primary school children. Vegetables were the most wasted food group.

Conclusions: These findings align with previous research indicating the prevalence of breads or sandwiches, fruits, savoury and sweet snacks in lunchboxes. Food and packaging waste correlated with the subpar nutritional quality of lunchbox foods. Uniting nutritional and environmental priorities in the context of school lunchbox contents may help advance both goals for many schools, improving children's health and sustainability.

Keywords: child, lunch, waste, packaging, schools, lunchbox, photography, Australia

## INTRODUCTION

Overall dietary quality among Australian children and adolescents has been found to be energy dense and nutritionally inadequate because of overconsumption of unhealthy foods and underconsumption of core foods (ABS, 2012; Johnson et al., 2017). Discretionary foods and beverages such as sugar-sweetened drinks, sweet baked goods, and savoury snacks that are high in sugar, fat, and salt (NHMRC, 2013) account for more than one-third of total energy intake among those aged 2-18 years (ABS, 2012; Johnson et al., 2017). National health survey data from 2018 indicated that, while $73 \%$ of children met the daily recommendation for two serves of fruit, only $6 \%$ met the recommended number of serves of both fruits and vegetables (ABS, 2019). Furthermore, because of the amount of time children spend at school, their schools are an important setting for the development of their food consumption behaviours.

In Australia, most school children bring a packed lunch from home (Bell \& Swinburn, 2004) and this school food model is also found in Norway (Fossgard et al., 2021), Denmark (Andersen et al., 2015), the Netherlands (van Ansem et al., 2013), and Canada (O'Rourke et al., 2020). Australian children consume approximately one-third of their daily energy intake
at school and $44 \%$ of this is from discretionary items (Manson et al., 2021). Prior research has consistently highlighted the overrepresentation of energy-dense foods (Bell \& Swinburn, 2004), energy-dense, micronutrient-poor snacks ('junk food') (Sanigorski et al., 2005), 'extra' (energy-dense) foods and drinks (Kelly et al., 2010), or extras (food that is low nutritional value and/or high in added fat, salt or sugar) (Brennan et al., 2010) in Australian children's school lunchboxes. Sanigorski et al. (2005) also identified that on average, a school lunchbox contained 3.1 servings of 'junk food' and Brennan et al. (2010) reported over 28\% of lunchboxes contained two or more servings of 'extras'. These trends have stayed consistent as per studies published more recently which have characterised lunchbox contents in large Australian samples to confirm the over-representation of discretionary items in children's lunchboxes, both in the early childhood education settings (Pearson et al., 2021) and primary schools (Manson et al., 2021; Sutherland et al., 2020). Different terms are used to describe 'discretionary' or non-core foods. Consistently these foods are intrinsically low in nutritional quality, industrially produced, hyper-palatable products accountable for displacing more nutritious core food items (Monteiro et al., 2019). Hereafter, these are referred to as ultraprocessed foods (UPFs), although we are aware of the emergent nature of the definition of UPFs and the evolving examples of food within this category (Gibney, 2019).

Inadvertently, UPFs have a range of environment-degrading effects (Anastasiou et al., 2022), and one that stands out is their single-use packaging. Seferidi et al. (2020) argue that while packaging allows for UPFs to be mass-produced, transported over long distances, and stored for long-terms, it is the avoidance of these foods in the first place, given they are 'nutritionally unnecessary', that will thereby decrease the environmental burden caused by such excess food packaging. While overconsumption of nutritionally inadequate UPFs in schools has been observed previously (Bell \& Swinburn, 2004; Brennan et al., 2010; Kelly et al., 2010; Machado et al., 2020; Monteiro et al., 2019; Sanigorski et al., 2005), the literature lacks
assessment of the amount and nature of packaging waste in lunchboxes that are synonymous with the consumption of those foods. There have been some USA studies which have audited food and packaging waste in the school cafeteria in the context of rising environmental concerns with the aim to divert school food waste from landfills (Boschini et al., 2018; Garcia-Herrero et al., 2019; Wilkie et al., 2015). However, lunchbox food waste assessment has been a gap identified in previous research (Brennan et al., 2010; Hubbard et al., 2014; Kelly et al., 2010). Whether children prefer to eat certain types of food and thus leave others uneaten will shed light on their food choices and provide insights into how closely their consumption patterns align with previously reported dietary trends and national guidelines.

In light of both the health and environmental considerations relating to children's school lunchboxes and their consumption of UPFs, the objectives of this observational study are: firstly, to conduct a current assessment of the food contents of packed lunches of preschool and primary school children; and secondly, to assess packaging and food waste associated with these lunchboxes. Overall, this study aims to quantify and characterise the types of food brought from home to school by preschool and primary school children, how they are packaged, and how much food is wasted.

## METHOD

## Study design and setting

This cross-sectional study involved observational audits of children's lunchboxes in government preschools and primary schools (hereafter "schools" unless comparisons made) in metropolitan Adelaide, South Australia. Data collection was undertaken between March and September 2021. Demographic data collected were limited to school type (i.e., preschool or
primary school), area-level socioeconomic status of schools (i.e., low, medium, high), class year level (i.e., grade), and age range of students in the class. Socioeconomic status (SES) was derived from the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) for Australia sourced from the Australian Bureau of Statistics (ABS, 2018).

## Recruitment procedure

Schools were recruited via convenience sampling and purposive sampling to ensure a spread of SES and school type. Schools were identified for invitation to participate either through prior connections of the school with KESAB environmental solutions or cold emailing followed up with cold calling. KESAB environmental solutions is a non-government organisation (NGO) delivering community-based environmental sustainability education programs, and is an industry partner for this study.

In the first instance, school administrators were emailed the relevant information and requested to seek participants to be involved in the study from their respective schools. Thus they forwarded the study details to the school principal or class teacher(s) whom they considered might be interested. Project information sheets and consent forms were included at this initial contact stage. Sites that confirmed interest in participation were then asked to provide children with a project flyer to take home to parents or guardians. The flyer outlined the project details and explained the nature and intent of the study. An opt-out form was provided if they did not wish for their child(ren) to participate, except for one preschool that requested for parents to be provided with consent forms instead.

In preschools, the entire group present on the date of audit were included in the study (excluding children whose parents had opted out). In primary schools, two classes from each school were selected to participate. The selection of classes was undertaken by the school. Schools were informed of the audit date and staff were requested not to inform children or
parents on which date the audit would take place, to reduce the likelihood of them changing their behaviour in terms of what they pack in their child(ren)'s lunchboxes (Brennan et al., 2010; Hubbard et al., 2014; Kelly et al., 2010).

## Data collection procedure

This study involved an observational method of data collection whereby lunchbox contents were recorded using photographs, similar to the protocol by Hubbard et al. (2014), the difference being that food contents remained in lunchboxes instead of being spread on to a placemat by the participants and they were not asked any additional information regarding their food. Children were asked to place their lunchbox wherever the school preferred to conduct the audit (either outdoors on a mat or on their desk in class), and they were requested to take the lids off containers and unwrap any opaque packaging (such as aluminium foil or paper bags). Children were also asked not to dispose of any uneaten food during the day. Individual lunchboxes were photographed twice: firstly, at the beginning of the school day or just before snack/fruit time in the preschools or recess time in the primary schools to capture the total contents of lunchboxes (Time 1, pre-consumption); and secondly, at the end of the lunch break (Time 2, post-consumption). Although the lunchbox photographs were the primary source of data for this study, additional notes were taken describing certain food and beverage items in case they were not clearly captured in the photograph.

The number of students present in class on the day of data collection, the number of lunchboxes, and number of students with canteen orders were also recorded. Lunch orders and purchases made from the school canteen were not studied. The information sheet specified clearly that the research did not intend to report individual student's or school's data, but broad and anonymous food-based and waste data would be reported. Accordingly,
no personal identifiers were collected. Any identifiers on lunchboxes (such as names stickers on lunchboxes or bags) were blurred.

## Data coding

A survey was designed using REDCap (Harris et al., 2009; Harris et al., 2019) to code photobased lunchbox data, details of which have been reported elsewhere (Author's Manuscript currently under review). In summary, lunchbox photographs were coded for presence and/or absence of the food and beverage category, followed by coding for specific items within the category. Food waste was also broadly coded and was defined as uneaten food captured at Time 2 (after lunchbreak was over and eating time ended). The packaging for a particular food and beverage item was also coded for presence and absence, and subsequently coded for description. Note: the category of reusables does not include coding of main bentostyle/compartmentalised lunchboxes or insulated/non-insulated lunch bags within which the main lunchbox or loose food items and separate/individual containers are placed, whereas small separate reusable containers were coded as reusables. Table 6.1 outlines the various categories of coding for this study.

Table 6.1 Categories for food and beverage, waste, and packaging coding

| Food and | 1) Vegetables (excludes mature form of peas and beans) |
| :--- | :--- |
| beverage | 2) Fruits |
| categories | 3) Grains or cereals |
|  | 4) Protein and alternatives (includes meat, seafood, poultry, eggs, and <br> mature types of legumes, beans and pulses) <br> 5) Dairy and alternatives (includes milk, yoghurt, cheese and their <br> alternatives) <br>  <br>  <br>  <br>  <br>  <br>  <br> 6) Snacks (or extras) i.e., light foods eaten between regular meals and <br> also includes many pre-packaged discretionary items <br> 7) Mixed meals i.e., items or dishes that contain multiple core food <br> ingredients |


|  | 8) Drinks (excludes reusable water bottle from home) |
| :--- | :--- |
| Waste categories | 1) No waste |
|  | 2) Some waste <br> 3) All waste |
|  | 4) Unidentifiable (data available, but food item underneath something <br> or in opaque container) <br> 5) Missing data (post- snack/lunch photo unavailable) |
| Packaging | 1) Reusables (containers children could bring food in again such as |
| categories (does | sandwich boxes and screw top containers, beeswax wraps). |
| not include main | 2) Organics (paper bags and wooden/bamboo cutlery, as well as <br> lunchboxes <br> 'natural' packaging of foods, such as fruit peels and skin or apple cores) |
| coded for | 3) Recyclables (cardboard or glass packaging, 10c drink containers) <br> presence/absence <br> elsewhere) |
| 4) Single-use/Landfill (soft plastic and squeeze pouches which would |  |
| typically go into landfill) |  |

## Data analysis

Descriptive statistics were used to characterise the schools and children that took part in the study. The contents of lunchboxes (including the prevalence of food and beverage, waste, and packaging categories as well as item descriptions) were summarised using counts and percentages. Chi squared tests for association were used to compare the presence of food and beverage, waste, and packaging categories by: 1) school type and 2) school SES.

For inter-rater reliability measure, calculations were derived for presence or absence of individual food and beverage items, whereas for waste and packaging, scores were designated before deriving an estimate. For every item in each lunchbox at Time 2, waste was scored as none (score $=0$ ), some $(0.5)$, or all waste $(1)$, or unidentifiable $/ \mathrm{missing}(0)$. A vegetable waste score was then calculated for each lunchbox by adding together the item waste scores, and then dividing by the number of vegetable items in the lunchbox. In this way, an average vegetable waste score was derived, with higher scores indicating more waste. Similar
derivations were used for the fruit, grain, protein, dairy, mixed, snack, and drink group items, and a total waste score across all eight major groups of lunchbox contents was then calculated by adding together the component waste scores. A packaging score for each lunchbox was calculated in a similar way. Each item in a food group was scored as having no packaging $($ score $=0)$, reusable packaging $(0.25)$, organic packaging ( 0.5 ), recyclable packaging (0.75), or single-use packaging (1). An average packaging score for each food group was then calculated by adding together the packaging scores and dividing by the number of items in that food group in the lunchbox. A total packaging score across the eight major groups was then calculated, with possible values ranging between 0 and 8 , such that higher scores indicated less desirable packaging (such as more prevalent single-use packaging).

The primary researcher (NKL) coded all lunchbox photos and $10 \%$ of the photos were randomly selected and coded by another researcher ( JH ) to evaluate reliability. The inter-rater reliability between the two coders was assessed using intraclass correlation coefficients (ICC) and $95 \%$ confidence intervals (CI). ICC values greater than 0.90 , between 0.75 and 0.9 , between 0.5 and 0.75 , and less than 0.5 were indicative of excellent, good, moderate, and poor reliability, respectively (Koo \& Li, 2016).

Statistical analyses were carried out using the STATA/MP version 17 (StataCorp, College Station, TX, USA).

## RESULTS

## Sample

A total of 111 sites were invited to participate ( 35 preschools and 76 primary), of which 23 sites agreed to be involved ( $21 \%$ consent rate). This included 14 preschools and 9 primary
schools in a range of socioeconomic areas (8 low SES - 4 preschools and 4 primary; 7 medium SES - 5 preschools and 2 primary; and 8 high SES - 5 preschools and 3 primary). Table 6.2 shows the sample characteristics. Out of the total sample of 728 children, only 14 parents declined participation ( $1.9 \%$ opt-out rate). A total of 681 lunchboxes were photographed, suggesting $93.5 \%$ of children brought a packed lunch from home. The analysis included 673 (87.1\%) lunchbox photographs, as initial (Time 1) photos were absent for 8 lunchboxes (1.2\%). Time 2 photos were absent for $11.7 \%$ of the sample, either due to nonattendance of child ( $\mathrm{n}=52$ ) or because children consumed all their food before Time 2 photos were taken ( $\mathrm{n}=28$ ). Nevertheless, Time 1 photos for these 80 lunchboxes were still coded for food/beverage and packaging attributes, but waste was coded as missing data. Figure 6.1 demonstrates examples of lunchbox photos captured at both time points.

Table 6.2 Characteristics of the sample of children and lunchboxes included in the audit analysis

| Characteristic | Preschool <br> $(\mathbf{n}=\mathbf{1 4})$ | Primary school <br> $(\mathbf{n = 9})$ |
| :--- | :---: | :---: |
| Year level | $\mathrm{n} / \mathrm{a}$ | 1 to 7 |
| Age range (years) | 3 to 5 | 6 to 13 |
| Children present (n) | 347 | 381 |
| Total lunchboxes (n) | 343 | 338 |
| Lunchbox photos captured at Time 1 and 2 (n) | 311 | 282 |
| Lunchbox photo missing at Time 1 or Time 2 (n) | $32^{*}$ | $56^{*}$ |
| No lunchbox (n) | 0 | 7 |
| Lunch order (n) | $1^{* *}$ | $50^{* *}$ |
| Parents opted-out (n) | 4 | 10 |
| ${ }^{* 3}$ preschool and 5 primary school lunchboxes were excluded from analysis due to missing Time 2 photos |  |  |
| ${ }^{* * 11}$ preschool child and 26 primary school children who had a lunch order also broughta a lunchbox packed from home |  |  |



Figure 6.1 Lunchbox photos capture at two time points-Time 1 (top row) and Time 2 (bottom row)

## Lunchbox Contents

## Prevalence of food and beverage category

The prevalence of foods and beverages from different categories is shown in Table 6.3, by school type (preschool, primary school) and area-level socioeconomic status (low, medium, high). This has been reported as the percentage of total lunchboxes $(\mathrm{N}=673)$ that contained at least one item from each of the food and beverage categories to indicate presence/absence. For the whole sample ( $\mathrm{N}=673$ ), grains or cereals appeared in $92.4 \%$, fruits in $78.3 \%$, snacks in $61.5 \%$, dairy in $32.2 \%$, vegetables in $25.9 \%$, protein in $9.2 \%$, drinks (other than water) in $4.6 \%$ and mixed meals in $1.2 \%$ of all lunchboxes.

Table 6.3 Presence of food and beverage categories in lunchboxes ( $N=673$ ), by school type and SES

|  | Vegetables | Fruits | Grains or cereals | Protein | Dairy | Snacks or extras | Mixed meals | Drinks |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Overall $\mathrm{N}=673 \mathrm{n}$ (\%) | 174 (25.9) | 527 (78.3) | 622 (92.4) | 62 (9.2) | 217 (32.2) | 414 (61.5) | 8 (1.2) | 31 (4.6) |
| Preschool $\mathrm{N}=340 \mathrm{n}$ (\%) | 121 (35.6) | 312 (91.8) | 318 (93.5) | 45 (13.2) | 154 (45.3) | 188 (55.3) | 3 (0.9) | 11 (3.2) |
| Primary $\mathrm{N}=333 \mathrm{n}$ (\%) | 53 (15.9) | 215 (64.6) | 304 (91.3) | 17 (5.1) | 63 (18.9) | 226 (67.9) | 5 (1.5) | 20 (6.0) |
| $\begin{aligned} & \chi^{2}(\mathrm{df}) \\ & \mathrm{P} \text { value }{ }^{1} \end{aligned}$ | $\begin{aligned} & \chi^{2}(\mathbf{1})=34.0 \\ & \mathbf{P}<0.01 \end{aligned}$ | $\begin{aligned} & \chi^{2}(1)=73.3 \\ & \mathbf{P}<0.01 \end{aligned}$ | $\begin{aligned} & \chi^{2}(1)=1.2 \\ & \mathrm{P}=0.27 \end{aligned}$ | $\begin{aligned} & \chi^{2}(1)=13.3 \\ & \mathbf{P}<0.01 \end{aligned}$ | $\begin{aligned} & \chi^{2}(1)=53.6 \\ & \mathbf{P}<0.01 \end{aligned}$ | $\begin{aligned} & \chi^{2}(1)=11.2 \\ & \mathbf{P}<0.01 \end{aligned}$ | $\begin{aligned} & \chi^{2}(1)=0.5 \\ & \mathrm{P}=0.46 \end{aligned}$ | $\begin{aligned} & \chi^{2}(1)=2.9 \\ & \mathrm{P}=0.09 \end{aligned}$ |
| Preschool |  |  |  |  |  |  |  |  |
| Low SES N=89 n(\%) | 22 (24.7) | 77 (86.5) | 84 (94.4) | 11 (12.4) | 49 (55.1) | 64 (71.9) | 1 (1.1) | 3 (3.4) |
| Medium SES N=129 n(\%) | 46 (35.7) | 120 (93.0) | 115 (89.1) | 17 (13.2) | 52 (40.3) | 64 (49.6) | 2 (1.6) | 8 (6.2) |
| High SES N=122 n(\%) | 53 (43.4) | 115 (94.3) | 119 (97.5) | 17 (13.9) | 53 (43.4) | 60 (49.2) | 0 (0) | 0 (0) |
| $\begin{aligned} & \chi^{2}(\mathrm{df}) \\ & \mathrm{P} \text { value }{ }^{2} \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=7.9 \\ & \mathbf{P}=0.02 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=4.5 \\ & \mathrm{P}=0.10 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=7.4 \\ & \mathbf{P}=0.02 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=0.1 \\ & \mathrm{P}=0.95 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=4.9 \\ & \mathrm{P}=0.09 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=13.5 \\ & \mathbf{P}<0.01 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=1.8 \\ & \mathrm{P}=0.41 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=7.7 \\ & \mathbf{P}=0.02 \end{aligned}$ |
| Primary school |  |  |  |  |  |  |  |  |
| Low SES N=122 n (\%) | 12 (9.8) | 63 (51.6) | 108 (88.5) | 4 (3.3) | 23 (18.9) | 83 (68.0) | 1 (0.8) | 9 (7.4) |
| Medium SES N=67 n(\%) | 14 (20.9) | 37 (55.2) | 64 (95.5) | 6 (9.0) | 13 (19.4) | 42 (62.7) | 2 (3.0) | 8 (11.9) |
| High SES N=144 n(\%) | 27 (18.8) | 115 (79.9) | 132 (91.7) | 7 (4.9) | 27 (18.8) | 101 (70.1) | 2 (1.4) | 3 (2.1) |
| $\begin{aligned} & \chi^{2}(\mathrm{df}) \\ & \mathrm{P} \text { value }{ }^{2} \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=5.5 \\ & \mathrm{P}=0.07 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=26.2 \\ & P<0.01 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=2.7 \\ & \mathrm{P}=0.26 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=2.9 \\ & \mathrm{P}=0.23 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=0.01 \\ & \mathrm{P}=0.99 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=1.2 \\ & \mathrm{P}=0.56 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=1.4 \\ & \mathrm{P}=0.50 \end{aligned}$ | $\begin{aligned} & \chi^{2}(2)=8.5 \\ & \mathrm{P}=0.01 \end{aligned}$ |

\% indicates percentage of lunchboxes containing at least one item from the food and beverage category

1. Chi square test of association between presence of food group and school type
2. Chi square test of association between presence of food group and SES category in preschool/primary school

When comparing preschools and primary schools, lunchboxes of preschool children were significantly more likely to contain fruits ( $91.8 \%$ vs $64.6 \% ; \chi^{2}(1)=73.3, \mathrm{P}<0.01$ ), vegetables ( $35.6 \%$ vs $15.9 \% ; \chi^{2}(1)=34.0, \mathrm{P}<0.01$ ), dairy items ( $45.3 \%$ vs $\left.18.9 \% ; \chi^{2}(1)=53.6, \mathrm{P}<0.01\right)$, and protein ( $13.2 \%$ vs $5.1 \% ; \chi^{2}(1)=13.3, \mathrm{P}<0.01$ ), compared to lunchboxes of primary school children. Snack foods were more prevalent in primary school children's lunchboxes (67.9\%) than preschool children's $\left(55.3 \% ; \chi^{2}(1)=11.2, \mathrm{P}<0.01\right)$.

Socioeconomic differences for food and beverage category presence also varied between preschools and primary schools. In preschools, presence of fruit was consistent across the three socioeconomic areas, but there was a significant difference in the presence of vegetables ( $43.4 \%$ in high SES vs $35.7 \%$ in medium SES vs $24.7 \%$ in low SES; $\chi^{2}(2)=7.9, \mathrm{P}=0.02$ ). Preschool children belonging to the most socio-economically disadvantaged areas had significantly more snack foods in their lunchboxes compared to their socio-economically advantaged counterparts ( $71.9 \%$ in low SES vs $49.6 \%$ in medium SES vs $49.2 \%$ in high SES; $\left.\chi^{2}(2)=13.5, \mathrm{P}<0.01\right)$. In primary schools, fruits were notably more prevalent in higher socioeconomic primary schools ( $79.9 \%$ in high SES vs $55.2 \%$ in medium SES vs $51.6 \%$ in low SES; $\left.\chi^{2}(2)=26.2, \mathrm{P}<0.01\right)$.

## Diversity of food and beverage items

There was a total of 3389 individual food/beverage items in the lunchboxes and the proportion of items in each category is presented in Figure 6.2. Of this total, grain food items were the most common ( $34.1 \%$ ) followed by fruits ( $25.5 \%$ ) and snacks ( $22 \%$ ). Table 6.4 provides details of the variety of items within each group that were frequently observed in the lunchboxes. For vegetables, cucumbers, carrots, and cherry tomatoes were the most common. For fruits, the top three were apples, bananas, and mandarins; but there was three times more variety in the types of fruits when compared to vegetables. For grains or cereals,
sandwiches/rolls/wraps were highly common, followed by savoury/sweet biscuits and crackers and baked goods. In the snacks category, potato chips (crisps), muesli bars, and grain/legume-based snacks were very common. Protein and dairy were limited in variety, with yoghurt and cheese being the most common items in the latter category. There were very few drink varieties or mixed meals. On average, children had one vegetable, one to two fruits, one to three grains or cereals item, one protein, one dairy, and one to two snacks in their lunchboxes. Almost every child had a water bottle, so they were neither assessed nor counted as drinks.


Figure 6.2 Proportion of different food groups observed based on total number of food items ( $N=3389$ ) in 673 lunchboxes

## Food Waste

Over half of vegetables had some or all waste (50.5\%), more so among preschoolers (56.8\%) compared to primary school children (35.1\%). Fruits were less wasted (36.8\%) in comparison to vegetables, but waste trends were higher in preschools (38.2\%) than in primary schools (33.8\%). Primary school children consumed more and wasted less of their lunchbox items in the grains or cereals, dairy, and snacks categories, compared to the preschoolers. Overall, snacks, dairy, and protein items were the food types most likely to be completely consumed. When examined by SES, the following differences were observed: Low SES preschoolers were more likely than high SES preschoolers to leave fruit and grain food waste. Further results are presented in Table 6.5.

## Packaging

Bento-style lunchboxes were more common among preschool children (54.7\%) versus primary children $\left(24 \% ; \chi^{2}(1)=66.3, \mathrm{P}<0.01\right)$, whereas lunch bags were common across both cohorts ( $77 \%$ for preschool and $69 \%$ for primary school), with some children bringing both. Table 6.6 provides an overview of the types of packaging (present or absent) in lunchboxes. Table 6.6 also presents the type of packaging that was used with different food types and items, to show the relationship between food type and packaging. Drinks, mixed meals, dairy (88.0\%) and snacks (85.8\%) were highly likely to be packaged, whereas fruits (33.3\%) and vegetables (32.0\%) were least likely to be packaged. Snacks made up the largest proportion ( $42.5 \%$ ) of the single-use packaging which would end up in landfill. Single-use packaging was also predominant for dairy foods and was frequently used for grains or cereals. Grains or cereals were packed in reusable containers almost as frequently as single-use packaging. Fruits and vegetables were predominantly packed in reusable containers, while all other food types, including drinks, snacks and dairy, were packed in reusable containers at least in some
instances. Fruits yielded the most (non-edible) organic waste. Recyclables were the least common packaging type found in lunchboxes, with the notable exception of drinks. When comparing packaging waste trends between preschools and primary schools, the latter had a higher proportion of single-use packaging within the grains and snacks category. Preschools had more reusable containers overall.

Table 6.7 lists the various packaging items within each category. There were 2569 individual items of packaging. Over half of the packaging items observed in lunchboxes were singleuse/landfill packaging ( $53 \%$; $n=1361$ pieces of packaging waste), $25.6 \%$ ( $n=658$ ) were reusables and $18.5 \%$ were organics $(\mathrm{n}=474)$. The most common reusable packaging was separate containers (85.3\%). Organics or compostable packaging made up $18.5 \%$ of overall observed packaging, with food scraps (i.e., fruit peels, rinds, and cores) constituting the highest proportion ( $92.6 \%$ ) of the organics category. Single-use packaging made up $60.2 \%$ of packaging items in primary school children's lunchboxes compared to $44.9 \%$ of packaging in preschoolers lunchboxes $\left(\chi^{2}(2)=60.45, \mathrm{P}<0.01\right)$. Overall, the single-use packaging category was dominated by soft plastic or silver lined wrappers ( $50.7 \%$ of the category and contributing $26.9 \%$ of all packaging), which contained items such as chips/crisps and bars (snacks). Re-sealable (zip-lock) plastic bags and cling wrap made up $22 \%$ of all single-use packaging, and was frequently used for items such as sandwiches and wraps (grains or cereals), present in both in preschools and primary schools. Squeeze pouches were a common source of single-use packaging in the preschool cohort (16.9\%) and a common type of packaging for flavoured yoghurts (dairy foods).

Table 6.4 Description and frequency of food and beverage items ( $N=3389$ ) in sample of 673 lunchboxes

| List of food and beverage items within each category | $\begin{gathered} \mathrm{n} \\ \text { pieces } \end{gathered}$ | \% of | \% of total items $\mathbf{N}$ |
| :---: | :---: | :---: | :---: |
| Vegetables [Total] | 269 | 100.0 | 7.9 |
| Cucumbers | 100 | 37.2 | 3.0 |
| Carrots | 68 | 25.3 | 2.0 |
| Tomato (includes cherry variant) | 44 | 16.4 | 1.3 |
| Others (e.g. capsicums, snow peas, celery, corn, dried seaweed, etc) | 57 | 21.2 | 1.7 |
| Fruits [Total] | 863 | 100.0 | 25.5 |
| Apples | 186 | 21.6 | 5.5 |
| Bananas | 154 | 17.8 | 4.5 |
| Citrus fruit (i.e., mandarin) | 141 | 16.3 | 4.2 |
| Berry fruit (i.e., strawberries) | 108 | 12.5 | 3.2 |
| Others (e.g. fresh grapes, watermelon, dried grapes, oranges, blueberries, etc) | 274 | 31.7 | 8.1 |
| Grains or cereals [Total] | 1155 | 100.0 | 34.1 |
| Regular breads, sandwiches, rolls, wraps, flat breads | 435 | 37.7 | 12.8 |
| Savoury biscuits and crackers (flour or wholegrain based) | 244 | 21.1 | 7.2 |
| Sweet biscuits, cookies, crackers, and wafers | 176 | 15.2 | 5.2 |
| Sweet baked products (e.g. cakes, muffins, slices, breads, buns, scrolls, doughnuts, pancakes) | 157 | 13.6 | 4.6 |
| Others (e.g. savoury topped breads, pastry products, fast food items, pasta and rice dishes, etc) | 143 | 12.4 | 4.2 |
| Protein [Total] | 68 | 100.0 | 2.0 |
| Processed meats (e.g. bacon, ham, salami, meatballs, fritz, sausages) | 47 | 69.1 | 1.4 |
| Crumbed meat product (e.g. nuggets) | 11 | 16.2 | 0.3 |
| Others (e.g. eggs, canned tuna, soybean products) | 10 | 14.7 | 0.3 |


| Dairy [Total] | $\mathbf{2 4 9}$ | $\mathbf{1 0 0 . 0}$ | $\mathbf{7 . 3}$ |
| :--- | :---: | :---: | :---: |
| Flavoured yoghurt | 121 | 48.6 | 3.6 |
| Cheese (i.e., hard and soft varieties) | 81 | 32.5 | 2.4 |
| Others (e.g. dairy desserts, Yakult ${ }^{\mathrm{TM}}$, plain yogurt, plain and flavoured milk, etc) | 47 | 18.9 | 1.4 |
| Snacks or extras [Total] | $\mathbf{7 4 5}$ | $\mathbf{1 0 0 . 0}$ | $\mathbf{2 2 . 0}$ |
| Potato or other vegetable chips/crisps/puffy snacks | 191 | 25.6 | 5.6 |
| Grain, cereal, fruit, nuts, or seeds bars | 183 | 24.6 | 5.4 |
| Grain or legume-based snacks/crisps/chips (includes popcorn) | 127 | 17.0 | 3.7 |
| Others (e.g. fruit leathers and straps, cheese and cracker snack packs, confectionery items, etc) | 244 | 32.8 | 7.2 |
| Mixed meals [Total] | $\mathbf{8}$ | $\mathbf{1 0 0 . 0}$ | $\mathbf{0 . 2}$ |
| Rice with vegetables/meat/egg, filled taco, soup | 8 | 100.0 | 0.2 |
| Drinks [Total] | $\mathbf{3 2}$ | $\mathbf{1 0 0 . 0}$ | $\mathbf{0 . 9}$ |
| Fruit or vegetable juices (reconstituted, made from concentrates, or with added sugar) | 21 | 65.6 | 0.6 |
| Others (e.g. breakfast cereal beverages, plain bottled water, soft drink (soda)) | 11 | 34.4 | 0.3 |

Table 6.5 Food waste measure of food and beverage items ( $N=3389$ ) by school type and SES

|  | Total n items (\%) | Preschool n items (\%) | Primary school n items (\%) | Preschool |  |  | Primary school |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | $\begin{aligned} & \text { Low } \\ & \mathrm{n}(\%) \end{aligned}$ | $\begin{gathered} \mathrm{Med} \\ \mathrm{n}(\%) \end{gathered}$ | $\begin{aligned} & \text { High } \\ & \mathrm{n}(\%) \end{aligned}$ | $\begin{aligned} & \text { Low } \\ & \mathrm{n}(\%) \end{aligned}$ | $\begin{gathered} \text { Med } \\ \mathrm{n}(\%) \end{gathered}$ | $\begin{aligned} & \text { High } \\ & \mathrm{n}(\%) \end{aligned}$ |
| Vegetables $\mathbf{n}$ (\%) | 269 (100) | 192 (71.4) | 77 (28.6) | 28 (14.6) | 69 (35.9) | 95 (49.5) | 17 (22.1) | 18 (23.4) | 42 (54.5) |
| No waste | 110 (40.9) | 65 (33.9) | 45 (58.4) | 9 (32.1) | 16 (23.2) | 40 (42.1) | 9 (52.9) | 8 (44.4) | 28 (66.7) |
| Some waste | 45 (16.7) | 37 (19.3) | 8 (10.4) | 4 (14.3) | 15 (21.7) | 18 (18.9) | 1 (5.9) | 3 (16.7) | 4 (9.5) |
| All waste | 91 (33.8) | 72 (37.5) | 19 (24.7) | 12 (42.9) | 30 (43.5) | 30 (31.6) | 5 (29.4) | 4 (22.2) | 10 (23.8) |
| Unidentifiable/ missing data | 23 (8.6) | 18 (9.4) | 5 (6.5) | 3 (10.7) | 8 (11.6) | 7 (7.4) | 2 (11.8) | 3 (16.7) | 0 (0) |
| $\chi 2$ (df) P value* ${ }^{12}$ |  | $\chi 2(2)=13.2 \mathrm{P}<0.01$ |  | $\chi 2(4)=6.5 \quad P=0.16$ |  |  | $\chi 2(4)=2.1 \quad P=0.71$ |  |  |
| Fruits | 863 (100) | 573 (66.4) | 290 (33.6) | 119 (20.8) | 216 (37.7) | 238 (41.5) | 79 (27.2) | 47 (16.2) | 164 (56.6) |
| No waste | 435 (50.4) | 268 (46.8) | 167 (57.6) | 45 (37.8) | 102 (47.2) | 121 (50.8) | 48 (60.8) | 21 (44.7) | 98 (59.8) |
| Some waste | 137 (15.9) | 105 (18.3) | 32 (11.0) | 25 (21.0) | 32 (14.8) | 48 (20.2) | 2 (2.5) | 4 (8.5) | 26 (15.9) |
| All waste | 180 (20.9) | 114 (19.9) | 66 (22.8) | 35 (29.4) | 36 (16.7) | 43 (18.1) | 21 (26.6) | 14 (29.8) | 31 (18.9) |
| Unidentifiable/ missing data | 111 (12.9) | 86 (15.0) | 25 (8.6) | 14 (11.8) | 46 (21.3) | 26 (10.9) | 8 (10.1) | 8 (17.0) | 9 (5.5) |
| $\chi 2$ (df) P value*12 |  | $\chi^{2}(2)=10.5 \mathrm{P}=0.01$ |  | $\chi 2(4)=10.4 P=0.04$ |  |  | $\chi 2(4)=12.8 \quad P=0.01$ |  |  |
| Grains or cereals | 1155 (100) | 608 (52.6) | 547 (47.4) | 161 (26.5) | 201 (33.1) | 246 (40.5) | 178 (32.5) | 108 (19.7) | 261 (47.7) |
| No waste | 666 (57.7) | 286 (47.0) | 380 (69.5) | 60 (37.3) | 98 (48.8) | 128 (52.0) | 130 (73.0) | 64 (59.3) | 186 (71.3) |
| Some waste | 221 (19.1) | 166 (27.3) | 55 (10.1) | 51 (31.7) | 45 (22.4) | 70 (28.5) | 14 (7.9) | 17 (15.7) | 24 (9.2) |
| All waste | 180 (15.6) | 118 (19.4) | 62 (11.3) | 41 (25.5) | 48 (23.9) | 29 (11.8) | 21 (11.8) | 10 (9.3) | 31 (11.9) |
| Unidentifiable/ missing data | 88 (7.6) | 38 (6.3) | 50 (9.1) | 9 (5.6) | 10 (5.0) | 19 (7.7) | 13 (7.3) | 17 (15.7) | 20 (7.7) |
| $\chi 2$ (df) P value*12 |  | $\chi 2(2)=81.8 \mathrm{P}<0.01$ |  | $\chi 2(4)=20.1 \mathrm{P}<0.01$ |  |  | $\chi 2(4)=6.8 \quad P=0.15$ |  |  |


| Protein | 68 (100) | 49 (72.1) | 19 (27.9) | 11 (22.4) | 19 (38.8) | 19 (38.8) | 4 (21.1) | 8 (42.1) | 7 (36.8) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No waste | 43 (63.2) | 33 (67.3) | 10 (52.6) | 7 (63.6) | 11 (57.9) | 15 (78.9) | 2 (50.0) | 3 (37.5) | 5 (71.4) |
| Some waste | 12 (17.6) | 10 (20.4) | 2 (10.5) | 3 (27.3) | 7 (36.8) | 0 (0) | 0 (0) | 0 (0) | 2 (28.6) |
| All waste | 5 (7.4) | 4 (8.2) | 1 (5.3) | 1 (9.1) | 1 (5.3) | 2 (10.5) | 1 (25.0) | 0 (0) | 0 (0) |
| Unidentifiable/ missing data | 8 (11.8) | 2 (4.1) | 6 (31.6) | 0 (0) | 0 (0) | 2 (10.5) | 1 (25.0) | 5 (62.5) | 0 (0) |
| $\chi 2$ (df) P value* ${ }^{12}$ |  | $\chi 2(2)=0.2 \mathrm{P}=0.88$ |  | $\chi 2(4)=7.7 \quad P=0.10$ |  |  | $\chi 2(4)=5.3 P=0.26$ |  |  |
| Dairy | 249 (100) | 179 (71.9) | 70 (28.1) | 59 (35.2) | 60 (31.5) | 60 (33.3) | 26 (37.1) | 13 (18.6) | 31 (44.3) |
| No waste | 156 (62.7) | 104 (58.1) | 52 (74.3) | 35 (59.3) | 30 (50.0) | 39 (65.0) | 18 (69.2) | 11 (84.6) | 23 (74.2) |
| Some waste | 18 (7.2) | 13 (7.3) | 5 (7.1) | 4 (6.8) | 6 (10.0) | 3 (5.0) | 2 (7.7) | 1 (7.7) | 2 (6.5) |
| All waste | 55 (22.1) | 45 (25.1) | 10 (14.3) | 18 (30.5) | 15 (25.0) | 12 (20.0) | 3 (11.5) | 1 (7.7) | 6 (19.4) |
| Unidentifiable/ missing data | 20 (8.0) | 17 (9.5) | 3 (4.3) | 2 (3.4) | 9 (15.0) | 6 (10.0) | 3 (11.5) | 0 (0) | 0 (0) |
| $\chi^{2}$ (df) P value*12 |  | $\chi 2(2)=4.5 \mathrm{P}=0.10$ |  | $\chi 2(4)=3.2 \quad P=0.53$ |  |  | $\chi 2(4)=1.1 \quad P=0.89$ |  |  |
| Snacks or extras | 745 (100) | 312 (41.9) | 433 (58.1) | 129 (42.8) | 102 (31.1) | 81 (26.1) | 183 (42.3) | 73 (16.9) | 177 (40.9) |
| No waste | 490 (65.8) | 161 (51.6) | 329 (76.0) | 68 (52.7) | 44 (43.1) | 49 (60.5) | 145 (79.2) | 44 (60.3) | 140 (79.1) |
| Some waste | 55 (7.4) | 45 (14.4) | 10 (2.3) | 16 (12.4) | 18 (17.6) | 11 (13.6) | 2 (1.1) | 1 (1.4) | 7 (4.0) |
| All waste | 133 (17.9) | 77 (24.7) | 56 (12.9) | 37 (28.7) | 26 (25.5) | 14 (17.3) | 17 (9.3) | 20 (27.4) | 19 (10.7) |
| Unidentifiable/ missing data | 67 (9.0) | 29 (9.3) | 38 (8.8) | 8 (6.2) | 14 (13.7) | 7 (8.6) | 19 (10.4) | 8 (11.0) | 11 (6.2) |
| $\chi^{2}(\mathrm{df}) \mathrm{P}$ value*12 |  | $\chi 2(2)=66.5 \mathrm{P}<0.01$ |  | $\chi 2(4)=6.2 P=0.19$ |  |  | $\chi 2(4)=20.8 \mathrm{P}<0.01$ |  |  |

1. Chi square test of association between approximate food waste amount and school type
2. Chi square test of association between presence of food group and SES category in preschool/primary school

Table 6.6 Presence of packaging category in relation to respective food and beverage categories for preschools and primary schools

| Food and beverage (F\&B) category | n items within F\&B category | n (\% items within F\&B category) |  | Packaging category <br> n and (\% items within packaging category) ${ }^{\#}$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Packaging absent | Packaging present | Reusable* | Organics | Recyclables | Single-use/Landfill |
| Vegetables | 269 | 183 (68.0) | 86 (32.0) | 67 (8.7) | 4 (0.8) | 1 (1.3) | 19 (1.4) |
| Preschool | 192 | 139 (72.4) | 53 (27.6) | 42 | 3 | 1 | 11 |
| Primary school | 77 | 44 (57.1) | 33 (42.9) | 25 | 1 | 0 | 8 |
| Fruits | 863 | 576 (66.7) | 287 (33.3) | 236 (30.8) | 440 (92.8) | 20 (26.3) | 47 (3.5) |
| Preschool | 573 | 365 (63.7) | 208 (36.3) | 184 | 239 | 11 | 21 |
| Primary school | 290 | 211 (72.8) | 79 (27.2) | 52 | 201 | 9 | 26 |
| Grains or cereals | 1155 | 361 (31.3) | 794 (68.7) | 341 (44.5) | 27 (5.7) | 2 (2.6) | 486 (35.7) |
| Preschool | 608 | 260 (42.8) | 348 (57.2) | 188 | 8 | 0 | 177 |
| Primary school | 547 | 101 (18.5) | 446 (81.5) | 153 | 19 | 2 | 309 |
| Protein | 68 | 37 (54.4) | 31 (45.6) | 17 (2.2) | 2 (0.4) | 0 (0) | 15 (1.1) |
| Preschool | 49 | 29 (59.2) | 20 (40.8) | 11 | 2 | 0 | 7 |
| Primary school | 19 | 8 (42.1) | 11 (57.9) | 6 | 0 | 0 | 8 |
| Dairy | 249 | 30 (12.0) | 219 (88.0) | 29 (3.8) | 1 (0.2) | 21 (27.6) | 195 (14.3) |
| Preschool | 179 | 25 (14.0) | 154 (86.0) | 24 | 1 | 10 | 133 |
| Primary school | 70 | 5 (7.1) | 65 (92.9) | 5 | 0 | 11 | 62 |
| Snacks or extras | 745 | 106 (14.2) | 639 (85.8) | 62 (8.1) | 0 (0) | 2 (2.6) | 578 (42.5) |
| Preschool | 312 | 86 (27.6) | 226 (72.4) | 34 | 0 | 0 | 192 |
| Primary school | 433 | 20 (4.6) | 413 (95.4) | 28 | 0 | 2 | 386 |
| Mixed meals | 8 | 0 (0) | 8 (100) | 12 (1.6) | 0 (0) | 0 (0) | 0 (0) |


| Preschool | 3 | 0 (0) | 3 (100) | 4 | 0 | 0 | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Primary school | 5 | 0 (0) | 5 (100) | 8 | 0 | 0 | 0 |
| Drinks | 32 | 0 (0) | 32 (100) | 2 (0.3) | 0 (0) | 30 (39.5) | 21 (1.5) |
| Preschool | 11 | 0 (0) | 11 (100) | 0 | 0 | 11 | 8 |
| Primary school | 21 | 0 (0) | 21 (100) | 2 | 0 | 19 | 13 |
| TOTAL | 3389 | 1293 (38.2) | 2096 (61.8) | 766 (100) | 474 (100) | 76 (100) | 1361 (100) |
| Preschool | 1927 | 904 (46.9) | 1023 (53.1) | 487 | 253 | 33 | 549 |
| Primary school | 1462 | $\begin{gathered} 389(26.6) \\ \chi 2(\mathbf{1})=1 \end{gathered}$ | $\begin{aligned} & 1073 \text { (73.4) } \\ & \mathbf{P}<\mathbf{0 . 0 1} \end{aligned}$ | 279 | 221 | 43 | 812 |

Table 6.7 Description and frequency measure of packaging items ( $N=2569$ ) in sample of 673 lunchboxes

| Packaging Type | Preschool $\mathrm{n}(\%)$ | Primary school n (\%) | Total $\mathrm{n}(\%)$ | Overall <br> $\%$ of N |
| :---: | :---: | :---: | :---: | :---: |
| Reusables | 387 (100) | 271 (100) | 658 (100) | 25.6 |
| Separate container* | 333 (86.0) | 228 (84.1) | 561 (85.3) | 21.8 |
| Reusable cutlery | 33 (8.5) | 24 (8.9) | 57 (8.7) | 2.2 |
| Stainless steel food flask | 9 (2.3) | 12 (4.4) | 21 (3.2) | 0.8 |
| Others (e.g. silicone bag/cup, cloth/cotton bag, beeswax wrap) | 12 (3.1) | 7 (2.6) | 19 (2.9) | 0.7 |
| Organics | 253 (100) | 221 (100) | 474 (100) | 18.5 |
| Food scraps | 236 (93.3) | 200 (90.5) | 439 (92.6) | 17.1 |
| Paper (wrapper/bag) | 3 (1.2) | 13 (5.9) | 16 (3.4) | 0.6 |
| Paper towel or tissue | 10 (4.0) | 6 (2.7) | 16 (3.4) | 0.6 |
| Others (e.g. compostable cutlery, certified compostable packaging) | 1 (0.4) | 2 (0.9) | 3 (0.6) | 0.1 |
| Recyclables | 33 (100) | 43 (100) | 76 (100) | 3.0 |
| Cardboard or carton | 21 (63.6) | 21 (48.8) | 42 (55.3) | 1.6 |
| 10cent drink container | 10 (30.3) | 16 (37.2) | 26 (34.2) | 1.0 |
| Others (e.g. hard plastic container, aluminium/steel tin or can, glass jar/bottle) | 2 (6.1) | 6 (14.0) | 8 (10.5) | 0.3 |
| Single-use or landfill | 549 (100) | 812 (100) | 1361 (100) | 53.0 |
| Soft plastic or silver lined wrapper | 232 (42.3) | 458 (56.4) | 690 (50.7) | 26.9 |
| Plastic resealable bags | 82 (14.9) | 110 (13.5) | 192 (14.1) | 7.5 |
| Mixed ( $\geq 2$ packaging elements) | 61 (11.1) | 62 (7.6) | 123 (9.0) | 4.8 |
| Squeeze pouches | 93 (16.9) | 25 (3.1) | 118 (8.7) | 4.6 |
| Cling wrap | 29 (5.3) | 79 (9.7) | 108 (7.9) | 4.2 |
| Muffin or cupcake case/ Parchment paper | 18 (3.3) | 24 (3.0) | 42 (3.1) | 1.6 |
| Foil (aluminium, paper lined) | 17 (3.1) | 21 (2.6) | 38 (2.8) | 1.5 |
| Others (e.g. small plastic or condiment packaging, plastic straw, cutlery, small tins or cans, etc) | 17 (3.1) | 33 (4.1) | 50 (3.7) | 1.9 |
| TOTAL | 1222 | 1347 | 2569 | 100\% |

*This table includes the adjusted count for separate containers

## Inter-coder reliability measure

Across the 68 lunchboxes that were dual coded, 153 ICC estimates were derived for presence/absence of food and beverage items. Of the 153 values, 124 were greater than 0.9 (excellent reliability), 4 were between 0.75 and 0.9 (good reliability), 10 were between 0.5 and 0.75 (moderate reliability), 2 were less than 0.5 (poor reliability), and 13 were not calculable due to insufficient observations ( $\mathrm{n}=0-2$ ) for the specific item. Vegetables and fruits constituted over half (55\%) of the excellent coding estimate, followed by snacks or extras ( $20 \%$ ), and grains or cereals ( $12.5 \%$ ). The latter two were also the predominant constituents of the moderate ICC estimate ( $50 \%$ and $40 \%$ ). The ICC estimate was 0.979 ( $95 \%$ CI 0.967 0.987 ) for total waste and 0.976 ( $95 \%$ CI $0.960-0.985$ ) for total packaging.

## DISCUSSION

The current study extends the literature through the addition of an environmental dimension to standard lunchbox assessments, done by the examination of the under-studied aspect of lunchbox foods i.e., food waste and packaging. This lunchbox contents data also presents an update to the most recent previous studies which were published near a decade ago (Brennan et al., 2010; Hubbard et al., 2014; Kelly et al., 2010; Sanigorski et al., 2005), and this South Australian data also complements more recent published research from New South Wales (Pearson et al., 2021; Sutherland et al., 2020) and nationally (Manson et al., 2021). Dietary patterns of school children have often not been in alignment with dietary guidelines, and the results of this study confirm this trend. Findings from this lunchbox assessment are consistent with previous studies which showed low consumption of vegetables and high consumption of snacks by children in Australia and New Zealand (Bell \& Swinburn, 2004; Brennan et al., 2010; Dresler-Hawke et al., 2009; Hubbard et al., 2014; Kelly et al., 2010; Sanigorski et al.,
2005) and also supports results from consecutive Australian Health Surveys (ABS, 2019). Consistent with the bin content analysis in New Zealand by Dresler-Hawke et al. (2009), where fruit and vegetables were mostly thrown away, waste results reported in this study affirm that children are often not consuming vegetables, even when they are sent from home and present in lunchboxes (which had occurred $25.9 \%$ of the time). Promisingly, a high proportion of children's lunchboxes contained fruit (78.3\%), but greater emphasis needs to be placed on vegetable consumption as well, in line with dietary guidelines. The rates of wastage of fruit and vegetables, if unconsumed by children, are likely to be a barrier to provision for many parents.

What has also remained consistent is the composition of a typical school lunch which includes a sandwich, fruit, savoury snacks and sweet treats, while mixed meals (such as leftovers) remain uncommon (Dresler-Hawke et al., 2009; Hubbard et al., 2014). There is a notable and encouraging absence of sugar-sweetened beverages in our sample of preschools and primary schools in comparison to previous studies (Bell \& Swinburn, 2004; Hubbard et al., 2014; Kelly et al., 2010; Sanigorski et al., 2005). This is likely to be because of school level policies actively discouraging such beverages and/or prohibiting such beverages from canteen sales, and flow-on effect into social norms in the schools. Savoury snacks like potato chips (crisps) and muesli/fruit bars were common in lunchboxes. The associated environmental implications of these pre-packaged foods are particularly noteworthy. These food choice patterns coincide with existing literature which notes children's consumption trends towards pre-packaged ultra-processed foods. As Sanigorski et al. (2005) also observed, children are not bringing just one but multiple snacks of these types, which has both nutritional implications and environmental implications from packaging. It is noteworthy that these UPFs were among the least wasted, indicating they were being consumed by children, which potentially reinforces
parents wanting to pack food that their children like, will eat, and will not result in food wastage.

As part of sustainability efforts in preschools and primary schools, Australian children are encouraged to bring 'nude' foods on specific days, and in general. This means bringing foods with either no packaging or reusable packaging only. There was higher presence of 'nude' or unpackaged foods in reusable containers or bento-style compartmentalised lunchboxes in preschools in comparison to primary schools. The difference is worth highlighting as it brings to the forefront the various factors influencing lunchbox packing practices between the two cohorts. Lalchandani et al. (2022) noted stronger presence and implementation of food policy in preschools compared to primary schools, which is reflected in the lunchbox contents observed in this study. The transition from preschool to primary school seems to impact what children bring in their lunchboxes in terms of nutritional quality and whether foods are prepackaged or not. This is likely to be due, at least in part to more explicit policy in place in preschools, as well as social norms in these settings and children's preferences for certain foods. For instance, a noteworthy difference between preschool and primary school settings that was observed through this study, was the differences in eating times and presence or absence of teacher supervision. Preschool eating times is longer and less structured than primary schools where eating time is often reduced to 10 minutes and children are unsupervised by teachers during the break. There are other factors such as older children being more involved in food choices and some even packing their own lunchboxes. Despite varying circumstances, there is potential for school-based reforms such as the continuation of policies from preschools into primary schools to encourage the continued consumption of nutritious and unpackaged foods into primary year levels, keeping in mind the growing autonomy of children's choices as they progress with age.

There were relatively few differences in lunchbox food contents observed by socioeconomic status. Vegetables and fruits were more prevalent in high SES schools. Preschool children in high SES areas brought more vegetables than lower SES counterparts, and in primary schools, there were more fruits in high SES areas. Snacks were more prevalent in preschoolers' lunchboxes in lower SES areas, but there was no difference by SES for primary school children, where they were common (61.5\%) across the board. SES is associated with prevalence of overweight and obesity in children according to Australian Institute of Health and Welfare (AIHW, 2018). Evidence suggests that low SES also has associations with the overall dietary quality among school children (Sanigorski et al., 2005), where consumption of fruits and vegetables is often compromised, hence calling for targeted health interventions there (Ghosh et al., 2016; Zarnowiecki et al., 2014). However, the dominance of pre-packaged snack foods in primary school lunchboxes, and across low and high SES areas overall, suggests that interventions should target students and schools in all areas by combining both health and environmental agendas together.

This study was able to draw tangible parallels between the types of food packed in school lunchboxes, consumed versus unconsumed foods that contributed to lunchbox food waste, and the prevalence of various packaging types of foods and beverages in lunchboxes. There is increased recognition of the importance of addressing nutrition early in life, and of healthy eating interventions directed to preschools, childcare centres and primary schools (Chaudhary et al., 2020; Mikkelsen et al., 2014; Nathan et al., 2019; Roseman et al., 2020). What seems to be missing is the attachment of the environmental consideration to healthy eating interventions, so the importance and connection of both agendas are realised for health promotion. One way to create positive dietary behaviour change could be to encourage an increase in the consumption of unpackaged foods and a decrease in the consumption of prepackaged and often UPFs, which may ultimately have positive implications for health and the
environment. To increase packing and consumption of unpackaged foods, targeted interventions to provide support or encouragement may be useful for lunchbox packers, either parents or children, to pack waste-free lunches, replace disposable packaging options with reusable ones, while driving consumption of nutritious core foods. Lalchandani et al. (2023a) recently reviewed ten studies that considered food and packaging waste in the context of lunchboxes; the scoping review highlighted the possibility of mobilizing the health and sustainability nexus by running interventions that are accessible and feasible for families to implement in their everyday life, encourage participator behaviours by children when it comes to lunchbox food choices and packing, and considering wider social influences when it comes to public health behaviours. However, whether environmental conservation in the context of lunchbox packing is a priority and the extent to which interventions or strategies are sought by parents and children, needs further investigation. Future research can explore what the perceived barriers are to packing lunchboxes that are in line with dietary guidelines and consist of minimal or no packaging.

## STUDY LIMITATIONS

The current study has several limitations. This study only audited lunchboxes of public preschool and primary school children in one state of Australia; although a majority of schools in the state are government schools, the lunchbox contents of private, faith based and independent schools' children were not assessed. Hence, this study sample may not be representative of the entire Australian population. Instead of micro-analysis of lunchbox contents where food items are weighed and recorded in detail for macro- and micro-nutrient composition, as per previously implemented protocols (Evans et al., 2010; Farris et al., 2015; Kelly et al., 2010; Sanigorski et al., 2005), this study did not include any detailed accounting
for food. For instance, sandwiches and wraps were not unwrapped or disassembled to analyse fillings, so it is anticipated that the protein group and to some extent dairy (cheese) might be underrepresented.

While this study was able to measure food consumption at school, children could have consumed any uneaten food left in the lunchbox during the latter part of the school day, on their way home, or at home as an afternoon snack. Hence, this food may not have been wasted as suggested by this study. There were also some limitations in collecting waste data at school, mainly because a lot of food items such as sandwiches, fruits, and snacks are highly portable (allowing children to consume them on their way to play); thus children may not have adhered to the request of leaving any uneaten foods in their lunchboxes, or they may have disposed of fruit peels and cores in the organics bins on site, meaning there was no way to determine the extent of the waste. Moreover, this study was unable to determine the fate of waste and packaging. There are multiple streams for various packaging to be recycled, but this study did not capture how the waste could have potentially been recycled and diverted from landfill (for instance, soft plastic recycling or the South Australian 10-cent container deposit scheme where drink cans and containers can be recycled in exchange for money). It is also notable there was a fruit fly outbreak in Adelaide during 2020-2021, which interrupted data collection to some extent. At the start of the school term in the last week of January 2021, there were restrictions on which fruits and vegetables could be packed in children's lunchboxes as fruit movement bans were announced across Adelaide. These restrictions led to some confusion but eventually, most schools navigated this impediment and lifted fruit bans while encouraging the disposal of fruit scraps on-site to restrict movement of fruit between geographical areas. In the last week of April 2021, data collection re-
commenced. The fruit fly outbreak and restrictions may or may not have caused differences in lunchbox contents during the data collection phase.

Regardless of limitations, the reliability of the tool developed for this study was tested and indicative of mostly excellent agreement, suggesting that individual coders made consistent observations with respect to coding the lunchbox photos. Lastly, this study was able to present an update on lunchbox contents data to guide future research and interventions.

## CONCLUSIONS

Overall, preschoolers' lunchboxes were nutritionally superior, however food waste measures were high in this cohort in comparison to primary school children. Single-use packaging were dominant in lunchboxes due to UPFs, and vegetables were the least preferred food group, as indicated by higher food waste. Given that school-based dietary trends of children are consistent with previous research, reducing waste in school lunchboxes can easily dovetail with public health nutrition goals. There is utility in studying the current school food environment to guide the development of school-based programs and interventions, in particular interventions that improve the quality of foods brought from home to school, not just for children's health but also for the environment. Understanding the multiple determinants of parental (or even children's) lunchbox packing behaviour is critical to understand the barriers and facilitators to packing an environmentally friendly lunchbox for improved health and environmental outcomes. Future research can also examine the extent to which children are responsible for packing their own lunches. There is also potential to further mobilize intersectionality of health and sustainability in school food policies and programs.

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Conflicts of Interest: None.

Ethical Standards Disclosure: This study was conducted according to the guidelines laid down in the National Statement on Ethical Conduct in Human Research (2007) in accordance with the National Health and Medical Research Council Act 1992. All procedures involving research study participants were approved by the Human Research Ethics Committee at the University of Adelaide (Approval Number H-2020-167). The Department for Education, South Australia also granted approval to conduct this research project and access Department for Education sites (Reference No: 2020-0036). An opt-out approach was utilised because of the low risk associated with the research, and the study aligns with all opt-out consent requirements as outlined in Chapter 2.3 within the National Statement on Ethical Conduct in Human Research. Parents who did not wish for their child(ren) to participate signed an optout form and returned it to the school, and the student researcher was informed. A preschool
indicated they preferred an opt-in consent approach; so, a consent form was sent to parents to sign to confirm their children's participation. Additionally, verbal consent from children in class was witnessed by the class teacher and formally recorded by the student researcher prior to data collection.

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## 웅 후웅 웅

## CHAPTER 7: FAMILIAL CONTEXT

## STUDY 4

Family Perspectives on Packing a Low-Waste and Nutritious School Lunchbox

### 7.1 Preface

This study investigated parent-child home-based lunchbox packing perspectives and practices to uncover the external influencing and intrinsic motivating factors to pack both a nutritious and low-waste lunchbox. Along with barriers and facilitators, the dialogue for potential school-based policy and structural reforms were raised. This study rounded out the entire research program (after having captured the school policy/program context and the school lunchbox contents) and provided insights of the home-environment and familial contexts within which lunchbox packing decisions are made. The manuscript presented in this chapter adhered to the formatting style as required by the target journal, including the reference list of the manuscript.

### 7.2 Highlights

- School food policies and programs often influenced what food parents would pack in the lunchboxes, and school waste policies and programs influence what parents might pack and what children would prefer to eat.
- Preschool level policies were found to be stronger and more comprehensive, particularly with regards to 'nude foods'. The absence of bins on school grounds were another enabler to packing and consuming 'nude foods'.
- Parents are faced with multiple priorities, including catering to their children's food preferences, minimising waste, considering cost and time factors, and ensuring their children are consuming nutritionally adequate food. Ultimately, despite these competing priorities, meeting children's food preferences dominated within the 'Hierarchy of Motivations', health and nutrition came second, and then sustainability considerations were exhibited.
- The study also highlights that the dimension of eco-friendliness adds another layer of complexity to the already challenging task of packing school lunchboxes. Therefore, assisting parents in meeting their priorities of nutrition and planetary health may be a way forward.


### 7.3 Statement of authorship

| Title of Paper | Family Perspectives on Packing a Low-Waste and <br> Nutritious School Lunchbox |
| :--- | :--- |
| Publication Status | Drafted for submission |

## Principal Author

| Name of Principal Author <br> (Candidate) | Neha Kishan Lalchandani |  |  |  |
| :--- | :--- | :---: | :---: | :---: |
| Contribution to the Paper | Conception and design of the study <br> Conceptualisation of research questions <br> Data collection <br> Data analysis <br> Manuscript writing <br> Editing and revisions <br> Corresponding author for publication process |  |  |  |
| Overall percentage (\%) | $80 \%$ |  |  |  |
| Certification: | This paper reports on original research I conducted during <br> the period of my Higher Degree by Research candidature <br> and is not subject to any obligations or contractual <br> agreements with a third party that would constrain its <br> inclusion in this thesis. I am the primary author of this <br> paper. |  |  |  |
| Signature | Date |  |  | 10 February 2023 |

## Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:
i. the candidate's stated contribution to the publication is accurate (as detailed above);
ii. permission is granted for the candidate in include the publication in the thesis; and
iii. the sum of all co-author contributions is equal to $100 \%$ less the candidate's stated contribution.

| Name of Co-Author | Caroline Miller |  |  |
| :--- | :--- | :--- | :--- |
| Contribution to the Paper | Conception and design of the study <br> Input regarding interpretation of results <br> Assistance with data synthesis <br> Revision of manuscript |  |  |
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| Signature |  | Date | 13 February 2023 |


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| Contribution to the Paper | Conception and design of the study <br> Assistance with themes development <br> Input regarding interpretation of results <br> Assistance with data synthesis <br> Revision of manuscript |  |  |
| Signature |  |  |  |

### 7.4 Publication draft


#### Abstract

There is limited understanding of the factors impacting preparation of a nutritious and lowwaste school lunchbox at home. Through semi-structured interviews, this study explored the experiences of 16 South Australian families (mostly parent-child dyads), who shared their views on lunchbox preparation practices and food choices. Each interview recording was transcribed verbatim. Data were coded into distinct categories to identify any major themes. The study used a critical realist lens and data were analysed using an inductive, thematic approach. Analysis yielded three main themes; 1) Extrinsic factors and school environment structures; 2) Intrinsic factors and a 'Hierarchy of Motivations'; 3) Location of responsibility for change. A range of external factors influenced familial lunchbox packing practices, competing personal priorities dictated what foods were packed in lunchboxes and if they were devoid of packaging, and the pivoting responsibility of feeding children at a personal, familial, and school level were discussed. Findings of this study indicate that pre-existing challenges associated with lunchbox packing practices prevent the prioritisation of environmental sustainability amidst competing personal priorities and external dissuading factors. Where the responsibility for change lies, in the context of improving nutrition and decreasing packaged foods in lunchboxes, warrants further research. This study provides initial information on which future research can build to improve nutrition while reducing waste in the context of school lunchboxes.


## INTRODUCTION

A packed lunch is a meal that children bring to school from home for consumption during their lunch break. This school food model is dominant in Australia (Metcalfe et al., 2008), making lunchboxes an important index of children's dietary intake, one third of which occurs during school hours (Manson et al., 2021). Although children are away from home at the time of eating, the lunchbox draws together home, school, parent, and child (Metcalfe et al., 2008). Parents are known to be the gatekeepers of children's nutritional habits (Gerards \& Kremers, 2015) and usually pack their children's lunchboxes. However, as children grow, they are more likely to pack their own lunchboxes and there is also an increasing degree of agency exercised by children when choosing what to eat (Bathgate \& Begley, 2011; Ensaff et al., 2018), which in turn influences food selection behaviours of parents.

Previous research has explored parental perceptions of lunchbox preparation. Through focus group discussions with parents of young children who attended low socioeconomic status (SES) schools in Perth (Western Australia), Bathgate and Begley (2011) recognised a number of barriers to providing a healthy school lunchbox. Their findings were echoed by Ensaff et al. (2018), who also conducted focus groups plus individual interviews with parents in the United Kingdom, and Hawthorne et al. (2018) who identified factors influencing Canadian parents' lunchbox packing practices via self-administered surveys. Parents mentioned children's food preferences as the top factor driving lunchbox food decisions across the three studies (Bathgate \& Begley, 2011; Ensaff et al., 2018; Hawthorne et al., 2018). Both Bathgate and Begley (2011) and Hawthorne et al. (2018) also mentioned personal convenience, time and financial constraints, and the lack of refrigeration and reheating options in the school setting, as dissuading factors working against including 'healthy foods' in lunchboxes and, instead, encouraging reliance on pre-packaged food. Additionally, peer pressure, lack of nutritional knowledge, limited grocery shopping ideas, and the unappetising appearance of
healthy food (Cleghorn et al., 2009) were reported to dispose parents towards pre-packaged food items that appeal more to children (Edwards et al., 2013). The provision of discretionary foods as a reward for good behaviour was also an identified influence on parents (Birch et al., 2007). The eating time allocated at school (Bathgate \& Begley, 2011) and school allergy policies (Hawthorne et al., 2018) were additional barriers to packing 'healthy' school lunches; the latter an issue that is increasingly found in other developed countries including Australia, where allergy management occurs throughout the school or by class-specific rules (Aydin et al., 2022).

A secondary analysis of American parents' survey data by Horning et al. (2017) found that parents were more likely to purchase pre-packaged processed meals due to time constraints and family preferences, compounded by reasons such as the lack of cooking and meal preparation skills. Indeed, it seems increasing confidence in cooking is an effective healthy eating promotion strategy, as Martins et al. (2020) found it a protective factor to decrease ultra-processed food consumption among children.

Many studies have recommended the need to understand the multiple determinants of food packing behaviours, including constraints faced by families (Hubbard et al., 2014). Furthermore, although barriers and facilitators (including perceived, physical, and social) for lunchbox packing practices are known from a health and nutrition perspective (Casado \& Rundle-Thiele, 2015; Hawthorne et al., 2018), what is not known is the influence of environmental concerns on the inclusion of packaged food, nor the combined influence of both nutrition and sustainability interests. Parents' and children's perspectives on environmental waste and the sustainability of packed lunches largely remain unexamined.

Moreover, although parents are the primary decision-makers of lunchbox contents, it is equally important to understand children's perspectives as they are the consumers of lunchbox
contents and influencers of parents' behaviour, and some older children may be packing their own lunchboxes. This point has been corroborated by Waddingham et al. (2015; 2018), who gathered rich information directly from children to understand why they made certain food choices from the school canteen (particularly "sometimes" or unhealthy foods). However, children's insights about lunchbox packing were not studied.

Therefore, looking beyond just health and nutrition, this exploratory qualitative study aimed to unpack primary school parents' and children's perspectives about food, packaging, and waste in lunchboxes. It sought to gain understanding of the factors influencing lunchbox packing, and to identify the contradictory and complementary facilitators for providing lowwaste and nutritious foods in lunchboxes.

## METHODOLOGY

## Study design and theoretical position

Drawing on semi-structured interviews to explore family perspectives, this research was guided by a critical realist epistemology, a meta-theoretical approach to qualitative research in which the researcher's own beliefs and ideas remain independent of the reality that is being explored, to yield an objective representation of participants' experiences (Braun \& Clarke, 2021, p. 169). Thus, although participants were aware that the researchers were interested in their perspectives on lunchbox food, packaging, and waste, NKL did not discuss their food science and nutrition expertise, and used unconditional positive regard (Rogers, 1959) during interviews, suspended judgement via verbal and non-verbal cues, and maintained a respectful and neutral stance towards participants' responses-to create an encouraging environment for effective sharing. The healthy/unhealthy food pedagogy was not put forward, as these definitions vary; which is why this study does not provide a definition for the same. This was
an exploratory study which meant no expectations or hypothesis testing occurred; the aim was to understand the everyday family dealings in lunchbox packing and consumption practices, via a reflexive thematic analysis process guided by Braun and Clarke (2021).

## Setting and participants

Interviews were conducted online between August and October 2022, and included families across South Australia. Parents and their primary school aged child(ren) (from any type of school, including public and private; and in year levels 3-6) were invited to participate in this study. We aimed to recruit the parent usually responsible for the lunchbox food shopping and packing, and mostly mothers registered interest to participate, in line with current literature indicating they predominantly carry out these roles (Bathgate \& Begley, 2011). This study was open to families from any socioeconomic area; socioeconomic status was derived from the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) for Australia sourced from the ABS (2018) by matching participants' postcodes to Socio-Economic Indexes for Areas (SEIFA) scores.

## Recruitment

Recruitment of participants occurred via a public Facebook page
(https://www.facebook.com/Lunchbox-Conversations-105994368857312) created specifically for this study, which posted the project flyer and a Google Form link for parents to express interest and indicate availability for an interview. The project's industry partner KESAB environmental solutions also assisted with promoting this study, via their social media channels and directly to relevant schools with whom they were engaging. Schools were emailed a flyer including a short project summary and the Facebook page link for parents to register their interest.

Registrants were emailed to arrange an interview time, and to provide the participant information sheet and consent form for parents, child-friendly project flyer, and third-party consent forms for parents to complete on behalf of their children. Parents were asked to discuss involvement in the research with their child by showing them the flyer. Potential participants who did not reply to the initial email were sent one follow-up email. Those who still did not respond were classed as no longer interested, with no further communications sent.

Typically, interviews were held with one parent and one child from each family, but other parent(s) or children were included if they wished to participate. Only participants who were able to speak and comprehend conversational English were interviewed. All parents provided informed written consent prior to the interview, for themselves and on behalf of participating children. Additionally, before commencing the interview, the research was explained to the child by NKL, any questions welcomed, and verbal assent requested from the child. Families were reimbursed for their time with a $\$ 30$ gift card.

## Interview schedule

The research team developed an interview schedule based on the study aims (see Appendix C.1). The schedule included questions about lunchbox packers and household food decisionmakers, priorities, and preferences when packing and consuming lunchbox foods, thoughts on 'nude food', difficulties involved in packing a nutritious and low-waste lunchbox, and thoughts about children packing their own lunchboxes. Additionally, based on the flow of the conversation, thoughts around reusable containers, school bins, and food packaging disposal were prompted. Potential changes at the school level were also explored, as was the concept of eco-friendliness as a lunchbox priority.

## Data collection and procedure

Data were collected through semi-structured interviews, conducted via Microsoft Teams, and using the interview schedule as a guide. Probing technique (Lingard \& Kennedy, 2010) was purposefully implemented using follow-up questions to elicit responses from participants, especially when questions were close-ended or certain aspects required elaboration. Interviews were audio and video recorded as well as auto-transcribed by Microsoft Teams. NKL cleaned the transcripts by listening to recordings again and correcting any errors. Pseudonyms were also integrated at this stage, as well as anonymising any other identifying features relating to participants and school sites. Transcripts were de-identified using a unique naming convention to ensure confidentiality (e.g., Lunchbox Conversations 01, Female Parent1, Male Child1 Age 11 Year 5, MedSES, Public School). Prior to analysis, transcripts were sent to participants who requested opportunity for review. The average interview lasted 27 minutes (range 16-39) and no follow-up interviews were conducted. As interviews were conducted and transcripts finalised, reflexivity was employed to assess the quality of the dataset being gathered for richness and depth, guided by information power (Malterud et al., 2016). Through this process, the research team determined that conceptual depth (data saturation) was reached at interview 16 in relation to the emergent constructs of interest (Nelson, 2017).

## Data analysis

Interview transcripts were imported into NVivo ${ }^{\mathrm{TM}}$ (Version 20 QSR International) to support data management, coding logging, and analysis. Data were analysed using Braun and Clarke's updated thematic analysis method (Braun \& Clarke, 2021) using a critical realism lens. This involved: (1) a process of careful reading by NKL to develop familiarisation with the data; (2) line-by-line coding to form initial code labels using an inductive approach; and (3) conducting another round of coding (going through the data set in a different order) to refine the code
labels (Braun \& Clarke, 2021, p. 70). Sorting and clustered patterning of codes across the dataset led to development of candidate themes. These initial themes were then refined to generate settled themes (Braun \& Clarke, 2021, p. 79), followed by categorising them into levels (i.e., key themes and subthemes). Illustrative quotes from the dataset were extracted to complement each theme and subtheme. NKL and SC met regularly to discuss and guide the analysis process and substantiate the findings, while preventing biases of a single researcher influencing data interpretation (Elo \& Kyngäs, 2008).

## RESULTS

## Overview of participants and lunchbox contents

Conceptual depth (data saturation) was reached at interview 16 whereby sufficient depth of understanding was achieved in relation to the emergent constructs of interest (Nelson, 2017). Table 8.1 shows the characteristics of the sample involved in this study. Participants were 16 parents ( $94 \%$ females; $6 \%$ males) and 15 children ( $60 \%$ females; $40 \%$ males); one set of children declined participation and hence only the parent from that family was interviewed. Seventy-five percent of families had children attending government (alias public) schools and more than half of them belonged to a high SES area. Children's age ranged between 8 to 12 years, with an almost equal representation of Years 3, 4, and 5, and the least in Year 6. Lunchbox packers were parents (mostly mothers), both child and parent, or children themselves. Mostly, lunchboxes were reported to contain a sandwich (either filled with a protein and some salad or a sweet spread like jam or honey), cut up vegetables, fruits, savoury snacks such as crackers or pretzels, and a sweet baked good like a cookie or muffin.

Table 8.1 Characteristics of participants interviewed

| Participants | $\mathbf{N}=31$ |
| :---: | :---: |
| Parents | 16 |
| Sex |  |
| Female | 15 |
| Male | 1 |
| Children | 15 |
| Sex |  |
| Female | 9 |
| Male | 6 |
| Age (Years) |  |
| 8-9 | 6 |
| 10-12 | 9 |
| Year Level |  |
| 3 | 4 |
| 4 | 4 |
| 5 | 5 |
| 6 | 2 |
| Number of siblings per household |  |
| 1 | 3 |
| 2 | 8 |
| 3 | 5 |
| School Type |  |
| Public | 12 |
| Private (Independent, Catholic) | 4 |
| SEIFA Index of Advantage and Disadvantage ${ }^{1}$ |  |
| Medium | 6 |
| High | 10 |
| Lunchbox packer |  |
| Mother | 5 |
| Father | 1 |
| Both parents (on different days) | 3 |
| Child | 3 |
| Both child and parent | 4 |

1. SEIFA scores were divided into tertiles: low (743-889), medium (942-1005), and high (1009-1127) as per Australian Bureau of statistics (cite)

## Overview of themes

Thematic analysis of interview data resulted in the development of three key themes:

1) Extrinsic factors and school environment structures; 2) Intrinsic factors and 'Hierarchy of Motivations'; 3) Location of responsibility for change. There were seven sub-themes across the three overarching themes, and each of them are presented below with selected supporting quotes.

## Theme 1: Extrinsic Factors and School Environment Structures

A range of external factors including school structures were reported to have influence on what parents and children would pack in lunchboxes, on what children would ultimately eat, and on the waste remaining. The various factors described by participants included (a) the presence or absence of various school policies and programmes that determine what is appropriate to pack and what is feasibly consumable, and (b) the type of lunchbox setup required to enable consumption of certain foods by children.

## Subtheme 1: School Policies and Programmes

In all interviews, families talked about the policies and programmes that shaped lunchbox contents. In particular, five policies were commonly described and are outlined below. The presence of a 'nude food' program and types of bins at schools were specifically enquired about as part of the interview schedule. The other sub-themes were not prompted.

## No nuts allowed at school

Participants reported that certain schools or classes within schools imposed a 'No Nut Policy' which restricted children from bringing nuts or nuts-based food items to school. This was raised by parents, as a limiting factor influencing what they could or could not pack for their children. This policy also imposed a restriction on the quality of foods, especially the protein food group, inclining parents to pack discretionary nut-free food options instead.

I think having a nut-free class or school... I personally feel this is a problem because if they can carry nuts, then we can make some combinations and give them, instead of those junk foods. I think it's more healthy things that they can carry to school. Parent of a Year 6 Child (Age 12), HighSES, Public

So we can't have nuts and peanut butter is such a good thing, like a source of protein for us, or hazelnuts or little protein balls that are often based on nuts. [...] So I
wouldn't pack nuts. So yeah, it's the limitations on what you're allowed to bring. It's the limitations on what children will eat. - Parent of a Year 3 Child (Age 9), HighSES, Public

## Eating time at school

The available time for eating at school was reported by many participants as a factor influencing what children eat and, therefore, what is packed in their lunchbox. Most schools were reported to have 10 minutes allocated for eating lunch, followed by 30 minutes of play time. Some schools have two additional eating opportunities such as morning brain food/fruit time, followed by recess. In some schools, children were allowed to eat fruits and vegetables at any time during the school day. The limited eating time for lunch, especially in the older years, and its convergence with play time or prioritisation of the latter alongside social interactions was raised several times by the participants. However, some children described they would be eating during play time while socialising, and found that several eating occasions were enough despite the limited 10 -minute lunch break. One primary school parent raised a concern with the lack of teacher supervision during eating time, describing this supervision as more common in preschools.

But I do pack his lunchbox full and then it just comes back. And he's like, 'I didn't have time.' So it's more like just go and play and maybe because you're [the child is] a bit older now as well, you [the child] don't get the instruction to, like, sit down and eat. Whereas I think when they're younger, [they do]. - Parent of a Year 5 Child (Age 11), HighSES, Public

We have fruit time, recess, and lunch eating. At fruit we get about 5 minutes, for recess we get to go outside for 20 minutes. Lunch eating is 10 minutes and then we
got lunch play for 30 minutes. So we've got lots of time to eat. - Year 3 Child (Age 9), MedSES, Public

## 'Nude food' expectation / packaging to return home

Families were explicitly asked about whether there was a 'nude food' policy at their school, where lunchboxes are encouraged to be devoid of packaging, or any single-use packaging was to return home. Most parents and children mentioned that 'nude food' was highly encouraged either at the class level or school level, either once a week or on all days. There were also several mentions that preschools were more likely to operationalise 'nude food' than primary schools. The few families that did not belong to a school which encouraged 'nude food' were still in favour of packing litterless lunchboxes. In some schools, where 'nude food' policies were absent or 'nude food' days were infrequent, packaging to return home was expected by the school.

We have a nude food policy at school, so they're not supposed to bring any packaging. If they bring packaged foods then they're supposed to take the wrappers home with them. - Year 4 Child (Age 9), HighSES, Public

I think the preschool kind of had a policy where [...] they asked for non-packaged food [...] but we haven't had anything for it through the [primary] school. - Parent of a Year 3 Child (Age 9), MedSES, Public

## School bins policy

When families were asked about the presence of a 'nude food' policy at school, their responses were often complemented by the mention of the absence of bins for waste disposal to encourage 'nude food' consumption at school. Additionally, children were asked about the presence or absence of bins at school. A school policy of having no bins on school grounds was another driving factor to avoid packaging, especially if there was no explicit
encouragement of 'nude food'. This policy made children put the wrappers in their lunchbox to bring back home, and was typically described favourably by parents and children as they thought it led to cleaner school yards. Some schools reportedly had discontinued the provision of the general waste bin (to minimise single-use packaging ending up in landfill), or the compost bin or recycling bin (due to inappropriate or lack of use by children). Others provided specific bins or crates for collection of food scraps, bottle caps, 10-cent drink containers, soft plastics, and hard plastics. Some parents were surprised to learn about the changes of bin availability at their children's school, as they were unaware prior to the interview.

In some instances where bins were present at school, their positioning on school grounds was reported as determining the fate of packaging. The encouraging factor for rubbish to return home was the lack of accessibility of bins and their distant positioning i.e., if the bins were too far, children preferred to put wrappers in their lunchbox (and sometimes their pockets) to take back home.

Well, normally I put it in the bin, but if I'm feeling lazy and I don't want to, then I'll just keep it in my lunchbox. - Year 4 Child (Age 10), HighSES, Independent

## Preschool policy of no sugar

One parent mentioned the influence of a preschool's 'No Sugar Policy', a habit that has continued to stay with them during their children's primary school years; although they mentioned the opportunity to eat sugar at home existed, more so under parental supervision.

I think that the kids will normally have a sweet when they come home. But it's probably partly also because that was how it was set up in the preschool. [...] at preschool they have, sort of have a policy not to send sweets, including sweet sandwiches, so it was just a habit. And so the kids haven't been used to having sweet
things at school. And there's an opportunity to have them when they're home anyway. Umm, yeah, just habit I suppose from setting those foundations at preschool. - Parent of a Year 3 Child (Age 9), MedSES, Public

## Subtheme 2: Lunchbox infrastructure

The type of lunchbox or food containers was described as an important factor for parents in this study. They seemed highly driven to get the 'right' lunchbox for their children: one that fits the desired amount and type of foods, as well as preserves the quality, freshness, and texture. Some would have a stainless-steel lunchbox or thermos for children who preferred warm foods, while others would have a compartmentalised box with layers and dividers to keep various food items separate and to prevent them from mixing with each other. For wet food items, a separate screw-top container would often be used. Overall, it appeared that compartmentalised lunchboxes would result in children bringing less packaged foods, and the use of reusable containers were favoured by both parents and children instead of single-use packaging such as snap lock resealable bags or cling wrap. Children would also prefer lunchboxes if bins were further away, decreasing their need to access them for rubbish disposal.

I think it's good because I can take them [food] out of the containers and [...] leave the containers [in the classroom]. But with rubbish, I have to go and put in the bin and then come back. - Year 5 Child (Age 11), HighSES, Catholic

## Summary of Theme 1

A number of different extrinsic factors were described by participants as influencing their lunchbox packing behaviours and the need for including packaged food items. Particularly, school level policies driven by allergies and school eating timetables, presence or absence of a 'nude food' school expectation/encouragement (either explicit or implicit in the form of
packaging to return home), presence or absence of bins on school grounds, and the right lunchbox architecture were key factors raised.

## Theme 2: Intrinsic factors and 'Hierarchy of Motivations'

A range of factors compelled families to pack and consume lunchbox contents the way they did. The factors discussed under this theme are intrinsic in nature, which in this study's context means they are related to the individual. Personal factors are impacted by an array of competing motivations that have taken the shape of a 'Hierarchy of Motivations' in this study; i.e., what takes precedence at the home or family level when it comes to packing lunchboxes for consumption at school. Mainly, these answers were prompted by asking what was important to the parent when packing school lunchboxes.

## Subtheme 1: Priorities when packing lunchboxes

The priorities presented below are in the order of the 'Hierarchy of Motivations' indicated by the families. Children's food preferences, the balance of a lunchbox from a health and nutritional stance, and then the integration of sustainability in lunchbox packing practices were the order in which lunchbox packing considerations were ranked.

## Catering to children's food preferences

For parents, it was most important overall to cater to their children's food preferences. They indicated that meeting this priority would prevent food waste and ensure children would eat during school hours. Although in this sample of participants, children seemed to be the primary decision-maker of food choices, some parents indicated that they would do the shopping and provide certain 'healthy' foods that children can choose from. In instances where parents packed their children's lunchboxes, children's preferences would often take precedence as they ultimately chose what they wanted to eat from the lunchbox.

Yeah, I feel like sometimes I need an Excel spreadsheet with just like the list of possible lunch combinations, and then the kids and what they will like. [I] feel like that sometimes. - Parent of a Year 5 Child (Age 11), MedSES, Public

I think we make a conscious effort to try and keep it balanced, however, you know, food preferences, choices and when you see things coming back, you know, drive a lot of what goes into the lunchbox. - Parent of a Year 4 Child (Age 10), HighSES, Independent

Uh, I will give him the final decision. But whatever's on offer is what's available. We don't usually get anything extra. I pack them in the morning, and so I ask them what they want in their lunchbox and. Yeah, but they're the primary decision-makers for it. - Parent of Year 5 Child (Age 11), HighSES, Catholic

Children's interview responses also confirmed that their preferences were a priority, in what they eat and in what is packed. Children also expressed their affinity towards certain types of food which was driven largely by how they felt and what they enjoyed eating at school.

Umm. Honestly, it depends. Really depends on how I am feeling. - Year 4 Child (Age 10), MedSES, Public

Usually I just eat the food that's tasty. I find time to eat the other stuff, but mostly I just eat the stuff that I see first and the stuff that I want to eat and then later when I'm hungry, I just eat the other stuff. [...] I save the fruit and healthy stuff for later. Year 5 Child (Age 11), HighSES, Public

With regards to leftovers, when prompted as part of the interview schedule, children's opinions were mixed, with some avoiding them and others demonstrating keen interest for
them. Parents substantiated the reason they would not send leftovers by mentioning the lack of heating or refrigeration facilities at school.

No, not really. Umm. It just goes a bit too cold and yeah. Bit mushy. - Year 4 Child (Age 10), MedSES, Public

She would love to. She begs to. But. So far I haven't allowed that because they haven't got anywhere to reheat the food. - Parent of a Year 3 Child (Age 9), MedSES, Public

## Health and Nutritional Balance

Nutritional balance was also a key consideration along with appropriate quantities of food. Parents felt that food was important to keep their children active and focussed during school hours. When parents were asked what was important to them when deciding what to pack in their children's lunchbox in terms of nutrition, they suggested the importance of nourishing, wholesome, and unprocessed foods; by contrast, children did not offer any comments when prompted.

Uh needs to have some sort of health element in there. Not too sugary, not too salty, and not too much packaged things. - Parent of a Year 5 Child (Age 11), HighSES, Catholic
[...] vegetables normally because they're in school, they learn a lot, so it helps them to concentrate on their studies. - Parent of a Year 5 Child (Age 10), MedSES, Catholic

## Convenience/ease of packing lunchboxes

Lunchbox packing was often reported as a highly demanding task, especially given that it is required every day of the school week. As a result, the idea of convenient foods for time-poor parents was raised by participants.

I think it can come down to like [...] you know, the same thing over and over and over again like having to do it, day in, day out. I think [...] you tend to just grab the things that are convenient. - Parent of a Year 5 Child (Age 11), HighSES, Public

## Convergence of nutrition and environment

For very few parents, the connection between non-packaged foods and health was a driving factor to choose more nutritious foods for lunchboxes.

I leave the "sometimes foods" for after schools because obviously that's their wind down time. I'd rather them not have those things at school: One for the packaging purposes and not knowing that they're actually gonna put it in the right bin; or that the right bin is gonna get collected correctly from the school. Secondly because yeah, it's just not fuelling their body properly to be able to concentrate for the day. - Parent of a Year 4 Child (Age 9), HighSES, Public

But generally if you've not got them in packets, there's gonna be healthier food. I think mostly. - Parent of a Year 3 Child (Age 8), MedSES, Public

## Subtheme 2: Food-related environmental priorities

Overall, sentiment towards 'nude food' was positive and highly encouraged by this sample of families. Parents expressed their eco-conscious priorities that translated to their lunchbox food choices, and children highlighted the benefits of 'nude food' for planetary preservation.

I think it [nude food] should be very important because like, like you shouldn't bring so much package into school, like it will, you know, like ruin the earth and stuff. Year 5 Child (Age 10), MedSES, Catholic

It's [nude food] better because it's easier. You don't have to open a packet, you can just open a container. I mean sure packets are, umm mobile, but you can also use a container and that saves you the hassle of going to a bin and you can just like pop it [the small container] in your pocket and keep it there, yeah. - Year 5 Child (Age 11), MedSES, Public

Umm, I think I'm a bit of a greenie. (Laughs) I've always sort of felt that the environment is really important and I want my kids to enjoy the environment basically and not worry about the problems of today being worse. [...] So particularly since I've had kids, I've been very very conscious about it. Yeah. And I try and subtly encourage other people to do the same. - Parent of a Year 6 Child (Age 12), HighSES, Public

Most parents interviewed considered that they were already exhibiting eco-friendly behaviours in their lunchbox packing practices, because sustainability practices were important to them. When they were asked what they perceived the barriers to be for other families not prioritising eco-friendly lunchbox packing practices, they reflected that other parents did not consider environmentalism as passionately because they did not see the urgent need to do so and hence wasn't the top priority in the 'Hierarchy of Motivations'. Moreover, there are several barriers described as affecting the lunchbox packing behaviours of others: time, energy, decision fatigue, perceived financial cost, and predicted resistance from children.

So I don't think it is that difficult, but I can sense that for the way the world is set up now and people are so busy and so under the pump all the time, sometimes even just one extra thing feels like the too hard basket. - Parent of a Year 3 Child (Age 8), MedSES, Public

I think it's in the 'Too Hard Box'. They think they have to spend extra time on it, they have to fight with the children about it because they'd be changing 'Status quo'.

\author{

- Parent of a Year 3 Child (Age 9), MedSES, Public
}

Just time, energy, headspace. [...], if it's not an urgent matter, it can be really hard to engage someone on something like environmental matters. - Parent of a Year 4 Child (Age 9), HighSES, Public

## Summary of Theme 2

Both parents and children were driven by a set of personal factors influencing their lunchbox packing behaviours. Children's preferences for food that suited their palates and were convenient to eat was the most important priority. Health was also important, but it appeared that environmental considerations were not as high a priority as children's preferences and health.

## Theme 3: Location of responsibility for change

Where the responsibility for change lies, in the context of improving nutrition and decreasing packaged foods in lunchboxes, came up in the discussion with families. Particularly, parents had differing viewpoints on who should be responsible for children's diets in the school context. The potential for schools, parents, and children to influence school food outcomes were also discussed.

## Subtheme 1: Potential for shifting responsibility to children

Participants spoke about parents ultimately being responsible for lunchbox packing, given that lunchboxes are packed at home and parents are the primary gatekeepers of children's food consumptions and habits. However, there was an underlying sense that packing lunchboxes everyday seemed to be a demanding task for many parents. As a result, few parent participants were inclined to shift the responsibility of lunchbox packing towards children. When parents were asked if they would like their children to pack their own lunchboxes, most of them favoured that idea and would be supportive but noted that children would not wake up early enough to do it and would need supervision. One parent indicated schools should provide meals to children for lunch, while others chose to uphold the packing responsibility regardless but involving children to some extent such as in the shopping and cooking process. Getting children involved in their lunchbox preparation and packing practices would be ideal as they would then be more likely to eat the foods they choose and prepare themselves, and this would also reduce parental mental load. However, a select few were not inclined given the busy morning routine and the potential delays caused by children packing their own lunchboxes.

I think it is one of those things. It's a tedious job. It is a chore. You know it's like you have to feed them every day, three times a day, ohh my gosh. - Parent of a Year 4 Child (Age 9), HighSES, Public

I think it's a great idea and as I said [Child] knows how to make his own sandwich. He often complained... 'You put too much, didn't put enough basil in, or the ratio of this wasn't enough, so I didn't eat it or whatever.' So I'm like, well, you do it then, if you're so good at making your sandwich. - Parent of a Year 3 Child (Age 9), HighSES, Public

I am a working mum as well. So we're out of the house by 7:30. So getting them to do their current jobs of brushing teeth and putting clothes on is enough for me at the moment, without trying to get them to do their lunches as well. [...] It's more efficient for me to do four than for four people to do one. - Parent of a Year 3 Child (Age 9), MedSES, Public

Since children's preferences overruled parental lunchbox food choices, some children mentioned they were packing their own lunchboxes. Those who weren't already packing their lunchboxes said that if they did, they would pack the food items they liked, but having to do it early morning would be a big task.

Umm yeah, like so I can put the things I like. But then again, like if the parents do it, they'll like put healthier choices. Like I'd put like probably chocolate wraps or something. - Year 5 Child (Age 10), MedSES, Catholic

I think it [children packing their own lunchboxes] is a good idea, but I know that me and my sister probably won't be able to do it because we don't like getting up in the morning early enough to do it, so I don't think we'd have enough time, but it is a good idea if you can get up in the morning. - Year 4 Child (Age 10), HighSES, Independent

## Subtheme 2: School level changes and responsibilities

Most children had no suggestions about how schools can encourage consumption of lowwaste foods. The few that did were in favour of making 'nude food' customary and compulsory, rather than voluntary and once off. However, there were some indirect references to what schools are currently doing to encourage 'nude food' consumption, particularly through incentivisation, which children found worthy of mention.

Umm they can somehow make it [nude food] compulsory. Or. Um. They can't really force anyone for nude food. So... Maybe like a prize for who brings the best nude food. - Year 6 Child (Age 12) HighSES, Public

Well, I think the nude food in lunchboxes is a good idea, but just to have a day, I think that's not a good idea. Because people should be having nude food everyday. Year 4 Child (Age 9), HighSES, Public

Parents had a lot more to say about school level changes that could potentially occur to encourage consumption of low-waste nutritious foods. They were in favour of furthering 'nude food' practices within the school culture by making it an everyday practice through policy implementation. Programmes that would expand children's food and environmental literacy were also suggested, such as educational and pragmatic activities for children to bring home the nutritional and environmental dialogue to parents. There were also multiple references to preschool level policies that do not often carry on to primary schools, a lack of consistency in the way health policies are implemented, and one mention of schools potentially feeding children.

Nude food days are probably not enough, if they're once off. You kind of need to practice things more than that for it to become a habit. - Parent of a Year 3 Child (Age 9), MedSES, Public

## Summary of Theme 3

From parents, to children, to schools, the responsibility of each stakeholder was discussed under this theme, with complementing and competing perceptions noticeable across parents. Children had very little to contribute into this segment particularly when asked about what schools could do to encourage eco-friendly food choices in lunchboxes, although they had a fair bit to say with regards to implementing 'nude food' policy more widely at school and
opinions of packing their own lunchboxes were mixed. Parents stressed the impact of school culture on children's consumption of school food.

## DISCUSSION

This study was a qualitative exploration of families' perceptions of drivers and barriers to packing nutritious and environmentally friendly lunchboxes, to understand enablers and structural barriers with regards to children eating more healthily and minimising waste and packaging from lunchboxes. This study recognised the roles of parents as food providers for children, lunchbox packers, and gatekeepers of children's food choices, while also recognising the role of children as agents of change, autonomous participants of food choice and decision-making for their health and the planet. However, it is worth noting that the people who chose to participate were parents and their children in medium and high socioeconomic areas only. These participating families also (all or overwhelmingly) expressed a commitment to environmentalism.'

As reported over a decade ago (Bathgate \& Begley, 2011), the time required for planning, shopping, and preparing lunchbox foods was often cited by our participants as the biggest hurdles in packing a low-waste and nutritious lunchbox. Our results provide additional validation of the findings presented by Watson-Mackie et al. (2023) which described the nonnutritional barriers affecting what parents would pack in their children's lunchboxes. Barriers included: parents' busy lifestyles and mental load (hence, reaching for convenience); time pressures; allergy policies and food safety concerns; and school environmental structures around eating times. On the other hand, facilitators included: school-based food and packaging policies (in our study's context encouragement or expectation of 'nude food', and waste management practices-the absence of bins at school which implied packaging to
return home); and policies; and, children's involvement in making food choices which was seen as a waste-reduction enabler.

Children's food preferences were not seen as a facilitator or barrier for packing a low-waste nutritious lunchbox per se, but a necessary factor to uphold when packing school lunchboxes. Parents commented that children's preferences superseded most other factors, as it would be a waste of money buying foods they would not eat, and they would prefer their child ate something rather than remained hungry at school. While children have been shown to increasingly influence the food selection behaviours of the family (Dixon \& Banwell, 2004), and parents found it hard to maintain the equilibrium between what their child should eat versus they would actually eat (Bathgate \& Begley, 2011), this study showed that there were varying levels of negotiation between parent and child regarding the packing of food that children would eat at school. Feeding children at home was seen as a parental responsibility, with some parents noting that good eating habits can be developed at home through involvement in the food purchase and preparation stages, which will influence children's consumption habits beyond the home, including at school. The impacts of the home environment and familial factors on food choices, whether it is snacks or fruits and vegetables, is well-established in the literature (Damen et al., 2019; Sutter et al., 2019). School level policies served as both barriers and drivers to the packing of a nutritious and low-waste lunchbox. For instance, either the presence of a 'nude food' policy or the absence of bins at school drove the packing of package-free lunchboxes. It was also evident that the physical school environment imposed a range of barriers to the selection of nutritious and package free foods for lunchboxes. For instance, leftovers tend to be more environmentally friendly as they are often home-cooked meals that are packed in reusable containers. However, the lack of heating facilities or refrigeration at schools meant that although parents
were keen to send cooked meals or leftovers, they knew that the child would not be able to warm it at school or that it would have a high chance of spoilage on a hot day. Therefore, they would often fall back on packaged, non-perishable foods. The issue of 'nut-free' school policies (to protect children with allergies) was also raised by some parents, as further limiting the types of food that could be packed in lunchboxes.

As eloquently expressed by Ruis (2017, p. 24), "packing a lunchbox requires parents to be part nutritionist, part psychologist, part chef, and part entertainer" signifying that packing a lunchbox for children that is of optimal quality nutritionally and gastronomically is a significant challenge, even before considering environmental priorities. Packing lunches day after day was reported to be a monotonous chore, laden with challenges and unpredictable outcomes. This was raised by many parents in this study who continued to pack children's lunchboxes; others shifted the lunchbox packing responsibility to their children to overcome this 'mental load' while others wanted their children to upskill through this everyday task. Encouraging children to make decisions about what goes in their lunchbox with parental supervision or by getting them to pack their own lunchboxes can give them a sense of independence and control over their food. Bathgate and Begley (2011) and van der Horst et al. (2014) previously reported that involving children in their meal preparation tasks improves their dietary intake. The children that were part of our study were in school years 3-6 (aged between 9-12), and showed they were old enough to exercise a degree of autonomy in terms of what they chose to eat at school. Although NKL did not engage in discussions about which foods were 'healthy' or 'not healthy', children were aware of the distinctions between 'healthy' and 'unhealthy' foods as reported by previous studies (Bailey et al., 2022).

The school food environment can support the consumption of nutritious and low-waste foods. The opinions on sufficiency of school eating times seemed to be mixed in our study, and
whether that affects the amount of food children eat or leave unconsumed during school hours (Aydin et al., 2022; Burton et al., 2022) needs further investigation in the Australian context. The culture of the school was seen as an important encouraging factor, including the presence or absence of 'nude food' encouragement, and the absence of bins on school grounds to encourage less packaging in lunchboxes. In fact, the lack of 'nude food' program as an everyday measure was particularly noteworthy. Additionally, our study revealed that there were inconsistencies in the school food environment operations, particularly when events at school were not adhering to school nutrition policies, concurring with findings of Aydin et al. (2021). Noting the challenges of packing lunchboxes and particularly children's food preferences spearheading most food decisions, as well as the positive influence school policies can have on the same decisions when packing lunchboxes, future policies and programmes can leverage on the existing successes to further the nutritional and environmental agendas.

## STRENGTHS AND LIMITATIONS

This study furthers the existing tapestry of understanding around familial lunchbox packing practices by providing a rich, contextualised examination of packaging and waste considerations when making lunchbox food choices. Evidence of lived experience provided insights into school lunchbox packers' and consumers' perspectives, and the drivers and barriers involved when packing a nutritious and low-waste school lunchbox. This knowledge of lived experience is vital to the successful design, implementation and uptake of appropriate interventions and policies that are more equitable and effective to improve dietary health and wellbeing (Neve et al., 2021).

Conducting an interview with a parent and child(ren) together enabled us to invoke discussion on an everyday topic in which they are both involved. This approach meant that children could engage in conversation in presence of their parent/guardian, rather than alone with an unknown researcher, or with other children (or parents) in front of whom they might have modulated their ideas due to peer presence/pressure. However, we acknowledge that both children and parents are still likely to be interested in getting the answers 'right' when interviewed, which means social desirability bias cannot be eliminated even in the case of privately conducted key informant interviews. However, interviews tend to allow for richness and depth, whereas focus groups may have yielded greater breadth through context-dependent group interactions, but would also entail lack of disclosure of certain information (Hollander, 2004).

As the study was based on a self-selected sample, it is worth noting that it may have attracted parents who were already interested in nutrition and environmental topics and were therefore more likely to provide eco-friendly nutritious foods in the lunchbox. Furthermore, no participants from low SES areas signed up for this study, so there could be missing perspectives specific to that demographic with regards to lunchbox packing practices. Capturing these perspectives are important focus for further research.

## CONCLUSIONS

This study presented an analysis of families' perspectives on structural barriers and motivations when considering providing both low-waste and healthy food in lunchboxes. Individual level of responsibility to the more structural school level attributes were discussed. From both our study and previous literature, it seems that packing a lunchbox (especially one that is high in nutritional quality and low in waste) is an undervalued task. Parents must
juggle competing priorities while trying to feed children nutritionally-adequate foods, ensuring children's food preferences are catered to, waste does not result, and cost and time factors are considered. What is required are effective interventions to assist with meeting those competing priorities, given the multi-tiered responsibility of feeding children. This study has shown that the dimension of eco-friendliness adds yet another challenge to the already challenging task of packing school lunchboxes, thus helping parents meet their priorities of nutrition and health might be a constructive way forward.

Ethical Statement: This study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2022-127). This study was conducted according to the guidelines laid down in the National Statement on Ethical Conduct in Human Research and all procedures involving research study. Written informed consent for data to be collected and published was obtained from all participating parents and third-party consent on behalf of children were also obtained from parents. Children were asked verbal assent prior to interview commencement.

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## CHAPTER 8: SYNTHESIS AND CONCLUSION

### 8.1 Thesis summary

What children eat during their day at school impacts their learning, development, and overall health and wellbeing. For most Australian children, home-packed lunches are their main source of food and nutrients during school hours. It is therefore essential to understand lunchbox contents in order to understand children's dietary consumption during school hours. Moreover, food and environmental outcomes are not separate from one another. Alongside food, it is equally important to understand the waste and packaging characteristics associated with food choices, given their potential detrimental impacts on the environment.

Therefore, this research program aimed to further understanding of the current landscape of food and waste in school children's lunchboxes-via scoping of the published literature (Chapter 3), analysing existing school policies and programs (Chapter 4), surveying lunchbox contents (Chapters 5 and 6), and investigating family perspectives on lunchbox packing (Chapter 7). This final chapter highlights and synthesises findings across the four studies in order to summarise what this body of research contributes to knowledge about policies, practices, and perspectives related to Australian school lunchboxes. The chapter also provides recommendations for future policy level reforms and academic research directions.

When the literature relating to health and environment in the context of school lunchboxes was examined as part of Study 1 (presented in Chapter 2), the importance of considering the socio-ecological influences on children's health and sustainability behaviour was a key takeaway, a theory that has been drawn on across this entire body of work. This literature review also showed the lack of packaging analysis conducted in association with children's lunchbox foods (Lalchandani et al., 2023a). The analysis of publicly-available school policies relating to healthy eating and environmentally friendly practices as part of Study 2 (presented in Chapter 4) demonstrated that the nexus between healthy eating and
sustainability was not apparent in schools (more of the former was found compared to the latter, especially at preschool level), and could be explored in forthcoming research and practices. School policies and programs shape the culture of the school, and while 'nude food' was mostly encouraged at preschools within the sample studied-along with ad hoc sustainability actions mentioned informally on few school websites-these agendas were not part of formal policy documents (Lalchandani et al., 2022). It was particularly worth noting there was a stronger presence of healthy eating policies at preschools compared to primary schools and there was evidence of these policies being enforced in the former. 'Nude food' was also highly encouraged at preschool year levels, and seemed to wane at primary schools. Overall, policies and programs around healthy eating and environmentally friendly practices (in combination) were lacking.

To gain an updated measure of actual food contents in Australian lunchboxes, along with the novel addition of food waste estimates (which would correlate with children's consumption preferences) and the packaging associated with lunchbox foods, Study 3 involved the development of an audit tool that was able to capture food, waste, and packaging characteristics of lunchboxes (presented in Chapter 5). Overall, results of the audit (presented in Chapter 6) indicated that preschool children's lunchboxes were nutritionally superior in terms of the presence of fruits, vegetables, and dairy items; primary children's lunchboxes contained more snacks in comparison. Consequently, it appeared that preschool children had less single-use packaging in their lunchboxes, but more food waste than primary school children. The prevalence of UPFs was also linked to single-use packaging dominance, suggesting the nuanced connection between packaging and the nutritional quality of foods.

Finally, familial perspectives around lunchbox packing practices gained from Study 4 (presented in Chapter 7) highlighted the importance placed by parents on catering to
children's food preferences, and the need for more consistent and supportive school environments to promote consumption of low-waste nutritious lunchbox foods. This study also highlighted the socio-ecological influences on family level health and sustainability behaviours, and the challenges of packing lunchboxes. There are varying levels of influences and motivations to consider, both at the home and school level, and at the individual and societal level, when developing future policies and programs in this space.

### 8.2 Synthesis of results

Overall, this body of work, through four distinct yet interwoven studies, explored the intersection of waste and nutrition in school children's lunchboxes, a concept that is understudied as confirmed in Study 1. A clear theme throughout the integrated research outcomes is that there is currently not enough policy guidance or structure facilitating nutritious low-waste lunchbox foods in primary schools. This finding was reflected in the qualitative policy and program analysis (Study 2), and demonstrated in what children were bringing to schools in their lunchboxes through Study 3. Disparities in the lunchbox contents of preschools versus primary schools were also confirmed through the quantitative lunchbox assessment. In the qualitative interviews with families as part of Study 4, parents raised the issue of healthy eating policies reducing from the preschool to primary school level, and this lack of structural and formal framework was associated with the differences observed in primary schoolers' lunchbox contents.

While sustainability can potentially be a driver for encouraging nutritious food choices, evidence of this concept was not prevalent in current policies nor observed in children's lunchbox contents, though it did come through in the parental perspectives. However, given the self-selected nature of interview participants, it is likely that other
viewpoints were not captured; social desirability bias may also have influenced reporting results. It is worth noting that some parents in Study 4 mentioned that they were able to sustain practices that began in preschools due to the policies and expectations in that context, which ultimately was found to influence lunchbox packing behaviours. This finding points again to the potential for primary school policies to align more closely with those in preschools. Lunchbox packing is a hard and underappreciated task, laden with a range of challenges, and creating consistent supportive environments to try and address change is necessary at all levels, especially since this research program has confirmed that lunchbox contents and packing behaviours are highly driven by policy presence at the school level.

Besides policy, the autonomy and preferences of children was an important factor of consideration in the school lunchbox model. Children's agency was most salient in Study 3 and 4; however, this was not focussed around the environmental agenda (as suggested by previous literature included in the Study 1 scoping review) but, rather, in terms of children's power in exerting preferences and desires over the choice of food included in their lunchboxes. Children's preferences were often for ultra-processed and packaged foods, rather than for low-waste, more nutritious foods, and these preferences were at the pinnacle of the 'Hierarchy of Motivations' identified in Study 4. It should be considered that developing formal school policies around low-waste lunchbox expectations might initially create tensions with children's agency and autonomous choices and, in turn, in family negotiations around lunchbox foods. Social norms are an influence on children's preferences, shaped in part by food advertising and marketing (Smith et al., 2019), but also by observing other children's dietary practices. Shifting the context of eating in schools, by changing lunchbox policies, has the potential to change social norms around children's food culture over time, and, in turn, what families pack in lunchboxes and the associated health and sustainability outcomes.

### 8.3 Significance, relevance, and contribution of this thesis

Australian school-based policies and programs, lunchbox contents, and familial perspectives have, to our knowledge, not yet been studied with a dual focus of nutrition and environment, which makes this a key novel aspect of this research study. Existing data on waste in Australian school lunchboxes were sparse, and the packaging data were non-existent. The four studies within this PhD program, involving a mixed methods approach and triangulation of policies, practices, and perspectives has, in combination, resulted in a strong evidence base to potentially drive the formation of future interventions to foster healthy eating and eco-friendly behaviours among young children and adolescents.

The philosophical paradigm of critical realism shaped the understandings I could access about food and waste in children's lunchboxes. The integration of qualitative and quantitative research methods provided, as Pawson et al. (1997) have said, a "family of answers" capturing the reality of the topic and its associated complexities, as well as the reasons for the complexities of that reality (Danermark et al., 2005; Sobh \& Perry, 2006). Further, the methodology implemented in this research program has melded sustainability and nutrition concepts, and, as a result, has contributed to extending the literature base in a new direction. In particular, the food waste and packaging data obtained through a large sample size in the lunchbox audit (Study 3) has provided an update on children's school food consumption data, as well as adding the new consideration of waste. Additionally, utilising mixed methods across socio-ecological levels and contexts allowed for a more comprehensive and nuanced understanding of the combination of health and environmental agendas to improve lunchbox contents, while considering various influencing and motivating factors.

Overall, there is an opportunity for lunchboxes to serve as a vehicle for achieving public health and sustainability goals. However, in line with the action areas of the Ottawa

Charter for Health Promotion, the key driving factor to change lunchbox contents (and, ultimately public health) is the presence or absence of policies and structures in place that support people to make environmentally-driven choices. This research has also highlighted the importance of involving parents and children into intervention development, and encouraging nutritious and sustainable food consumption practices by creating an environment that enables those behaviours and practices.

The aim of this research has also aligned with the principles established by the NHMRC that emphasises provision of foods and drinks in an environmentally sustainable way (NHMRC, 2013). Prioritising foods that are nutritious, as well as environmentally friendly, directly contribute to the 2030 United Nations Sustainable Development Goals, specifically Goal 3: Good Health and Well-being and Goal 12: Ensure sustainable consumption and production patterns (United Nations, 2015), especially because recent reports suggest environmental targets are lagging far behind and unachievable within the set time frame (Arora \& Mishra, 2019). The recently revised Right Bite Food and Drink Supply Standards for South Australian Schools (Department for Education, South Australia, 2023), which has replaced the 2008 Right Bite strategy (SA Health, 2008), applies to all food and drinks sold or provided to students at schools. What is particularly noteworthy, in the context of this research topic, is the standards' encouragement of promoting Green food and drink items and environmental practices that are in alignment with the single-use plastic legislation in South Australia. This further affirms the potential of the dual focus of nutrition and environment in the context of school lunchboxes in lending insights into the development of policies that encourage low-packaged minimally-processed food consumption during school hours.

In summary, findings from this program of work have novel and pragmatic implications for promoting health-related behaviours in the context of climate change which can lead to 'co-benefits', where actions that benefit the environment also benefit public health, particularly reduction of packaged food consumption by children in their everyday school context. A key recommendation out of this body of work is for stronger policy focus for improving lunchbox packing contents for children's health and planetary conservation, especially since this aspect of school food is currently not formally regulated (Lucas et al., 2017). If structural level change is created around 'nude food' or litterless lunches, particularly regarding the extension of preschool level food policies into primary schools, that could be a driving factor to change food related choices, norms, and behaviours. However, further considerations are needed to facilitate these changes, as will be discussed next.

### 8.4 Future directions for policy and programs based on this research

Children spend a significant portion of their time in schools, making it an important locus for interventions related to health and the environment, including in relation to waste. However, the home environment should not be neglected as that is where majority of the food decisions are made beforehand. Based on this research program's findings, school-based policies and programs influencing healthy, low-waste lunchbox contents are warranted, particularly at the primary school level. Building on the results of the research presented in the previous chapters of this thesis and summarised in the previous sections of this chapter, and integrating relevant global directions, recommendations for future policy and programs are discussed below.

School level culture changes and normalising certain practices may enable the packing of low-waste nutritious lunchboxes. This was evident through the policy/program analysis
from Study 2, potentially influencing lunchbox contents observed in Study 3. Hence, establishing certain expectations at the policy level will also drive favourable social norms. Normalising litterless lunches or 'nude foods' which occurs more so at the preschool level should be conveyed to the primary year levels. This normalisation through formally regulated policies would reduce potential pressure and judgement from parents, but this path needs to be approached carefully, as school food guidance and expectations can often translate to lunchboxes being an object of surveillance and scrutiny (Pike \& Leahy, 2012). Hence, there is a need for more inclusive and achievable school lunchbox expectations that enable and support parents to provide lunchbox foods, and those that look beyond the narrow (nutritionreductionist) conceptualisation adopted by most Anglo-Western guidelines that marginalise and exclude children from diverse backgrounds. Being cognisant of 'the variety of health meanings' (Hayes-Conroy, 2016) is crucial when developing new food cultures at schools.

A Canada-based litterless lunch study by Trotter and Lentini (2014), who explored the social barriers to litterless lunches, found that social norms, convenience, and lack of awareness were the primary barriers to adopting litterless lunches. Specifically, the study found that parents were concerned about how their child's peers would perceive their litterless lunch, that litterless lunches required more time and planning, and that parents lacked knowledge on how to properly pack a litterless lunch. By comparison, in the sample of participants in Study 4 (presented in Chapter 7), parents who were already exhibiting proenvironmental beliefs and potentially influenced by environmentally-conscious social norms demonstrated that the idea of litterless lunches and environmental sustainability (along with health) was a priority for them, although it seemed to be located the bottom of the 'Hierarchy of Motivations'.

In order to converge healthier diets with reduced environmental impact, Ridoutt et al. (2021) noted that a change in the food production system is necessary to help Australians easily identify and improve their access to lower environmental impact and healthier food products. While their suggestion of encouraging Australians to consume more core foods and decrease consumption of discretionary foods holds merit, drawing on the socio-ecological theory that has spanned across this research program, it is vital that the external settings within which individuals sit, and that influence them, need to be able to support a shift towards the desired dietary patterns. The current regulatory framework for food systems focusses heavily on individual consumer choices and fails to account for the broader environmental and social factors that contribute to the production and consumption of UPFs that hold the status as commercial commodities today (Hendrickson \& Heffernan, 2002). The need to shift from an individual-focussed approach to a systemic approach, in order to achieve sustainable and healthy food consumption, would involve a whole-of-government approach that involves multiple sectors and actors, particularly engaging with the food industry to drive environmentally food production systems (Mozaffarian et al., 2018; Nguyen, 2018).

Although a shift in food trends for public health development is vital, food industries can further leverage on sustainability and create compostable packaging for common packaged food items found in lunchboxes, given that changing cultural preferences around food choices is challenging and often slow-moving. One possible way to meet the needs of sustainability on the 'Hierarchy of Motivations' found in Study 4, is conceptualising how policy can be changed at the food production level in terms of packaging. Although this recommended change is for a different and antecedent point of food purchasing and consumption stage, it is a window of opportunity worth considering, given South Australia's recent commitment and investment to discard single-use plastic products based on the South Australia's Single-use and Other Plastic Products (Waste Avoidance) Act 2020
(https://www.replacethewaste.sa.gov.au/). Plastic items such as straws, cutlery, coffee cups have already been banned since 2021-2022, with upcoming further bans planned for 20232025 for products including supermarket plastic bags, fruit stickers, and attached products such as plastic straws in juice boxes. However, these movements could further consider prevalent lunchbox food items, such as packaged snack items common in the primary year levels and yoghurt pouches common in the preschool lunchboxes (as identified in Study 3).

Avoidance and reduction of packaging and waste is a worthwhile starting point to achieve the opportunity for nutritious and environmentally sustainable food consumption trends. Although lunchboxes are consumed at school, their packing happens at home, and the procurement of lunchbox foods happens outside the home. Programs to support parents with lunchbox packing, and include children in the process, are also a notable avenue to discover. Moreover, given the significance of children's food preferences in the lunchbox context, as well-evidenced in Study 4, and their exposure to the school environment, transforming education in schools so that the health of the children and planet are operationalised together is a step in the right direction (Cooke et al., 2011). Alongside food, it is also useful to work with broader environmental values, and focus on environmental literacy through various waste reduction initiatives and recycling programs in schools. This can help children understand the impact of their food choices on the environment and the importance of sustainable practices. For example, Jones et al. (2012) explored the effectiveness of a food sustainability education program in promoting healthier eating habits among primary school children in England. The program was designed to integrate food sustainability education into the school curriculum through a variety of components, including classroom lessons, gardening activities, cooking workshops, and food waste reduction initiatives, yielding positive outcomes. Although these are ideal recommendations, these might not play out as anticipated as the burden on school teachers is a huge deterring factor, health and
sustainability education topics are diluted within an already crowded curriculum, and often the ad hoc inclusion of sustainability education is based on educators' personal affinity towards the topic (Almeida et al., 2018; Madsen et al., 2015). However, Lalchandani et al. (2023b) identified scope to meld nutrition and sustainability concepts through a holistic and integrated approach to education, moving away from conservative healthism practices, acknowledging the pedagogical stances of educators, and empowering students to become active agents of change.

Reducing UPF consumption and promoting healthier diets could be effective strategies for preventing obesity and improving overall health in children and adolescents (Khandpur et al., 2020; Neri et al., 2022). Dovetailing packaging reduction initiatives at the school level to decrease UPFs consumption can be an intersection to consider in the school curriculum landscape. However, a Canadian cross-sectional study (Black et al., 2015) that assessed the integration of healthy and environmentally sustainable food initiatives in schools showed that while there was a high level of awareness of the importance of healthy and sustainable food initiatives among school staff and administrators, there were significant barriers to the integration of these initiatives into school food systems. These barriers included limited funding, lack of support from school boards, and a lack of access to healthy and sustainable food options.

Finally, the presence of core foods in lunchboxes, although a gold standard of the national dietary guideline, is not the panacea of children's diet and health. As evidenced by the third study of this research program, although there were presence of fruits and vegetables in school lunchboxes, there was also a lot of wastage. Food ending up in landfill which results in methane gas emissions is a pressing issue (Adhikari et al., 2006). Therefore, to reduce food waste and improve children's health, they need to eat the foods that are being packed in
lunchboxes, which means development of food preferences is a key factor to consider. School-based programmes around sensory education to improve children's likeability towards core foods have been successful in the UK through TasteED (Taste Education, 2022) and in Australia through CSIRO's taste education program called Vegetable Education Resource To Increase Children's Acceptance and Liking (VERTICAL) (Poelman et al., 2020), which brings curriculum and teacher-ready resources to the classroom to focus on fostering vegetable enjoyment in students (Foundation to Year 6). It covers taste and taste development, knowledge of vegetables and their taste properties, cultural diversity, vegetable growing and processing, and the role that vegetables play in a healthy and varied diet; and, as emphasised by the researchers, it does not educate learners on the healthiness or nonhealthiness of certain foods. An umbrella review of strategies to enhance vegetable liking in early childhood, which examined 29 systematic reviews on the topic (Bell et al., 2021), also found that sensory education, such as exposing children to different textures and flavours of vegetables, can help increase their acceptance and liking of vegetables.

### 8.5 Future directions for academic research

Children's food consumption in the school setting has been a key area of interest in the literature. The results of this research program have served as an evidence base for further research to be conducted in the school food space to identify effective strategies for promoting health and sustainability in schools, especially in relation to the school lunchbox model. However, it is also important to bridge the gap between the home and school environment as lunchboxes are involved in a double-tiered setting of the home and school. Because lunchbox food is consumed outside the family, after the food choices are made within the family, the home is still a site for behaviour development and change, but the way in which other related but external contexts (such as schools) can support that is worth
investigating. Moreover, as discussed in Study 4, the environmental priority sits very low in the 'Hierarchy of Motivations' for what goes into a lunchbox, so future research might explore how can a framework be created to prioritise that in order to shift food choices. Additional areas for further research are outlined below.

Diet and physical activity have implications on obesity (Brown et al., 2019), and this impact can emerge from school settings when supplemented with a supportive home environment (Bleich et al., 2018). A systematic review of evidence postulated that multi-level interventions across the immediate settings in which children are situated can yield improved health outcomes for obesity prevention (Moore et al., 2013), keeping in mind the complex pathways involved and age groups targeted (Maher et al., 2019). It is crucial to acknowledge that both the home and school environments have a bi-directional influence on each other, so collaboration between schools and parents is important as part of the multi-level context that the Ecological Systems Theory framework entails (Davison \& Birch, 2001).

Parents' knowledge, attitudes and behaviours can also be considered given their influence on children and their food-decision making. Study 4 represents an initial step towards understanding this influence, but future research could build on the findings presented here to further examine the role of parents. A participatory approach to gather the input of stakeholders, including parents to generate new ideas for improving the school meal experience for children is valuable (Johnson et al., 2020). Based on learnings from Study 2 and 3, which highlighted the impact of school policies and programs on the home environment, the established communication pathways between school and home can be used as a medium to enhance food and sustainability messaging. The effectiveness of a mobile health (mHealth) intervention called 'SWAP IT', that provided parents with information to make healthier swaps in the lunchbox of school children in New South Wales, showed some
improvements in the nutritional quality of packed lunchboxes (Pearson et al., 2022;
Sutherland et al., 2019). If early successes at the food and nutrition level are promising based on the 'SWAP IT' trial results, and the functionality of food-based apps to support behaviour change and promote healthy eating habits is evident (Mauch et al., 2018), there might be merit in developing sustainability messages targeting parents and children and interlacing that with food and nutrition messaging. Therefore, the layering of sustainability and nutrition messages in school communication apps can be an area of future research.

Future research can also explore how the food industry engages with children, as they are active consumers in this context and not passive recipients of advertising and branding. They are primary consumers of lunchbox foods, and their preferences take the most precedence over other factors (evidenced by Study 4). For instance, marketing of specific commodities targeted to children, such as 'fun' items like cheese stringers, cartoonembellished breakfast cereals, and brightly packaged yoghurt squeezes influence their foodbased habits and consumption choices (Edwards et al., 2013; Lavriša \& Pravst, 2019). A study by Elliott (2018) compared Canadian children's perceptions of the healthfulness of milk by asking them to rate images of milk in varied containers (i.e., glass vs carton). The results showed that children rated milk in a glass bottle as significantly healthier than milk in any type of carton packaging; this finding may be attributed to a perceived association between glass bottles and traditional or "old-fashioned" values, which are often linked to healthfulness (Sproesser et al., 2019). Therefore, studying foods targeted towards children, and also parents, particularly with regards to lunchbox food advertisements, is an engagement and interaction worthwhile exploring.

Finally, further research could usefully examine the relationship between food choices made by school students and the context of eating in the school environment, including the
time and locations available. This topic was mentioned by participants in Study 4 as influencing the food consumption and waste related to lunchboxes. Close to three decades ago, Getlinger et al. (1996) reported that food waste decreased from $31.7 \%$ to $25.6 \%$ when recess was scheduled before lunch. More recently, this dialogue has resurfaced as the 10minute lunch eating time was reported by $58 \%$ of parents to be inadequate (Burton et al., 2022). However, more research is needed to build greater understanding in this space. Discussions have also arisen in Australia about the potential to shift from lunchboxes to school meal provision in future. Although some research exists comparing the nutritional value of different school meal models, such as nutritional inadequacies identified in the lunchbox model compared with a school-meal provision one (Taylor et al., 2019; Johnston et al., 2012), there is need for more research to understand the benefits and costs of different approaches, including in relation to sustainability.

### 8.6 Research implications for stakeholders

From all the studies in this program, it was evident that multiple stakeholders are involved with healthy eating behaviour development and encouraging environmentally friendly actions. This responsibility seems to be diffused across policy makers, schools, environmental agencies, school staff members, parents, and school children. Where the responsibility for the intersection of healthy eating and eco-friendly practices lies is unclear and an avenue worth exploring. Moreover, although there are comprehensive nutrition policies and guidelines in place in Australia, there is a lack of consistent and coherent policies across all settings and accountability mechanisms are deficient in relation to nutrition (Rosewarne et al., 2020). The key barriers identified for the successful implementation of nutrition policies included limited funding and resources, a lack of government support, and
the influence of industry interests (Rosewarne et al., 2020). Therefore, for policies and programs to succeed, the importance of work partnerships is high, with collaboration needed between nutrition and environmental initiatives and organisations in order to support childhood obesity prevention initiatives, as well as sustainability interventions.

KESAB environmental solutions, industry partner for this project, facilitate environment-preservation endeavours locally in South Australia through their educational support programs. This collaboration has been mutually fruitful for this PhD program and for KESAB. A personal correspondence with the Industry Partner representative has indicated that this research has:

- provided data to feed into existing school level waste-related educational programs such as Wipe Out Waste (WOW) and KESAB's programs relating to 'Nude Food', particularly the Less to Landfill Challenge;
- facilitated and enhanced links to new and existing partners, particularly The University of Adelaide and Department for Education, South Australia;
- provided the schools which KESAB has links with an opportunity to participate in the lunchbox research study and to receive data that they can work with and disseminate to their school community at the conclusion of the study;
- provided information about the interest in and use of plastic alternatives in school lunchboxes (e.g., beeswax wraps, compostable bags, bento-style lunchboxes) which assists in the planning of programs and targeted campaigns; and
- provided exposure for KESAB to a broader audience, through outputs resulted from this research program such as journal publications and conference presentations.

Acknowledging potential challenges and barriers to policy and program development and implementation in the school food space, for the Department for Education, South Australia, this research has:

- demonstrated areas and mechanisms to enhance current waste practices in schools;
- lent support to the Department's position of including waste in future food and drink supply standards in schools;
- allowed the Department to consider engagement of children and families on topics of noted importance, such as environmental consideration, in relation to food and drink;
- further cemented pre-established partnerships with KESAB environmental solutions;
- enabled research findings to be communicated with key health stakeholders to consider reframing of health and wellbeing messages.

At a national level, findings from this research program have relevance to the upcoming revision of the Australian Dietary Guidelines, due for release in the final quarter of 2025 (NHMRC, 2023), where the integration and communication of environmental and sustainability considerations within food guidelines can be improved. When Hendrie et al. (2022) compared current Australian diets with the Australian Dietary Guidelines and the EAT-Lancet Planetary Health Diet to assess their health and environmental impacts, the EATLancet diet was found to have the lowest environmental impact, while still meeting the nutritional requirements of a healthy diet. On the other hand, Australian diets did not meet the recommended dietary guidelines for the five core food groups and were discretionary foods laden. Most importantly, related to the aims and outputs of this research program, the lack of
packaging waste angle within dietary guidelines is potentially a topic to consider, since this intersection is also understudied in the literature.

### 8.7 Thesis limitations

Beyond the limitations identified in relation to each individual study in this thesis (and included in each respective manuscript), there were also some limitations in the overall research program. In considering sustainability/environmental concerns in lunchboxes, it should be noted that focussing only on packaging and food waste is a potential limitation of the research presented in this thesis. Other environmental impacts of lunchbox foods (e.g., how it was grown/produced/transported) were not studied, but may be fruitful for future research, as they can also help assess the environmental footprint of lunchbox foods. Moreover, this thesis did not account for packaging outcomes at home, because although lunchbox foods are consumed at school (the site of focus for this research), the packing of lunchboxes occurs at home. That is, although food may appear 'nude' in a lunchbox, there may have been associated packaging waste in the home environment that was not considered here.

The traffic light food labelling system in Australia involves assigning Red, Amber, or Green labels to food items based on their nutritional content, with Red indicating less healthy options and Green indicating healthier options (Lucas et al., 2017; Pettigrew et al., 2011). Previously, the Right Bite strategy of South Australia implemented the same system and categorised food into Green, Amber, and Red categories as a tool to promote healthier food choices in schools (SA Health, 2008). Recently, revised local standards in support of the Wellbeing SA Food and Drink Classification Guide for Schools (Wellbeing SA, 2023) recommended categorisation of school food and drinks as Green (best option), Amber (choose
carefully), Red 1 (limit), Red 2 (do not supply). As this research program did not classify lunchbox foods into these traffic light categories (mainly because packed lunches from home, unlike school-based food providers, are not covered by this guidance); there would be merit in undertaking these classifications to align lunchbox contents with published guidelines. The NOVA classification system (Monteiro et al., 2019) was also not utilised as a categorisation tool in this research, the analysis of which could have strengthened the ultra-processed discourse in conjunction with the food packaging findings. The rationale behind not segregating foods into these categories was motivated by a desire to move away from the nutritional judgement of foods based solely on standard systems. Instead, the focus was on leveraging the packaging aspect to make connections with specific food types packed in lunchboxes, which allowed for the exploration of a broad-level relationship between food, waste, and packaging, without introducing preconceived nutritional biases.

### 8.8 Personal Reflections

My understanding of public health ideologies and practices has evolved significantly through this PhD journey. Before commencing this research program, I had a food science and nutrition background, and was deeply invested in the micro-level aspects of food and nutrients. Through undertaking postgraduate level public health coursework in my first year, followed by the conceptualisation of this research, and considering food, health, and sustainability behaviours at a broad level, I have moved away from the nutrient-focussed lens to more public health ideas. The lunchbox audit tool described in Chapter 5 reflects the very narrow nutrient-focussed lens I carried, but the outcomes reported in Chapter 6 demonstrate the wider scope of public health understanding I have gained over the years. My interactions with my participants who I interviewed as part of Study 4, and where I portrayed positive and
non-judgmental regard, confirmed by their willingness to openly share their thoughts and opinions without feelings of guilt or shame, also signifies my overarching understanding of population level health as sitting within a system beyond an individual's control. I am a strong proponent of creating supportive contexts that enable sustained positive dietary change and empower individuals to engage in context-specific eating patterns, rather than holding individuals responsible for their agency and choice in a system that hinders them from making healthy and sustainable food choices. My recommendation would be the development of a system that integrates eating and learning, enabling children to embrace health-promoting foods positively using environmental-sustainability as a lucrative motivator, sustaining and extending the successes of past policies and programs, and valuing and prioritising children's health over neoliberal agendas.

### 8.9 Conclusions

This research program has explored public health and sustainability as a conjoined policy discourse, in the context of children's school lunchboxes, with a move away from micro-level slicing of food for its nutrient components to more pragmatic broad dietary considerations using a whole-foods lens. As a high proportion of children continue to bring a lunchbox from home, this research confirms the importance of studying lunchbox foods for shaping public health interventions. Until a more comprehensive and nuanced approach to food classification is obtained, using environmental motivators to shift the nutrition dialogue at schools is a valuable opportunity, since broadly, this concept is easy to understand by the target population of this research program, namely, children. This research program highlights the importance and potential of a low-waste lunchbox, especially considering the prevalence of childhood obesity and related health concerns, as well as environmental preservation.

However, it has also been recognised that there are multiple barriers to the packing of nutritious low-waste lunchbox, and that structural and policy level changes are needed to create environments where these barriers will be reduced.

In this program of work, I consciously avoided a negative angle, in which school lunchboxes were targets of objects of moral surveillance. This research program used an optout and anonymised approach which was key to obtaining a big sample for the lunchbox audit study and has enabled creation of a valuable evidence base of updated lunchbox food and waste data, with a novel packaging dimension as well. Incorporating an environmental perspective into school-based initiatives can facilitate multi-sectoral coordination in the scale up of nutrition-based actions. Findings of the studies within this research program have demonstrated: the school level characteristics that promote health and sustainable behaviours, especially at the preschool level; some of the challenges that remain in terms of complexity of lunchbox packing and consumption behaviours; and future policy level reforms and research directions that can be considered to address those challenges, with the ultimate goals of improved childhood and planetary health, through the creation of supporting and enabling structural environments.

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http://www.un.org/sustainabledevelopment/sustainable-development-goals/ [Accessed 25 February 2023].

Wellbeing SA. 2023. Wellbeing SA Food and Drink Classification Guides [Online]. Available: https://www.wellbeingsa.sa.gov.au/our-work/healthy-places-people/healthy-food-nutrition/healthy-food-environments-hub/wellbeing-sa-food-and-drink-classification-guides?token=biFr6_dvA7MyVHldwSDns82-qGRdLURK [Accessed 18 July 2023].
"The earth is what we all have in common."

- Wendell Berr


## APPENDICES

## APPENDIX A: Study 1 Supplementary Files

## Appendix A.1: PRISMA Checklist for Scoping Review

## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

| SECTION | ITEM | PRISMA-ScR CHECKLIST ITEM | REPORTED ON PAGE \# |
| :---: | :---: | :---: | :---: |
| TITLE |  |  |  |
| Title | 1 | Identify the report as a scoping review. | 1 |
| ABSTRACT |  |  |  |
| Structured summary | 2 | Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives. | 1 |
| INTRODUCTION |  |  |  |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach. | 1-2 |
| Objectives | 4 | Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives. | 2 |
| METHODS |  |  |  |
| Protocol and registration | 5 | Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number. | 2 |
| Eligibility criteria | 6 | Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale. | 3 |
| Information sources* | 7 | Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed. | 3 |
| Search | 8 | Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated. | 3 |
| Selection of sources of evidence $\dagger$ | 9 | State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review. | 3 |
| Data charting process $\ddagger$ | 10 | Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators. | 3 |
| Data items | 11 | List and define all variables for which data were sought and any assumptions and simplifications made. | 3 |
| Critical appraisal of individual sources of evidence§ | 12 | If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate). | N/A |
| Synthesis of results | 13 | Describe the methods of handling and summarizing the data that were charted. | 3-4 |

St.Michael's
Inspired Care. Inspiring Science.

| SECTION | ITEM | PRISMA-ScR CHECKLIST ITEM | REPORTED ON PAGE \# |
| :---: | :---: | :---: | :---: |
| RESULTS |  |  |  |
| Selection of sources of evidence | 14 | Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram. | 3-4 |
| Characteristics of sources of evidence | 15 | For each source of evidence, present characteristics for which data were charted and provide the citations. | 3 |
| Critical appraisal within sources of evidence | 16 | If done, present data on critical appraisal of included sources of evidence (see item 12). | N/A |
| Results of individual sources of evidence | 17 | For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives. | 3-8 |
| Synthesis of results | 18 | Summarize and/or present the charting results as they relate to the review questions and objectives. | 3-8 |
| DISCUSSION |  |  |  |
| Summary of evidence | 19 | Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups. | 9-10 |
| Limitations | 20 | Discuss the limitations of the scoping review process. | 10 |
| Conclusions | 21 | Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps. | 10 |
| FUNDING |  |  |  |
| Funding | 22 | Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review. | 10 |

$\mathrm{JBI}=$ Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.
*Where sources of evidence (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.
$\dagger$ A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with information sources (see first footnote).
$\ddagger$ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.
$\S$ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

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Appendix A.2: Search Strategy for Scoping Review

## SEARCH STRATEGY FOR

## School lunchboxes as an opportunity for health and environmental considerations: A Scoping Review

## Logic Grid: PubMed

https://pubmed.ncbi.nlm.nih.gov/advanced/

| Setting | Behaviour (Healthy Food <br> Choice) | Environmental Factors |
| :---: | :---: | :---: |
| "child"[mh] OR "schools, nursery"[mh] OR "schools"[mh:noexp] OR child*[tw] OR kid[tw] OR kids[tw] OR school*[tw] OR preschool[tw] OR kindergarten[tw] OR "school health services"[mh:noexp] OR lunchbox*[tw] OR elementary school*[tw] | "food and beverages"[mh] <br> OR "diet"[mh] OR food consumption behavio? ${ }^{*}[t w]$ OR healthy diet*[tw] OR healthy food choice*[tw] OR "nutritional physiological phenomena"[mh] OR food decision*[tw] OR food decision making[tw] OR food choice*[tw] OR "food preferences"[mh] OR food preference*[tw] OR food choice motives[tw] OR (("self control"[mh] OR | ```sustainability[tw] OR environmentally friendly[tw] OR eco- friendly[tw] OR "eco friendly" \({ }^{[t w]}\) OR ecofriendly[tw] OR pro- environmental[tw] OR environmental stewardship[tw] OR environmentally conscious[tw] OR environmental sustainability[tw] OR planetary health[tw] OR environmental impact*[tw]``` |



## Logic Grid: EMBASE

https://www.embase.com/\#advancedSearch/default

| Setting | Behaviour (Healthy Food Choice) | Environmental Factors |
| :---: | :---: | :---: |
| child/de OR "preschool child"/de OR "school child"/de OR school/de OR child*:ti,ab,kw OR kid:ti,ab,kw OR kids:ti,ab,kw <br> OR school*:ti,ab,kw OR <br> preschool:ti,ab,kw OR <br> kindergarten:ti,ab,kw OR <br> "school health <br> service":ti,ab,kw OR <br> "lunchbox*":ti,ab,kw OR <br> "elementary <br> school*":ti,ab,kw | ```food/de OR diet/de OR nutrition/de OR"food consumption behavio? \({ }^{* * ": t i, a b, k w ~ O R ~}\) "healthy diet*":ti,ab,kw OR "healthy food choice"":ti,ab,kw OR "food decision*":ti,ab,kw OR "food decision making":ti,ab,kw OR "food choice*":ti,ab,kw OR "food preference"/de OR "food preference*":ti,ab,kw OR "food choice motives":ti,ab,kw OR (("self control"/de OR "personal autonomy"/de) AND (food*:ti,ab,kw OR diet*:ti,ab,kw)) OR "fruit``` | sustainability:ti,ab,kw OR <br> "environmentally <br> friendly":ti,ab,kw OR eco- <br> friendly:ti,ab,kw OR <br> ecofriendly:ti,ab,kw OR pro- <br> environmental:ti,ab,kw <br> OR "environmental <br> stewardship":ti,ab,kw OR <br> "environmentally <br> conscious":ti,ab,kw OR <br> "environmental <br> sustainability":ti,ab,kw OR <br> "planetary health":ti,ab,kw <br> OR "environmental <br> impact*":ti,ab,kw OR <br> "environmental policy"/de <br> OR "school <br> garden*":ti,ab,kw OR <br> ((environment/de OR |


|  | intake":ti,ab,kw OR | "climate change"/de) AND |
| :--- | :--- | :--- |
|  | "vegetable intake":ti,ab,kw | health/de) OR "ecological |
| OR "school |  |  |
| nutrition":ti,ab,kw OR |  |  |
| "nutrition" | footprint":ti,ab,kw OR |  |
| education":ti,ab,kw |  | "greenhouse gas <br> emission":ti,ab,kw OR <br> "carbon footprint":ti,ab,kw <br> OR ((food:ti,ab,kw OR <br> diet:ti,ab,kw) AND <br> "climate change":ti,ab,kw) |
|  |  | OR ((food:ti,ab,kw OR <br> diet:ti,ab,kw) AND "global <br> warming":ti,ab,kw) OR |
|  |  | "food waste":ti,ab,kw OR |
| "environment* |  |  |
| education":ti,ab,kw |  |  |

## Logic Grid: SCOPUS

https://www.scopus.com/search/form.uri?display=basic\&clear=t\&origin=searchadvan ced\&txGid=5bbd2936ad87e3c26bec5bb6cfb22c32\#basic

| Setting | Behaviour (Healthy Food Choice) | Environmental Factors |
| :---: | :---: | :---: |
| child OR "preschool child" OR "school child" OR child* OR kid OR kids OR school OR school* OR preschool OR kindergarten OR "school health service" OR lunchbox* OR "elementary school*" | food OR diet OR nutrition <br> OR "food consumption behavio? ${ }^{* *}$ " OR "healthy diet*" OR "healthy food choice*" OR "food decision*" OR "food decision making" OR "food choice*" OR "food preference" OR "food preference*" OR "food choice motives" OR (("self control" OR "personal autonomy") AND (food* OR diet*)) OR "fruit intake" OR "vegetable intake" OR "school nutrition" OR "nutrition* education" | sustainability OR <br> "environmentally friendly" <br> OR eco-friendly OR eco <br> friendly OR ecofriendly OR <br> pro-environmental OR <br> "environmental <br> stewardship" OR <br> "environmentally <br> conscious" OR <br> "environmental <br> sustainability" OR <br> "planetary health" OR <br> "environmental impact*" <br> OR "environmental policy" <br> OR "school garden*" OR <br> ((environment OR "climate <br> change") AND health) OR <br> "ecological footprint" OR <br> "greenhouse gas |

\(\left.$$
\begin{array}{|l|l|l|}\hline & & \begin{array}{l}\text { emission" OR "carbon } \\
\text { footprint" OR ((food OR } \\
\text { diet) AND "climate }\end{array}
$$ <br>
change") OR ((food OR <br>
diet) AND "global <br>
warming") OR "food <br>

waste" OR\end{array}\right\}\)| "environment*al |
| :--- |
| education" |

## Logic Grid: Web of Science

https://www.webofscience.com/wos/woscc/summary/5c28328d-834d-4395-ae92-

## 386ba8b04f71-00dc4be9/relevance/1

| Setting | Behaviour (Healthy Food <br> Choice) | Environmental Factors |
| :---: | :---: | :---: |
| TI=(child OR "preschool child" OR "school child" OR child* OR kid OR kids OR school OR school* OR preschool OR kindergarten OR "school health service") OR AB=(child $O R$ "preschool child" OR "school child" OR child* OR kid OR kids OR school OR school* OR preschool OR kindergarten OR "school health service") OR AK=(child OR "preschool child" OR "school child" OR child* OR kid OR kids OR school OR school* OR preschool OR kindergarten OR "school health service" | $\mathrm{Tl}=($ food OR diet OR nutrition OR "food consumption behavio? ${ }^{* *}$ OR "healthy diet*" OR "healthy food choice*" OR nutrition OR "food decision*" OR "food decision making" OR "food choice*" OR "food preference" OR "food preference*" OR "food choice motives" OR (("self control" OR "personal autonomy") AND (food* OR diet*)) OR "fruit intake" OR "vegetable intake" OR "school nutrition" OR "nutrition education" ) OR $A B=($ food | $\mathrm{TI}=($ sustainability OR <br> "environmentally friendly" <br> OR eco-friendly OR eco <br> friendly OR ecofriendly <br> OR pro-environmental OR <br> "environmental <br> stewardship" OR <br> "environmentally <br> conscious" OR <br> "environmental <br> sustainability" OR <br> "planetary health" OR <br> "environmental impact*" <br> OR "environmental policy" <br> OR "school garden*" OR <br> ((environment OR <br> "climate change") AND <br> health) OR "ecological <br> footprint" OR "greenhouse |


| OR "lunchbox*" OR <br> "elementary school*" ) | OR diet OR nutrition OR "food consumption behavio? r*" OR "healthy diet*" OR "healthy food choice*" OR nutrition OR "food decision*" OR "food decision making" OR "food choice*" OR "food preference" OR "food preference*" OR "food choice motives" OR (("self control" OR "personal autonomy") AND (food* OR diet*)) OR "fruit intake" OR "vegetable intake" OR "school nutrition" OR "nutrition education" ) OR AK=(food OR diet OR nutrition OR "food consumption behavio? r*" OR "healthy diet*" OR "healthy food choice*" OR nutrition OR "food decision*" OR "food | gas emission" OR "carbon <br> footprint" OR ((food OR <br> diet) AND "climate <br> change") OR ((food OR <br> diet) AND "global <br> warming") OR "food <br> waste" OR "environmental <br> education" ) OR <br> $A B=$ (sustainability $O R$ <br> "environmentally friendly" <br> OR eco-friendly OR eco <br> friendly OR ecofriendly <br> OR pro-environmental OR <br> "environmental <br> stewardship" OR <br> "environmentally <br> conscious" OR <br> "environmental <br> sustainability" OR <br> "planetary health" OR <br> "environmental impact*" <br> OR "environmental policy" <br> OR "school garden*" OR <br> ((environment OR |
| :---: | :---: | :---: |



|  | OR "environmental policy" <br> OR "school garden*" OR <br> ((environment OR |
| :--- | :--- | :--- |
| "climate change") AND |  |
| health) OR "ecological |  |
| footprint" OR "greenhouse |  |
| gas emission" OR "carbon |  |
| footprint" OR ((food OR |  |
| diet) AND "climate |  |
| change") OR ((food OR |  |
| diet) AND "global |  |
| warming") OR "food |  |
| waste" OR "environmental |  |
| education" ) |  |

## Logic Grid: PsycINFO

https://ovidsp.ovid.com/ovidweb.cgi?T=JS\&NEWS=N\&PAGE=main\&SHAREDSEAR

## CHID=333W2EIW6YObX4qY66vwhoLR0LT6fdOc5LizudfDhyL9ceLIUvdejDaljgmXR

 2jmx| Setting | Behaviour (Healthy Food <br> Choice) | Environmental Factors |
| :--- | :--- | :--- |
| child.sh OR preschool | food.sh OR diet.sh OR | Sustainability.ti,ab OR |
| students.sh OR primary | nutrition.sh OR food | environmentally |
| school students.sh OR | consumption | behavio?r*.ti,ab OR |
| School Based | healthy diet*.ti,ab OR | friendly.ti,ab OR eco- |
| Intervention.sh OR |  |  |
| school.sh OR child*.ti,ab OR | healthy food choice*.ti,ab | environmental.ti,ab OR OR |
| kid.ti,ab OR kids.ti,ab OR | OR food decision*.ti,ab | environmental |
| school*.ti,ab OR | OR food decision | stewardship.ti,ab OR |
| preschool.ti,ab OR | making.ti,ab OR food | environmentally |
| kindergarten.ti,ab OR school | choice*.ti,ab OR food | conscious.ti,ab OR |
| health service.ti,ab OR | preferences.sh OR food | environmental |
| lunchbox*.ti,ab OR | preference*.ti,ab OR food | sustainability.ti,ab OR |
| elementary school.ti,ab | choice motives.ti,ab OR | planetary health.ti,ab OR |
| ((self control.sh OR | environmental |  |
| autonomy.sh) AND |  |  |
| (food*.ti,ab OR |  |  |
| diet*.ti,ab)) OR fruit | intake.ti,ab OR vegetable | environment.sh OR school |


|  | intake.ti,ab OR school | school garden*.ti,ab OR |
| :--- | :--- | :--- |
| nutrition.ti,ab OR | ((environment.sh OR |  |
| nutrition* education.ti,ab |  | climate change.sh) AND <br> health.sh) OR ecological <br> footprint.ti,ab OR |
|  |  | greenhouse gas <br> emission.ti,ab OR carbon <br> footprint.ti,ab OR <br> ((food.ti,ab OR diet.ti,ab) |
| AND climate change.ti,ab) |  |  |
| OR ((food.ti,ab OR |  |  |
| diet.ti,ab) AND global |  |  |
| warming.ti,ab) OR food |  |  |
| waste.ti,ab OR |  |  |
| environment* |  |  |
| education.ti,ab |  |  |

## APPENDIX B: Study 3 Supplementary Files

## Appendix B.1: First Ethics Approval from University HREC



CONDITIONS OF APPROVAL: Thank you for addressing the feedback. The revised ethics application provided on the 19th of August 2020 has been approved.

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled Annual Report on Project Status is to be used when reporting annual progress and project completion and can be downloaded at http://www.adelaide.edu.au/research-services/oreci/human/reporting/. Prior to expiry, ethics approval may be extended for a further period.

Participants in the study are to be given a copy of the information sheet and the signed consent form to retain. It is also a condition of approval that you immediately report anything which might warrant review of ethical approval including:

- serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical acceptability of the project,
- proposed changes to the protocol or project investigators; and
- the project is discontinued before the expected date of completion.


## Yours sincerely,

Ms Yvette Kim Clarissa Wijnandts
Secretary
The University of Adelaide

## Appendix B.2: Second (amended) Ethics Approval from University HR



RESEARCH SERVICES
OFFICE OF RESEARCH ETHICS, COMPLIANCE AND INTEGRITY

Our reference 34639
THE UNIVERSITY OF ADELAIDE
LEVEL 4, RUNDLE MAL PLAZA
50 RUNDLE MAL
ADELAIDE SA 5000 AUSTRALIA
TELEPHONE +61883135137
FACSIMILE +61883133700
EMAIL hrec@adelaide.edu.au
CRICOS Provider Number 00123M
Dr Shona Crabb
Public Health

## Dear Dr Crabb

ETHICS APPROVAL No: H-2020-167
PROJECT TITLE: School Food Environments: A lunchbox and waste audit in South Australian Public Schools

The ethics application for the above project has been reviewed by the Low Risk Human Research Ethics Review Group (Faculty of Health and Medical Sciences) and is deemed to meet the requirements of the National Statement on Ethical Conduct in Human Research 2007 (Updated 2018) involving no more than low risk for research participants.

You are authorised to commence your research on: 21/08/2020
The ethics expiry date for this project is: 31/08/2023

## NAMED INVESTIGATORS:

| Chief Investigator: | Dr Shona Crabb |
| :---: | :---: |
| Student - Postgraduate by Research: | Ms Neha Kishan Lalchandani |
| Associate Investigator: | Dr Clare Hume |
| Associate Investigator: | Professor Caroline Miller |
| Associate Investigator: | Ms Jo Hendrikx |

CONDITIONS OF APPROVAL: Thank you for addressing the feedback. The revised ethics application provided on the 19th of August 2020 has been approved.

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled Annual Report on Project Status is to be used when reporting annual progress and project completion and can be downloaded at http://hww.adelaide.edu.au/research-services/oreci/human/reporting/. Prior to expiry, ethics approval may be extended for a further period.

Participants in the study are to be given a copy of the information sheet and the signed consent form to retain. It is also a condition of approval that you immediately report anything which might warrant review of ethical approval including:

- serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical acceptability of the project,
- proposed changes to the protocol or project investigators; and
- the project is discontinued before the expected date of completion.


## Yours sincerely,

Ms Yvette Kim Clarissa Wijnandts
Secretary
The University of Adelaide

## Appendix B.3: Third (amended) Ethics Approval from University HREC



RESEARCH SERVICES
OFFICE OF RESEARCH ETHICS, COMPLIANCE
AND INTEGRITY
THE UNIVERSITY OF ADELAIDE
Our reference 34639

11 March 2021
LEVEL 4, RUNDLE MAL PLAZA
50 RUNDLE MALL
ADELAIDE SA 5000 AUSTRALIA
TELEPHONE +61883135137
FACSIMILE +61883133700
EMAIL hrec@adelaide.edu.au
CRICOS Provider Number 00123M
Dr Shona Crabb
Public Health

## Dear Dr Crabb

| ETHICS APPROVAL No: | $\mathrm{H}-2020-167$ |
| :--- | :--- |
| PROJECT TITLE: | School Food Environments: A lunchbox and waste audit in South |
|  | Australian Public Schools |

Thank you for providing the amended application dated the 4th of March 2021. The request to visit schools for data collection without a KESAB representative has been approved.

The ethics amendment for the above project has been reviewed by the Low Risk Human Research Ethics Review Group (Faculty of Health and Medical Sciences) and is deemed to meet the requirements of the National Statement on Ethical Conduct in Human Research 2007 (Updated 2018) involving no more than low risk for research participants.

You are authorised to commence your research on: $21 / 08 / 2020$
The ethics expiry date for this project is: 31/08/2023

## NAMED INVESTIGATORS:

Chief Investigator: $\quad \mathrm{Dr}$ Shona Crabb

Student - Postgraduate Masters Ms Neha Kishan Lalchandani by Research:

| Associate Investigator: | Dr Clare Hume |
| :--- | :--- |
| Associate Investigator: | Professor Caroline Miller |
| Associate Investigator: | Ms Jo Hendrikx |

CONDITIONS OF APPROVAL: Thank you for addressing the feedback. The revised ethics application provided on the 19th of August 2020 has been approved.

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled Annual Report on Project Status is to be used when reporting annual progress and project completion and can be downloaded at http://hww.adelaide.edu.au/research-services/oreci/human/reporting/. Prior to expiry, ethics
approval may be extended for a further period.
Participants in the study are to be given a copy of the information sheet and the signed consent form to retain. It is also a condition of approval that you immediately report anything which might warrant review of ethical approval including:

- serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical acceptability of the project,
- proposed changes to the protocol or project investigators; and
- the project is discontinued before the expected date of completion.


## Yours sincerely,

Ms Yvette Kim Clarissa Wijnandts
Secretary
The University of Adelaide

## Appendix B.4: Project Approval from Department for Education

Government of South Australia
Department for Education

System Performance
31 Flinders Street
Adelaide SA 5000
GPO Box 1152
Adelaide SA 5001
DX 541
Tel. +61882261609
Education.ResearchUnit@sa.aov.au
mww.education.sa.aov.au
Reference No: 2020-0036

Ms Neha Kishan
School of Public Health
University of Adelaide

## Dear Ms Kishan

Your research project "School Food Environments: A lunchbox and waste audit in South Australian Public Schools" has been reviewed by a senior officer within the Department.

I am pleased to advise you that your application has been approved, subject to the following conditions:

- That a copy of any final reports, presentations or manuscripts accepted for publication be submitted to the Education. ResearchUnit@sa.gov.au mailbox 30 days prior to their publication.
- That a copy of any reports, presentations or manuscripts provided to participants be submitted to the Education.ResearchUnit@sa.gov.au mailbox.
- The researcher maintains contact with the Healthy Eating team of the Engagement and Wellbeing Directorate of the Department for Education regarding the timing of school visits and any outcomes of the research, including media release or attention using the below contact details:


## Danielle Proud

Project Officer, Healthy Eating
t82261931 edanielle.proud2@sa.gov.au
Please contact Georgia in the Data Reporting and Analytics directorate for any other matters you may wish to discuss regarding your application (Tel. (08) 82261609 or email: Education.ResearchUnit@sa.gov.au)

I wish you well with your research.
Yours sincerely

Ben Temperly
EXECUTIVE DIRECTOR, SYSTEM PERFORMANCE
2 September 2020

## Appendix B.5: Site Approval from Department for Education



System Performance
31 Flinders Street
Adelaide SA 500
GPO Box 1152
Adelaide SA 5001
DX 541
Tel. +61882261609
Education.ResearchUnit@sa.gov.al
www.education.sa.gov.au

REFERENCE NO: 2020-0036
RESEARCHER: Neha Kishan
RESEARCH BODY: University of Adelaide

Dear Principal/Director/Site Manager
The research project titled "School Food Environments: A lunchbox and waste audit in South Australian Public Schools" has been reviewed centrally and granted approval for access to Department for Education sites. However, the researcher(s) will still need your agreement to proceed with this research at your site.

The researcher(s) whose names appear below are the only persons permitted to conduct research on your site:

| Name | Clearance Type | Expiry Date |
| :---: | :---: | :---: |
| Neha Kishan Lalchandani | WWCC SA | $25 / 11 / 2024$ |

Please contact Georgia in the Data Reporting and Analytics directorate for any other matters you may wish to discuss regarding your participation (Tel. (08) 82261609 or email: Education.ResearchUnit@sa.gov.au).

Yours sincerely

## Ben Temperly EXECUTIVE DIRECTOR, SYSTEM PERFORMANCE

2 September 2020

## School Food Environments: A lunchbox and waste audit in South Australian Public Schools

STUDENT RESEARCHER: Neha Kishan Lalchandani INDUSTRY PARTNER: Jo Hendrikx (KESAB environmental solutions)


What is the project about?
In collaboration with KESAB environmental solutions, this research project involves auditing food and packaging contents in pre-and primary schoolers' lunchboxes, to determine how much of the lunchbox contents children consume and how much of it gets wasted. The results of this study will help guide the development of suitable interventions to increase environmentally sustainable and healthy food consumption in the school setting.

What are the potential benefits of the research project?
This study aims to help us understand more about children's current lunchbox contents, so that we can determine how to encourage increasingly healthy and eco-friendly eating behaviours in future.


What will the research project involve?
The audit will be facilitated by the class teacher and children will be asked to place their lunchboxes on their respective desks. Photos of lunchboxes will be taken by the student researcher in the classroom before recess and after lunch break. Only photos of lunchboxes will be taken using a de-identified process, and no sensitive or personal information will be collected.

If you are happy for your child to participate in this project, please fill the consent form attached below and return it to the school within two weeks of the date of this letter.


For more information regarding this project, please refer to this Participant information Sheet

HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: H-2020-167 PRINCIPAL INVESTIGATOR: Dr Shona Crabb

Appendix B.7: Project Information Flyer Used During Recruitment Phase (opt-out
based)

## School Food Environments: A lunchbox and waste audit in South Australian Public Schools

## STUDENT RESEARCHER: Neha Kishan Lalchandani INDUSTRY PARTNER: Jo Hendrikx (KESAB environmental solutions)



What is the project about?
In collaboration with KESAB environmental solutions, this research project involves auditing food and packaging contents in pre-and primary schoolers' lunchboxes, to determine how much of the lunchbox contents children consume and how much of it gets wasted. The results of this study will help guide the development of suitable interventions to increase environmentally sustainable and healthy food consumption in the school setting.

What are the potential benefits of the research project?
This study aims to help us understand more about children's current lunchbox contents, so that we can determine how to encourage increasingly healthy and eco-friendly eating behaviours in future.


What will the research project involve?
The audit will be facilitated by the class teacher and children will be asked to place their lunchboxes on their respective desks. Photos of lunchboxes will be taken by the student researcher in the classroom before recess and after lunch break. Only photos of lunchboxes will be taken using a de-identified process, and no sensitive or personal information will be collected.

If you are happy for your child to participate in this project, you do not need to do anything further. If you do not wish your child to participate in this research study, please fill the opt-out form attached below and return it to the school within two weeks of the date of this letter.


For more information regarding this project, please refer to this Participant Information Sheet

HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: H-2020-167 PRINCIPAL INVESTIGATOR: Dr Shona Crabb

## Appendix B.8: Project Information Sheet for Preschools

. $\because$ THE UNIVERSITY


## PROJECT INFORMATION SHEET

PROJECT TITLE: School Food Environments: A lunchbox and waste audit in South Australian Public Schools HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: H-2020-167 PRINCIPAL INVESTIGATOR: Dr Shona Crabb STUDENT RESEARCHER: Neha Kishan Lalchandani STUDENT'S DEGREE: MPhil Public Health

Your preschool is invited to participate in the research project described below.

## What is the project about?

In collaboration with KESAB environmental solutions, this research project involves auditing food and packaging contents in pre- and primary schoolers' lunchboxes, to determine how much of the lunchbox contents children consume and how much of it gets wasted. The results of this study will help guide the development of suitable interventions to increase environmentally sustainable and healthy food consumption in the school setting.

Who is undertaking the project?
This project is being conducted by Neha Kishan Lalchandani as part of her Master of Philosophy (Public Health) degree at the University of Adelaide. The project is being supervised by Dr Shona Crabb, Dr Clare Hume, and Professor Caroline Miller. This project's external industry partner, KESAB environmental solutions, will be providing support to conduct the school lunchbox audits, which will be an additional element alongside the bin audits they routinely conduct as part of their initiative to reduce waste outcomes in pre- and primary schools. KESAB has pre-existing relationships and established agreements with a number of schools in South Australia, and their bin audits are regular features on school calendars. This research project is being guided by this existing association. The research collaborator from KESAB environmental solutions is Jo Hendrikx.

Why am I being invited to participate?
Public primary schools and kindergartens located in the Greater Adelaide Region have been invited to take part in this study (aiming for a spread of schools across socio-economic status and geographic areas), in alignment with KESAB's audit schedule.

What am I being invited to do?
Your preschool is being invited to participate in this lunchbox audit, which will be conducted in conjunction with KESAB's existing scheduled school bin audits. You are only expected to provide basic demographic data about class (e.g. number of children, and age range) in the consent form. Individual level personal or sensitive data of the preschool children will NOT be collected.

Once you consent for your preschool to participate in this study, you will be asked to send the project details including the Project Flyer and Opt-Out/Consent form to parents/guardians of the children, through your preferred medium of communication. The date of the lunchbox audit that will be conducted at your preschool, will be the same as KESAB's scheduled bin audit. However, parents/guardians are not to be informed on which particular date the audit will take place to prevent them from changing their behaviour in terms of what they pack in their child(ren)'s lunchbox, hence hopefully avoiding social desirability bias.

On the day of the audit, preschool children will be explained the purpose of conducting the research project by the class teacher (supported by Neha or Jo if required), who will ask the children to place their lunchboxes on their respective desks or a tarpaulin to be photographed in the classroom by the student researcher. To conduct the audit, the student researcher will take photographs of the children's lunchboxes before recess and after lunch break. The number of children who get their meals from the canteen or those who do not bring a lunchbox will be acknowledged in the study.

## How much time will my involvement in the project take?

Photographing the lunchboxes will be done in the classroom setting and will take approximately 10 minutes before recess and approximately 10 minutes after lunch break. You will need to set a time to meet with your preschool staff members to discuss the project details and date of audit. If teachers would like to arrange or prepare a learning activity around the audit, timing can be adjusted accordingly.

## Are there any risks associated with participating in this project?

Children will be in a safe environment within the preschool setting, and the audit will be facilitated by the teacher. Moreover, this research study is an additional element to the bin audits that KESAB conducts, and no risk to participants have been reported previously. Hence, the likelihood of any burden/discomfort on the school children is minimal.
Only photos of lunchboxes will be taken, and no sensitive or personal information will be collected. In case lunchboxes are labelled with child(ren)'s names, it will be ensured that all visible names will be blurred in photographs to protect their identities. The lunchboxes that need to be placed on the tarpaulin to be photographed will be handled only by the children or class teacher if necessary. Specific contents of certain items such as sandwich fillings will not be identified as unwrapping or disassembling of any food items will not take place. The student researcher will NOT have further discussions with any child to inquire about the details of the lunchbox contents. Moreover, if children do not want to participate, they will not be pressured.
Wherever possible, batch photos will be taken to prevent the process from being time consuming and minimising intrusion into their eating schedule.
Furthermore, the student researcher holds a valid Working with Children Check issued by the Department of Human Services Screening Unit (Government of South Australia)

What are the potential benefits of the research project?
This study aims to help us understand more about children's current lunchbox contents, so that we can determine how to encourage increasingly healthy and eco-friendly eating behaviours in future.

## Can I withdraw from the project?

Participation in this project is completely voluntary. Schools are free to withdraw their data from the study at any point, until the analysis of data is complete.

## What will happen to my information?

Names and details of schools will be de-identified throughout the course of the research study. During the reporting of research results, personal identifiers will not be included as school names will be replaced by codes in order to protect the privacy and confidentiality of the schools. The student researcher will designate codes to each school for the data analysis and reporting process. The original details of the school names linked with the codes will remain secured in a password protected file on the University computer's hard drive within the University of Adelaide's School of Public Health. This protected information containing the school names associated with the codes will only be accessible by the listed researchers on this ethics application.

Lunchbox photographs will be stored in folders (that will be named after the designated school codes) and sub-folders (that will be named after the classroom) - all these photographs will be saved in a password protected University computer's within the University of Adelaide's School of Public Health.

During the data collection period, names of school staff and children will not be collected or recorded. In case lunchboxes are labelled with child(ren)'s names, we will ensure that all visible names will be blurred to protect their identities throughout the study. Any personal identifiers will not be collected or reported Data will be securely stored for at least 5 years after the completion of the project within the School of Public Health at the University of Adelaide.
The study outcomes will be made publicly available through the form of journal article publications, thesis publication, and conference/seminar/poster presentations, with anonymity of school names completely guaranteed in the reporting of results.
The data collected for this study will not be used for future use for any other project, or shared with any other researchers. Consent provided by parents/guardians is specific just to this research project

Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

Once the research study has been completed and results analysed, a report summary of the study results will be provided to respective schools, for knowledge translation purposes (which may be of value for the teachers to share with the class), and can also be disseminated to parents/guardians via the school newsletter. A copy of the published research can be sent to you at your request.

Who do I contact if I have questions about the project?
If you would like to ask any questions about this project, or you would like us to explain these details to you, please contact

## Dr Shona Crabb

Principal Investigator / Supervisor
The University of Adelaide
shona.crabb@adelaide.edu.au
+61883131686

## Neha Kishan Lalchandani

Research Student
The University of Adelaide
neha.lalchandani@adelaide.edu.au
+61883131695

## Dr Clare Hume

Supervisor
The University of Adelaide
clare.hume@adelaide.edu.au

Professor Caroline Miller
Supervisor
The University of Adelaide
caroline.miller@adelaide.edu.au
$+61881284091$

## Jo Hendrikx

Research Collaborator
KESAB environmental solutions
JHendrikx@kesab.asn.au
+61882347255

What if I have a complaint or any concerns?
The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2020-167) and approved by Department for Education (South Australia). This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research 2007 (Updated 2018). If you have questions or problems associated with the practica aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Human Research Ethics Committee's Secretariat on Phone: +61883136028
Email: hrec@adelaide.edu.au
Post: Level 4, Rundle Mall Plaza, 50 Rundle Mall, ADELAIDE SA 5000
Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

## If I want to participate, what do I do?

If you would like your preschool to be part of this research study, you can confirm your intent to participate by filling the consent form attached. We will then be in touch regarding the audit date and time.

Yours sincerely,
Neha Kishan Lalchandani
Dr Shona Crabb
Dr Clare Hume
Professor Caroline Miller
Jo Hendrikx

## Appendix B.9: Consent Form for Preschools

## Human Research Ethics Committee (HREC)

## PRESCHOOL CONSENT FORM

1. I have read the attached Information Sheet and give consent to [INSERT PRESCHOOL NAME]'s participation in the following research project:

| Title: | School Food Environments: A lunchbox and waste audit in South <br> Australian Public Schools |
| :--- | :--- |
| Ethics Approval <br> Number: | H-2020-167 |

2. I have had the project, so far as it affects any members of $m y$ site and the participating children, and the potential risks and burdens fully explained to my satisfaction by the research worker. I have had the opportunity to ask any questions I may have about the project and my participation. My consent is given freely.
3. Although I understand the purpose of the research project, it has also been explained that my involvement may not be of any benefit to the school community in the immediate future.
4. I agree to ensure that the project details including the Project Flyer and Consent/Opt-Out form will be sent to parents/guardians of the children.
5. I agree to allow the student researcher to conduct the lunchbox audit in the preschool by photographing the lunchboxes before and after they are eaten by the children, excepting any children whose parents/guardians have chosen to opt-out of this research study.
6. I understand that the preschool is free to withdraw from the project at any time before the analysis of data is complete.
7. I have been informed that while the information gained in the project may be published, all the preschool names will remain de-identified, and no personal identifiers of anyone participating in this study will be collected or published.
8. I understand my information will only be disclosed according to the consent provided, except where disclosure is required by law.
9. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

## Preschool Principal/Director to complete:

Scheduled audit date: $\qquad$
Name: $\qquad$

Signature: $\qquad$

Date of consent $\qquad$

## Preschool Demographics

Number of children: $\qquad$

Age range: $\qquad$
of ADELAIDE

\author{

## PROJECT INFORMATION SHEET

 <br> PROJECT TITLE: School Food Environments: A lunchbox and waste audit in South Australian Public Schools <br> HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: H-2020-167 PRINCIPAL INVESTIGATOR: Dr Shona Crabb STUDENT RESEARCHER: Neha Kishan Lalchandani STUDENT'S DEGREE: MPhil Public Health}

Your school is invited to participate in the research project described below.

## What is the project about?

In collaboration with KESAB environmental solutions, this research project involves auditing food and packaging contents in pre- and primary schoolers' lunchboxes, to determine how much of the lunchbox contents children consume and how much of it gets wasted. The results of this study will help guide the development of suitable interventions to increase environmentally sustainable and healthy food consumption in the school setting.

## Who is undertaking the project?

This project is being conducted by Neha Kishan Lalchandani as part of her Master of Philosophy (Public Health) degree at the University of Adelaide. The project is being supervised by Dr Shona Crabb, Dr Clare Hume, and Professor Caroline Miller. This project's external industry partner, KESAB environmental solutions, will be providing support to conduct the school lunchbox audits, which will be an additional element alongside the bin audits they routinely conduct as part of their initiative to reduce waste outcomes in schools. KESAB has pre-existing relationships and established agreements with a number of schools in South Australia, and their bin audits are regular features on school calendars. This research project is being guided by this existing association. The research collaborator from KESAB environmental solutions is Jo Hendrikx.

Why am I being invited to participate?
Public primary schools and kindergartens located in the Greater Adelaide Region have been invited to take part in this study (aiming for a spread of schools across socio-economic status and geographic areas), in alignment with KESAB's audit schedule.

## What am I being invited to do?

Your school is being invited to nominate two classes to participate in this lunchbox audit, which will be conducted in conjunction with KESAB's existing scheduled school bin audits. You are only expected to provide basic demographic data about the nominated class (e.g. children's year level, number of children, and age range) in the consent forms. Individual level personal or sensitive data of the school children will NOT be collected.

Once you consent for your school to participate in this study, you will be asked to send the project details including the Project Flyer and Opt-Out/Consent form to parents/guardians of the children from the nominated classes, through your preferred medium of communication. The date of the lunchbox audit that will be conducted at your school, will be the same as KESAB's scheduled bin audit. However, parents/guardians are not to be informed on which particular date the audit will take place to prevent

# ** THE UNIVERSITY <br> (H) of ADELAIDE <br> them from changing their behaviour in terms of what they pack in their 

 child(ren)'s lunchbox, hence hopefully avoiding social desirability bias.On the day of the audit, school children will be explained the purpose of conducting the research project by the class teacher (supported by Neha or Jo if required), who will ask the children to place their lunchboxes on their respective desks or a tarpaulin to be photographed in the classroom by the student researcher. To conduct the audit, the student researcher will take photographs of the children's lunchboxes before recess and after lunch break. The number of children who get their meals from the canteen or those who do not bring a lunchbox will be acknowledged in the study.

## How much time will my involvement in the project take?

Photographing the lunchboxes will be done in the classroom setting and will take approximately 10 minutes before recess and approximately 10 minutes after lunch break. You will need to set a time to meet with your school staff members to nominate the two classes to participate in the lunchbox audit for this project. If teachers would like to arrange or prepare a learning activity around the audit, timing can be adjusted accordingly.

## Are there any risks associated with participating in this project?

Children will be in a safe environment within the school and classroom setting, and the audit will be facilitated by the class teacher. Moreover, this research study is an additional element to the bin audits that KESAB conducts, and no risk to participants have been reported previously. Hence, the likelihood of any burden/discomfort on the school children is minimal.
Only photos of lunchboxes will be taken, and no sensitive or personal information will be collected. In case lunchboxes are labelled with child(ren)'s names, it will be ensured that all visible names will be blurred in photographs to protect their identities. The lunchboxes that need to be placed on the tarpaulin to be photographed will be handled only by the children or class teacher if necessary. Specific contents of certain items such as sandwich fillings will not be identified as unwrapping or disassembling of any food items will not take place. The student researcher will NOT have further discussions with any child to inquire about the details of the lunchbox contents. Moreover, if children do not want to participate, they will not be pressured.
Wherever possible, batch photos will be taken to prevent the process from being time consuming and minimising intrusion into their eating schedule.
Furthermore, the student researcher holds a valid Working with Children Check issued by the Department of Human Services Screening Unit (Government of South Australia).

What are the potential benefits of the research project?
This study aims to help us understand more about children's current lunchbox contents, so that we can determine how to encourage increasingly healthy and eco-friendly eating behaviours in future.

## Can I withdraw from the project?

Participation in this project is completely voluntary. Schools are free to withdraw their data from the study at any point, until the analysis of data is complete.

## What will happen to my information?

Names and details of schools will be de-identified throughout the course of the research study. During the reporting of research results, personal identifiers will not be included as school names will be replaced by codes in order to protect the privacy and confidentiality of the schools. The student researcher will designate codes to each school for the data analysis and reporting process. The original details of the school names linked with the codes will remain secured in a password protected file on the University
computer's hard drive within the University of Adelaide's School of Public
Health. This protected information containing the school names associated with the codes will only be accessible by the listed researchers on this ethics application.

Lunchbox photographs will be stored in folders (that will be named after the designated school codes) and sub-folders (that will be named after the classroom) - all these photographs will be saved in a password protected University computer's within the University of Adelaide's School of Public Health.

During the data collection period, names of school staff and children will not be collected or recorded. In case lunchboxes are labelled with child(ren)'s names, we will ensure that all visible names will be blurred to protect their identities throughout the study. Any personal identifiers will not be collected or reported. Data will be securely stored for at least 5 years after the completion of the project within the School of Public Health at the University of Adelaide.
The study outcomes will be made publicly available through the form of journal article publications, thesis publication, and conference/seminar/poster presentations, with anonymity of school names completely guaranteed in the reporting of results.
The data collected for this study will not be used for future use for any other project, or shared with any other researchers. Consent provided by parents/guardians is specific just to this research project

Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

Once the research study has been completed and results analysed, a report summary of the study results will be provided to respective schools, for knowledge translation purposes (which may be of value for the teachers to share with the class), and can also be disseminated to parents/guardians via the school newsletter. A copy of the published research can be sent to you at your request.

Who do I contact if I have questions about the project?
If you would like to ask any questions about this project, or you would like us to explain these details to you, please contact:

## Dr Shona Crabb

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The University of Adelaide
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Neha Kishan Lalchandani
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## Jo Hendrikx

Research Collaborator
KESAB environmental solutions
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+61882347255

## What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2020-167) and approved by Department for Education (South Australia). This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research 2007 (Updated 2018). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Human Research Ethics Committee's Secretariat on: Phone: +61883136028
Email: hrec@adelaide.edu.au
Post: Level 4, Rundle Mall Plaza, 50 Rundle Mall, ADELAIDE SA 5000
Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

If I want to participate, what do I do?
If you would like your school to be part of this research study, you can confirm your intent to participate by filling the consent form attached, and nominating the two classes that can be audited by the student researcher. We will then be in touch regarding the audit date and time.

Yours sincerely,
Neha Kishan Lalchandani
Dr Shona Crabb
Dr Clare Hume
Professor Caroline Miller
Jo Hendrikx

## Appendix B.11: Consent Form for Primary Schools

## Human Research Ethics Committee (HREC)

## PRIMARY SCHOOL CONSENT FORM

1. I have read the attached Information Sheet and give consent to [INSERT PRIMARY SCHOOL NAME]'s participation in the following research project:

| Title: | School Food Environments: A lunchbox and waste audit in South <br> Australian Public Schools |
| :--- | :--- |
| Ethics Approval <br> Number: | H-2020-167 |

2. I have had the project, so far as it affects any members of my site and the participating children, and the potential risks and burdens fully explained to my satisfaction by the research worker. I have had the opportunity to ask any questions I may have about the project and my participation. My consent is given freely.
3. Although I understand the purpose of the research project, it has also been explained that my involvement may not be of any benefit to the school community in the immediate future.
4. I agree to nominate the two classes listed below to be audited according to the procedures outlined in the participant information sheet.

| No. | Class (Year Level) | Number of children | Age range of children |
| :---: | :---: | :---: | :---: |
| 1 |  |  |  |
| 2 |  |  |  |

5. I agree to ensure that the project details including the Project Flyer and Consent/Opt-Out form will be sent to parents/guardians of the children from the nominated classes.
6. I agree to allow the student researcher to conduct the lunchbox audit in the nominated classrooms by photographing the lunchboxes before and after they are eaten by the school children, excepting any children whose parents/guardians have chosen to opt-out of this research study.
7. I understand that the school is free to withdraw from the project at any time before the analysis of data is complete.
8. I have been informed that while the information gained in the project may be published, all the school names will remain de-identified, and no personal identifiers of anyone participating in this study will be collected or published.
9. I understand my information will only be disclosed according to the consent provided, except where disclosure is required by law.
10. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

## School Principal/Director to complete:

Scheduled audit date: $\qquad$

Name:

Signature: $\qquad$

Date of consent: $\qquad$

## Appendix B.12: Participant Information Sheet for Parents (consent form)

## PARTICIPANT INFORMATION SHEET

PROJECT TITLE: School Food Environments: A lunchbox and waste audit in South Australian Public Schools

HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: H-2020-167 PRINCIPAL INVESTIGATOR: Dr Shona Crabb STUDENT RESEARCHER: Neha Kishan Lalchandani STUDENT'S DEGREE: MPhil Public Health

Dear Parent/Guardian,

This Participant Information Sheet details a research project that will be conducted at your child's school during Term 4 of 2020.

What is the project about?
In collaboration with KESAB environmental solutions, this research project involves auditing food and packaging contents in pre- and primary schoolers' lunchboxes, to determine how much of the lunchbox contents children consume and how much of it is wasted. The results of this study will help guide the development of suitable interventions to increase environmentally sustainable and healthy food consumption in the school setting.

Who is undertaking the project?
This project is being conducted by Neha Kishan Lalchandani as part of her Master of Philosophy (Public Health) degree at the University of Adelaide. The project is being supervised by Dr Shona Crabb, Dr Clare Hume, and Professor Caroline Miller. This project's external industry partner, KESAB environmental solutions, will be providing support to conduct the school lunchbox audits, which will be an additional element alongside the bin audits they routinely conduct as part of their initiative to reduce waste outcomes in schools. KESAB has pre-existing relationships and established agreements with a number of schools in South Australia, and their bin audits are regular features on school calendars. This research project is being guided by this existing association. The research collaborator from KESAB environmental solutions is Jo Hendrikx.

Why am I being invited to participate?
Your school has consented to participate in this study. All children in the class will be included in the audit, excluding: those who order food from the canteen, and those for whom consent is withheld. Since your child belongs to the nominated class, you are being informed of this research study through this participation information sheet.

## What am I being invited to do?

There is nothing expected of you as parents, as the audit will take place in the classroom, moderated by the class teacher. You are only expected to prepare your child's lunchbox as per normal.

On the day of the audit, school children will be explained the purpose of conducting the research project by the class teacher, who will ask the children to place their lunchboxes on their respective desks or on a tarpaulin to be photographed in the classroom by the student researcher. To conduct the audit, the student researcher will take photographs of the children's lunchboxes before recess and after lunch break.


## How much time will my involvement in the project take?

Photographing the lunchboxes will be done in the classroom setting and will take approximately 10 minutes before recess and approximately 10 minutes after lunch break. Class teachers may develop a learning activity around the audit; but this will be at the discretion of the teacher, and not part of the research project.

## Are there any risks associated with participating in this project?

Children will be in a safe environment within the school and classroom setting, and the audit will be facilitated by the class teacher. Moreover, this research study is an additional element to the routine bin audits that KESAB conducts, and no risk to participants have been reported previously. Hence, the likelihood of any burden/discomfort on the school children is minimal.
Only photos of lunchboxes will be taken, and no sensitive or personal information will be collected. In case lunchboxes are labelled with child(ren)'s names, it will be ensured that all visible names will be blurred in photographs to protect their identities. The lunchboxes that need to be placed on the tarpaulin to be photographed will be handled only by the children or class teacher if necessary. Specific contents of certain items such as sandwich fillings will not be identified as unwrapping or disassembling of any food items will not take place. The student researcher will NOT have further discussions with any child to inquire about the details of the lunchbox contents. Moreover, if children do not want to participate, they will not be pressured
Wherever possible, batch photos will be taken to prevent the process from being time consuming and minimising intrusion into their eating schedule.
Furthermore, the student researcher holds a valid Working with Children Check issued by the Department of Human Services Screening Unit (Government of South Australia)

## What are the potential benefits of the research project?

This study aims to help us understand more about children's current lunchbox contents, so that we can determine how to encourage increasingly healthy and eco-friendly eating behaviours in future.

## Can I withdraw from the project?

Participation in this project is completely voluntary. If you would like your child to participate, please fill the consent form attached and return it to the school within two weeks of the date of this letter. However, kindly note that once the data is collected, it cannot be withdrawn as the photographs cannot be traced back to the children given the de-identified nature of the data collection process.

## What will happen to my information?

Names and details of schools will be de-identified throughout the course of the research study. During the reporting of research results, personal identifiers will not be included as school names will be replaced by codes in order to protect the privacy and confidentiality of the schools. The student researcher will designate codes to each school for the data analysis and reporting process. The original details of the school names linked with the codes will remain secured in a password protected file on the University computer's hard drive within the University of Adelaide's School of Public Health. This protected information containing the school names associated with the codes will only be accessible by the listed researchers on this ethics application
Lunchbox photographs will be stored in folders (that will be named after the designated school codes) and sub-folders (that will be named after the classroom) - all these photographs will be saved in a password protected University computer's within the University of Adelaide's School of Public Health.

During the data collection period, names of school staff and children will
not be collected or recorded. In case lunchboxes are labelled with child(ren)'s names, we will ensure that all visible names will be blurred to protect their identities throughout the study. Any personal identifiers will not be collected or reported.
Data will be securely stored for at least 5 years after the completion of the project within the School of Public Health at the University of Adelaide.
The study outcomes will be made publicly available through the form of journal article publications, thesis publication, and conference/seminar/poster presentations, with anonymity of school names completely guaranteed in the reporting of results.
The data collected for this study will not be used for future use for any other project, or shared with any other researchers.

Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

A copy of the published research can be sent to you at your request. Schools will also be provided with a report summarising the findings for knowledge translation purposes (which may be of value for the teachers to share with the class).

Who do I contact if I have questions about the project?
If you would like to ask any questions about this project, or you would like us to explain these details to you, please contact

## Dr Shona Crabb

Principal Investigator / Supervisor
The University of Adelaide
shona.crabb@adelaide.edu.au
$+61883131686$

Neha Kishan Lalchandani
Research Student
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+61883131695

## Dr Clare Hume

Supervisor
The University of Adelaide
clare.hume@adelaide.edu.au

Professor Caroline Miller
Supervisor
The University of Adelaide
caroline.miller@adelaide.edu.au
+61881284091

## Jo Hendrikx

Research Collaborator
KESAB environmental solutions

JHendrikx@kesab.asn.au
+61882347255

## What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2020-167) and approved by Department for Education (South Australia). This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research 2007 (Updated 2018). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Human Research Ethics Committee's Secretariat on Phone: +61883136028
Email: hrec@adelaide.edu.au
Post: Level 4, Rundle Mall Plaza, 50 Rundle Mall, ADELAIDE SA 5000
Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

## If I want to participate, what do I do?

If you are happy for your child to participate in this project, please fill the consent form attached below and return it to the school within two weeks of the date of this letter

Yours sincerely,
Neha Kishan Lalchandani
Dr Shona Crabb
Dr Clare Hume
Professor Caroline Miller
Jo Hendrikx

## Appendix B.13: Consent Form for Participating Parents (Preschool)

*: THE UNIVERSITY of ADELAIDE

## Human Research Ethics Committee (HREC)

## PARENTS CONSENT FORM

1. I give consent to [INSERT PRESCHOOL NAME]'s involvement in the following research project:

| Title: | School Food Environments: A lunchbox and waste audit in South <br> Australian Public Schools |
| :--- | :--- |
| Ethics Approval <br> Number: | H-2020-167 |

2. The preschool representative has fully explained the project to me. I have read the project details outlined in the project information flyer. I have had the opportunity to ask any questions I may have about the project and my participation. My consent is given freely.
3. I have been given the opportunity to have a member of my family or a friend present while the project was explained to me.
4. Although I understand the purpose of the research project, it has also been explained that my involvement may not be of any benefit to the preschool community or my child in the immediate future.
5. I agree to allow the student researcher to take photographs of my child's lunchbox before recess and after lunch break.
6. I have been informed that while the information gained in the project may be published, all the preschool names will remain de-identified, and no personal identifiers of anyone participating in this study will be collected or published.
7. I understand that the preschool is free to withdraw from the project at any time before the analysis of data is complete.
8. I understand that I am unable to withdraw from the project after providing consent because there will be no way for the student researcher to identify my child's lunchbox specifically, given the de-identified nature of the data collection.
9. I understand my information will only be disclosed according to the consent provided, except where disclosure is required by law.
10. I am aware that I should provide the preschool my Consent Form, when completed, and retain the project information flyer.

Third Party to Participant (Parent) to complete:

Name: $\qquad$ Signature: $\qquad$ Date: $\qquad$

## Appendix B.14: Participant Information Sheet for Parents (opt-out)

## THE UNIVERSITY of ADELAIDE <br> PARTICIPANT INFORMATION SHEET

PROJECT TITLE: School Food Environments: A lunchbox and waste audit in South Australian Public Schools

HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: H-2020-167 PRINCIPAL INVESTIGATOR: Dr Shona Crabb STUDENT RESEARCHER: Neha Kishan Lalchandani STUDENT'S DEGREE: MPhil Public Health<br>Dear Parent/Guardian,

This Participant Information Sheet details a research project that will be conducted at your child's school during Term 4 of 2020.

What is the project about?
In collaboration with KESAB environmental solutions, this research project involves auditing food and packaging contents in pre- and primary schoolers' lunchboxes, to determine how much of the lunchbox contents children consume and how much of it is wasted. The results of this study will help guide the development of suitable interventions to increase environmentally sustainable and healthy food consumption in the school setting.

Who is undertaking the project?
This project is being conducted by Neha Kishan Lalchandani as part of her Master of Philosophy (Public Health) degree at the University of Adelaide. The project is being supervised by Dr Shona Crabb, Dr Clare Hume, and Professor Caroline Miller. This project's external industry partner, KESAB environmental solutions, will be providing support to conduct the school lunchbox audits, which will be an additional element alongside the bin audits they routinely conduct as part of their initiative to reduce waste outcomes in schools. KESAB has pre-existing relationships and established agreements with a number of schools in South Australia, and their bin audits are regular features on school calendars. This research project is being guided by this existing association. The research collaborator from KESAB environmental solutions is Jo Hendrikx.

Why am I being invited to participate?
Your school has consented to participate in this study. All children in the class will be included in the audit, excluding: those who order food from the canteen, and those for whom consent is withheld (which you can do so by filling the Opt-Out form attached at the end of this information sheet). Since your child belongs to the nominated class, you are being informed of this research study through this participation information sheet.

## What am I being invited to do?

There is nothing expected of you as parents, as the audit will take place in the classroom, moderated by the class teacher. You are only expected to prepare your child's lunchbox as per normal.

On the day of the audit, school children will be explained the purpose of conducting the research project by the class teacher, who will ask the children to place their lunchboxes on their respective desks or on a
tarpaulin to be photographed in the classroom by the student researcher.
To conduct the audit, the student researcher will take photographs of the children's lunchboxes before recess and after lunch break.

How much time will my involvement in the project take?
Photographing the lunchboxes will be done in the classroom setting and will take approximately 10 minutes before recess and approximately 10 minutes after lunch break. Class teachers may develop a learning activity around the audit; but this will be at the discretion of the teacher, and not part of the research project.

Are there any risks associated with participating in this project?
Children will be in a safe environment within the school and classroom setting, and the audit will be facilitated by the class teacher. Moreover, this research study is an additional element to the routine bin audits that KESAB conducts, and no risk to participants have been reported previously. Hence, the likelihood of any burden/discomfort on the school children is minimal.
Only photos of lunchboxes will be taken, and no sensitive or personal information will be collected. In case lunchboxes are labelled with child(ren)'s names, it will be ensured that all visible names will be blurred in photographs to protect their identities. The lunchboxes that need to be placed on the tarpaulin to be photographed will be handled only by the children or class teacher if necessary. Specific contents of certain items such as sandwich fillings will not be identified as unwrapping or disassembling of any food items will not take place. The student researcher will NOT have further discussions with any child to inquire about the details of the lunchbox contents. Moreover, if children do not want to participate, they will not be pressured.
Wherever possible, batch photos will be taken to prevent the process from being time consuming and minimising intrusion into their eating schedule.
Furthermore, the student researcher holds a valid Working with Children Check issued by the Department of Human Services Screening Unit (Government of South Australia).

What are the potential benefits of the research project?
This study aims to help us understand more about children's current lunchbox contents, so that we can determine how to encourage increasingly healthy and eco-friendly eating behaviours in future.

## Can I withdraw from the project?

Participation in this project is completely voluntary. If you do not wish your child to participate, please fill the Opt-Out form attached and return it to the school within two weeks of the date of this letter. However, kindly note that once the data is collected, it cannot be withdrawn as the photographs cannot be traced back to the children given the de-identified nature of the data collection process.

## What will happen to my information?

Names and details of schools will be de-identified throughout the course of the research study. During the reporting of research results, personal identifiers will not be included as school names will be replaced by codes in order to protect the privacy and confidentiality of the schools. The student researcher will designate codes to each school for the data analysis and reporting process. The original details of the school names linked with the codes will remain secured in a password protected file on the University computer's hard drive within the University of Adelaide's School of Public Health. This protected information containing the school names associated with the codes will only be accessible by the listed researchers on this ethics application.

Lunchbox photographs will be stored in folders (that will be named after
the designated school codes) and sub-folders (that will be named after the classroom) - all these photographs will be saved in a password protected University computer's within the University of Adelaide's School of Public Health.

During the data collection period, names of school staff and children will not be collected or recorded. In case lunchboxes are labelled with child(ren)'s names, we will ensure that all visible names will be blurred to protect their identities throughout the study. Any personal identifiers will not be collected or reported Data will be securely stored for at least 5 years after the completion of the project within the School of Public Health at the University of Adelaide.
The study outcomes will be made publicly available through the form of journal article publications, thesis publication, and conference/seminar/poster presentations, with anonymity of school names completely guaranteed in the reporting of results.
The data collected for this study will not be used for future use for any other project, or shared with any other researchers.

Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

A copy of the published research can be sent to you at your request. Schools will also be provided with a report summarising the findings for knowledge translation purposes (which may be of value for the teachers to share with the class).

Who do I contact if I have questions about the project?
If you would like to ask any questions about this project, or you would like us to explain these details to you, please contact:

## Dr Shona Crabb

Principal Investigator / Supervisor
The University of Adelaide
shona.crabb@adelaide.edu.au
+61883131686

Neha Kishan Lalchandani
Research Student
The University of Adelaide
neha.lalchandani@adelaide.edu.au
+61883131695

## Dr Clare Hume

Supervisor
The University of Adelaide
clare.hume@adelaide.edu.au
Professor Caroline Miller
Supervisor
The University of Adelaide
caroline.miller@adelaide.edu.au
+61881284091

## Jo Hendrikx

Research Collaborator
KESAB environmental solutions
JHendrikx@kesab.asn.au
+61882347255

## What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2020-167) and approved by Department for Education (South Australia). This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research 2007 (Updated 2018). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Human Research Ethics Committee's Secretariat on Phone: +61883136028
Email: hrec@adelaide.edu.au
Post: Level 4, Rundle Mall Plaza, 50 Rundle Mall, ADELAIDE SA 5000
Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

## If I want to participate, what do I do?

If you are happy for your child to participate in this project, you do not need to do anything further. If you do not wish your child to participate in this research study, please fill the opt-out form attached below and return it to the school within two weeks of the date of this letter.

Yours sincerely,
Neha Kishan Lalchandani
Dr Shona Crabb
Dr Clare Hume
Professor Caroline Miller
Jo Hendrikx

## Appendix B.15: Opt-out Form for Non-Participating Parents (Preschool)

PROJECT TITLE: School Food Environments: A lunchbox and waste audit in South Australian Public Schools.

I understand that the above study will be conducted at my child's preschool.
I do not wish my son/daughter, $\qquad$ , to be included in this study.

Parent/Guardian Name

Signature

Date

## Appendix B.16: Opt-out Form for Non-Participating Parents (Primary school)

OPT-OUT FORM

PROJECT TITLE: School Food Environments: A lunchbox and waste audit in South Australian Public Schools.

I understand that the above study will be conducted at my child's primary school.
I do not wish my son/daughter, $\qquad$ of class $\qquad$ , to be included in this study.

Parent/Guardian Name

Signature

Date

## Appendix B.17: REDCap Lunchbox Audit Tool Data Dictionary Codebook

Lunchbox Audit Tool





| 21 | singleuse_type_veg_1 <br> Show the field ONLY if: [veg_pack_1_descr(4)] = '1' | Single-use or landfill Type: Vegetable 1 | checkoox |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | singleuse_type_veg_1_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_veg_1__2 | Cling wrap |
|  |  |  | 3 | singleuse_tyoe_veg_1_3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_veg_1_-4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_veg_1__5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_veg_1_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_veg_1_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_tyoe_veg_1_-8 | Plastic straw |
|  |  |  | 9 | singleuse_type_veg_1__9 | Plastic cutlery |
|  |  |  | 10 | singleuse_tyoe_veg_1__10 | Small tins or cans |
|  |  |  | 11 | singleuse_type_veg_1_11 | Mixed ( $\geq 2$ packaging elements) |
|  |  |  | 12 | singleuse_tyoe_veg_1_12 | Non-certified compostable bag |
| 22 | veg_type_2 <br> Show the field ONLY if: [veg_num] = '2' or [veg_num] = '3' or [veg_num] = '4' or [veg _num] = '5' | Vegetable Type 2 | dropdown |  |  |
|  |  |  | 1 Fresh (e.g. vegetable sticks, cherry tomatoes) <br> 2 Chen |  |  |
|  |  |  | 2 | Cooked (i.e. boiled, grilled, stir-fried, leftovers) |  |
|  |  |  | 3 | Fried or oven-baked (e.g. vegetable fritters, battered/crumbed) |  |
|  |  |  | 4 | Frozen |  |
|  |  |  | 5 | Canned |  |
|  |  |  | 6 | Preserved (dried, fermented, pickled) |  |




| 34 | veg_type_3 <br> Show the field ONLY if: [veg_num] = '3' or [veg_num] $={ }^{\prime} 4$ ' or [Veg_num] $={ }^{\prime} 5$ ' | Vegetable Type 3 | dropdown |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | Fresh (e.g. vegetable sticks, cherry tomatoes) |
|  |  |  | 2 | Cooked (i.e. boiled, grilled, stir-fried, leftovers) |
|  |  |  | 3 | Fried or oven-baked (e.g. vegetable fritters, battered/crumbed) |
|  |  |  | 4 | Frozen |
|  |  |  | 5 | Canned |
|  |  |  | 6 | Preserved (dried, fermented, pickled) |
| 35 | veg_descr_3 <br> Show the field ONLY if: [veg_num] = '3' or [veg_num] = '4' or [veg_num] = '5' | Description: Vegetable 3 | dropdown |  |
|  |  |  | 1 | Avocado |
|  |  |  | 2 | Beans (green, French) |
|  |  |  | 3 | Beetroot |
|  |  |  | 4 | Broccoli or broccolini and cauliflower |
|  |  |  | 5 | Cabbage and similar brassica vegetables |
|  |  |  | 6 | Capsicums or bell peppers |
|  |  |  | 7 | Carrots |
|  |  |  | 8 | Celery (stalk vegetables) |
|  |  |  | 9 | Corn |
|  |  |  | 10 | Cucumbers |
|  |  |  | 11 | Eggplant |
|  |  |  | 12 | Leaf vegetables (lettuce, spinach) |
|  |  |  | 13 | Mushrooms |
|  |  |  | 14 | Onion, leek and garlic |
|  |  |  | 15 | Peas and edible-podded peas |
|  |  |  | 16 | Potatoes |
|  |  |  | 17 | Potato mixed dishes (mashed, bake, tilled) |
|  |  |  | 18 | Potato products (french fries, wedges, hashbrowns, gems) |
|  |  |  | 19 | Pumpkin |
|  |  |  | 20 | Seaweed, nori (dried and flavoured) |
|  |  |  | 21 | Seaweed, nori (dried) |
|  |  |  | 22 | Seaweed (fresh) |
|  |  |  | 23 | Sweet potato |
|  |  |  | 24 | Tomato (includes cherry variant) |
|  |  |  | 25 | Zucchini or squash |
|  |  |  | 26 | Vegetable combination (plain or salads with dressing or cream) |
|  |  |  | 27 | Stuffed vegetables or stir fry vegetable dishes |
|  |  |  | 28 | Other |
| 36 | mix_veg_descr_3 <br> Show the field ONLY if: [veg_descr_3] = '26' or [veg_d escr_3] = '27' | Mix Vegetables Description 3 | text |  |
| 37 | veg_other_3 <br> Show the field ONLY if: [veg_descr_3] = '28' | Other Vegetable 3 | text |  |
| 38 | veg_waste_3 <br> Show the field ONLY if: ([photo_status] = '1') and ([ve g_num] = '3' or [veg_num] = '4' or [veg_num] = '5') | Waste: Vegetable 3 | radio |  |
|  |  |  | 1 | No waste |
|  |  |  | 2 | Some waste |
|  |  |  | 3 | All waste |
|  |  |  | 4 | Unidentifiable |
|  |  |  | 5 | Missing data |
| 39 | $\begin{aligned} & \text { organic_waste_veg_3 } \\ & \text { Show the field ONLY if: } \\ & \text { ([veg_num] = '3' or [veg_num] } \\ & =\text { ' } 4 \text { ' or }\left[\text { veg_num }=~=~^{\prime} 5^{\prime}\right. \text { ) } \end{aligned}$ | Organic waste: Vegetable 3 | $\mid c$ <br> 1 <br> 1 <br> 0 <br> 0  | no, Required $\begin{array}{\|c\|} \hline \text { Yes } \\ \hline \text { No } \end{array}$ |




| 1/20/22, | 53 PM |  | Cap |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 52 | \|veg_pack_4 <br> Show the field ONLY if: [veg_num] = '4' or [veg_num] $=$ '5' | Packaging: Vegetable 4 | $\|c\|$ yesn  <br> 1   <br> 0   | no, Required <br> Yes |  |
| 53 | veg_pack_4_descr <br> Show the field ONLY if: [veg_pack_4] = '1' | Packaging Description: Vegetable 4 | checkbox |  |  |
|  |  |  | 1 | veg_pack_4_descr__1 Reus | Reusables |
|  |  |  | 2 | veg_pack_4_descr__ 2 Orga | Organics |
|  |  |  | 3 | veg_pack_4_descr_3 Recy | Recyclables |
|  |  |  | 4 | veg_pack_4_descr__4 Singl | Single-use or landfill |
| 54 | reusable_type_veg_4 <br> Show the field ONLY if: <br> [veg_pack_4_descr(1)] = '1' | Reusable Type: Vegetable 4 | checkbox |  |  |
|  |  |  | 1 | reusable_type_veg_4__1 Se | Separate container |
|  |  |  | 2 | reusable_type_veg_4__2 ${ }^{\text {Sta }}$ | Stainless steel food flask |
|  |  |  | 3 | reusable_type_veg_4_3 ${ }^{\text {a }} \begin{aligned} & \text { B } \\ & \text { W }\end{aligned}$ | Beeswax (or other wax) wrap |
|  |  |  | 4 | reusable type veg 4_4 4 | Cloth or cotton bag |
|  |  |  | 5 | reusable_type_veg_4__5 Sil | Silicone bag |
|  |  |  | 6 | reusable_type_veg_4_6 6 | Silicone cups |
|  |  |  | 7 | reusable_type_veg_4__7 | Reusable cutlery |
| 55 | organics_type_veg_4 <br> Show the field ONLY if: <br> [veg_pack_4_descr(2)] = '1' | Organics Type: Vegetable 4 | checkbox |  |  |
|  |  |  | 1 | organics_type_veg_4__1 Pa | Paper (wrapper/bag) |
|  |  |  | 2 | organics_type_veg_4__2 Pa | Paper towel or tissue |
|  |  |  | 3 | organics_type_veg_4_3 ${ }^{\text {C }}$ | Certified compostable packaging |
|  |  |  | 4 | organics_type_veg_4_4 4 Co | Compostable cutlery |
| 56 | recycle_type_veg_4 <br> Show the field ONLY if: [veg_pack_4_descr(3)] = '1' | Recyclables Type: Vegetable 4 | checkoox |  |  |
|  |  |  | 1 | recycle_type_veg_4__1 10 | 10 cent drink container |
|  |  |  | 2 | recycle_type_veg_4__2 Gla | Glass jar or bottle |
|  |  |  | 3 | recycle_type_veg_4_3 Can | Cardooard or carton |
|  |  |  | 4 | recycle_type_veg_4 4 Har | Hard plastic container |
|  |  |  | 5 | recycle_type_veg_4_55 $\begin{aligned} & \text { Alu } \\ & \text { can }\end{aligned}$ | Aluminium/steel tin or can |
|  | singleuse_type_veg_4 <br> Show the field ONLY if: <br> [veg_pack_4_descr(4)] = '1' | Single-use or landfill Type: Vegetable 4 | checkbox |  |  |
| 57 |  |  | 1 | singleuse_type_veg_4_1 | $\begin{array}{\|l} \hline \begin{array}{l} \text { Foil (aluminium, } \\ \text { paper lined) } \end{array} \\ \hline \end{array}$ |
|  |  |  | 2 | singleuse_type_veg_4__2 | 2 Cling wrap |
|  |  |  | 3 | singleuse_type_veg_4_3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_veg_4_4 | 4 Ziplock bag |
|  |  |  | 5 | singleuse_type_veg_4__5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_veg_4__6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_veg_4_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_veg_4_8 | 8 Plastic straw |
|  |  |  | 9 | singleuse_type_veg_4_9 | 9 Plastic cutlery |
|  |  |  | 10 | singleuse type veg 4 _ 10 | 10 Small tins or cans |
|  |  |  | 11 | singleuse_type_veg_4_11 | $11 \begin{aligned} & \text { Mixed ( } \geq 2 \\ & \text { parkaging } \\ & \text { elements) }\end{aligned}$ |
|  |  |  | 12 | singleuse_type_veg_4__12 | Non-certified compostable bag |


| 58 | veg_type_5 <br> Show the field ONLY if: [veg_num] = '5' | Vegetable Type 5 | dropdown |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | Fresh (e.g. vegetable sticks, cherry tomatoes) |
|  |  |  | 2 | Cooked (i.e. boiled, griled, stir-fried, leftovers) |
|  |  |  | 3 | Fried or oven-baked (e.g. vegetable fritters, battered/crumbed) |
|  |  |  | 4 | Frozen |
|  |  |  | 5 | Canned |
|  |  |  | 6 | Preserved (dried, fermented, pickled) |
| 59 | veg_descr_5 <br> Show the field ONLY if: [veg_num] = '5' | Description: Vegetable 5 | dropdown |  |
|  |  |  | 1 | Avocado |
|  |  |  | 2 | Beans (green, French) |
|  |  |  | 3 | Beetroot |
|  |  |  | 4 | Broccoli or broccolini and cauliflower |
|  |  |  | 5 | Cabbage and similar brassica vegetables |
|  |  |  | 6 | Capsicums or bell peppers |
|  |  |  | 7 | Carrots |
|  |  |  | 8 | Celery (stalk vegetables) |
|  |  |  | 9 | Corn |
|  |  |  | 10 | Cucumbers |
|  |  |  | 11 | Eggplant |
|  |  |  | 12 | Leaf vegetables (lettuce, spinach) |
|  |  |  | 13 | Mushrooms |
|  |  |  | 14 | Onion, leek and garlic |
|  |  |  | 15 | Peas and edible-podded peas |
|  |  |  | 16 | Potatoes |
|  |  |  | 17 | Potato mixed dishes (mashed, bake, filled) |
|  |  |  | 18 | Potato products (french fries, wedges, hashbrowns, gems) |
|  |  |  | 19 | Pumpkin |
|  |  |  | 20 | Seaweed, nori (dried and flavoured) |
|  |  |  | 21 | Seaweed, nori (dried) |
|  |  |  | 22 | Seaweed (fresh) |
|  |  |  | 23 | Sweet potato |
|  |  |  | 24 | Tomato (includes cherry variant) |
|  |  |  | 25 | Zucchini or squash |
|  |  |  | 26 | Vegetable combination (plain or salads with dressing or cream) |
|  |  |  | 27 | Stuffed vegetables or stir fry vegetable dishes |
|  |  |  | 28 | Other |
| 60 | mix_veg_descr_5 <br> Show the field ONLY if: [veg_descr_5] = '26' or [veg_d escr_5] = '27' | Mix Vegetables Description 5 | text |  |
| 61 | veg_other_5 <br> Show the field ONLY if: [veg_descr_5] = '28' | Other Vegetable 5 | text |  |
| 62 | veg_waste_5 <br> Show the field ONLY if: ([photo_status] = '1') and ([ve g_num] = '5') | Waste: Vegetable 5 | radio |  |
|  |  |  | 1 | No waste |
|  |  |  | 2 | Some waste |
|  |  |  | 3 | All waste |
|  |  |  | 4 | Unidentifiable |
|  |  |  | 5 | Missing data |
| 63 | organic_waste_veg_5 <br> Show the field ONLY if: ([veg_num] = '5') | Organic waste: Vegetable 5 | 1 <br> 1 <br> 0 | no, Required Yes <br> No |





| 83 | singleuse_type_fruit_1 <br> Show the field ONLY if: [ffuit_pack_1_descr(4)] = '1' | Single-use or landfill Type: Fruit 1 | checkbox |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | singleuse_type_fruit_1_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type fruit_1 2 | Cling wrap |
|  |  |  | 3 | singleuse_type_fruit_1_3 | Soft plastic or <br> silver lined <br> wrapper |
|  |  |  | 4 | singleuse_type_fruit_1_4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_fruit_1__5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_fruit_1_-6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_fruit_1__7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_fruit_1_ 8 | Plastic straw |
|  |  |  | 9 | singleuse_type_fruit_1__9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_fruit_1__10 | Small tins or cans |
|  |  |  | 11 | singleuse_type_fruit_1__11 | Mixed ( $\geq 2$ packaging elements) |
|  |  |  | 12 | singleuse_type_fruit_1_12 | Non-certified compostable bag |
| 84 | fruit_type_2 <br> Show the field ONLY if: [fruit_num] = '2' or [fruit_nu m ] = '3' or [fruit_num] = '4' or [fruit_num] = '5' | Fruit Type 2 | dropdown |  |  |
|  |  |  | 1 | Fresh fruit |  |
|  |  |  | 2 | Frozen fruit |  |
|  |  |  | 3 | Canned or preserved fruit |  |
|  |  |  | 4 | Tub or diced fruit |  |
|  |  |  | 5 | Pureed fruit |  |
|  |  |  | 6 | Dried fruit |  |



| 1/20/22, 1:53 PM Lunchbox Audit Tool \| REDCap |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 91 | fruit_pack_2_descr <br> Show the field ONLY if: [fruit_pack_2] = '1' | Packaging Description: Fruit 2 | checkbox |  |  |
|  |  |  | 1 | fruit_pack_2_descr__1 1 Reus | usables |
|  |  |  | 2 | fruit_pack_2_descr__ 2 Orga | ganics |
|  |  |  | 3 | fruit_pack_2_descr__3 ${ }^{\text {R }}$ Recy | cyclables |
|  |  |  | 4 | fruit_pack_2_descr__4 Sing | ngle-use or landfill |
| 92 | reusable_type_fruit_2 <br> Show the field ONLY if: [fruit_pack 2_descr(1)] = '1' | Reusable Type: Fruit 2 | checkbox |  |  |
|  |  |  | 1 | reusable_type_fruit_2_1 ${ }^{\text {a }}$ | Separate container |
|  |  |  | 2 | reusable_type_fruit_2_2 $2 \begin{aligned} & \text { 2 } \\ & \end{aligned} \begin{aligned} & \text { Sta } \\ & \text { fla }\end{aligned}$ | Stainless steel food flask |
|  |  |  | 3 | reusable_type_fruit_2_3 ${ }^{3} \begin{aligned} & \text { B } \\ & \text { W }\end{aligned}$ | Beeswax (or other wax) wrap |
|  |  |  | 4 | reusable_type_fruit_2_4 Cla | Cloth or cotton bag |
|  |  |  | 5 | reusable_type_fruit_2_5 Si | Silicone bag |
|  |  |  | 6 | reusable_type_fruit_2_6 ${ }^{\text {Si }}$ | Silicone cups |
|  |  |  | 7 | reusable_type_fruit_2_7 7 Re | Reusable cutlery |
| 93 | organics_type_fruit_2 <br> Show the field ONLY if: [fruit_pack_2_descr(2)] = '1' | Organics Type: Fruit 2 | checkbox |  |  |
|  |  |  | 1 | organics_type_fruit_2_11 Pa | Paper (wrapoer/bag) |
|  |  |  | 2 | organics_type_fruit_2_2 2 Pa | Paper towel or tissue |
|  |  |  | 3 | organics_type_fruit_2_3 ${ }^{\text {Ce }}$ | Certified compostable packaging |
|  |  |  | 4 | organics_type_fruit_2_4 ${ }^{\text {a }}$ CO | Compostable cutlery |
| 94 | recycle_type_fruit_2 <br> Show the field ONLY if: [fruit_pack_2_descr(3)] = '1' | Recyclables Type: Fruit 2 | checkbox |  |  |
|  |  |  | 1 | recycle_type_fruit_2_-1 $\begin{aligned} & 10 \mathrm{c} \\ & \text { con }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_fruit_2_2 ${ }^{2}$ Glas | Glass jar or botte |
|  |  |  | 3 | recycle_type_fruit_2_3 ${ }^{\text {a }}$ Car | Cardboard or carton |
|  |  |  | 4 | recycle_type_fruit_2 _-4 ${ }^{\text {a }}$ Har | Hard plastic container |
|  |  |  | 5 | recycle_type_fruit_2_5 $\begin{aligned} & \text { Alum } \\ & \text { can }\end{aligned}$ | Aluminium/steel tin or can |
| 95 | singleuse_type_fruit_2 <br> Show the field ONLY if: [fruit_pack_2_descr(4)] = '1' | Single-use or landfill Type: Fruit 2 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_fruit_2_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_tyoe_fruit_2_2 | Cling wrap |
|  |  |  | 3 | singleuse_type_fruit_2_3 | Soft plastic or <br> silver lined <br> wrapper |
|  |  |  | 4 | singleuse_type_fruit_2_4 | 4 Ziplock bag |
|  |  |  | 5 | singleuse_type_fruit_2_-5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_fruit_2_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_fruit_2_7 | Small plastic or <br> condiment <br> packaging |
|  |  |  | 8 | singleuse_type_fruit_2_8 | Plastic straw |
|  |  |  | 9 | singleuse_type_fruit_2_-9 | Plastic cutiery |
|  |  |  | 10 | singleuse_type_fruit_2_10 | 10 Small tins or cans |
|  |  |  | 11 | singleuse_type_fruit 2_11 | 1Mixed ( $\geq 2$ <br> packaging <br> elements) |
|  |  |  | 12 | singleuse_type_fruit_2_12 | $12 \begin{aligned} & \text { Non-certified } \\ & \text { compostable bag } \end{aligned}$ |



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| 22, 1 | 53 PM |  | Cap |  |
| :---: | :---: | :---: | :---: | :---: |
| 108 | fruit_type_4 <br> Show the field ONLY if: [fruit_num] = '4' or [fruit_nu $m]=$ '5' | Fruit Type 4 | dropdown |  |
|  |  |  | 1 | Fresh fruit |
|  |  |  | 2 | Frozen fruit |
|  |  |  | 3 | Canned or preserved fruit |
|  |  |  | 4 | Tub or diced fruit |
|  |  |  | 5 | Pureed fruit |
|  |  |  | 6 | Dried fruit |
| 109 | fruit_descr_4 <br> Show the field ONLY if: <br> [fruit_num] = '4' or [fruit_nu $\mathrm{m}]={ }^{\prime} 5$ ' | Description: Fruit 4 | dropdown |  |
|  |  |  | 1 | Apples |
|  |  |  | 2 | Apricots |
|  |  |  | 3 | Bananas |
|  |  |  | 4 | Berry fruit (strawoerries) |
|  |  |  | 5 | Berry fruit (blueberries) |
|  |  |  | 6 | Berry fruit (raspberries) |
|  |  |  | 7 | Berry fruit (blackberries) |
|  |  |  | 8 | Citrus fruit (orange) |
|  |  |  | 9 | Citrus fruit (mandarin) |
|  |  |  | 10 | Cherries |
|  |  |  | 11 | Dates |
|  |  |  | 12 | Grapes (dried i.e. raisins, sultanas, and currants) |
|  |  |  | 13 | Grapes (fresh) |
|  |  |  | 14 | Kiwi |
|  |  |  | 15 | Lychee |
|  |  |  | 16 | Mangoes |
|  |  |  | 17 | Melon (honeydew, rockmeion) |
|  |  |  | 18 | Olives |
|  |  |  | 19 | Papaya or paw paw |
|  |  |  | 20 | Passionfruit |
|  |  |  | 21 | Peaches and nectarines |
|  |  |  | 22 | Pears |
|  |  |  | 23 | Pineapples |
|  |  |  | 24 | Plums |
|  |  |  | 25 | Watermelon |
|  |  |  | 26 | Fruit combination (plain or salads, dried fruit mix) |
|  |  |  | 27 | Other |
| 110 | mix_fruit_descr_4 <br> Show the field ONLY if: [ffuit_descr_4] = '26' | Mix Fruits Description 4 | text |  |
| 111 | fruit_other_4 <br> Show the field ONLY if: [fruit_descr_4] = '27' | Other Fruit 4 | text |  |
| 112 | fruit_waste_4 <br> Show the field ONLY if: ([photo_status] = ' 1 ') and ([fru it_num] = '4' or [fruit_num] = '5') | Waste: Fruit 4 | radio |  |
|  |  |  | 1 | No waste |
|  |  |  | 2 | Some waste |
|  |  |  | 3 | All waste |
|  |  |  | 4 | Unidentifiable |
|  |  |  | 5 | Missing data |
| 113 | organic_waste_fruit_4 <br> Show the field ONLY if: [fruit_num] = '4' or [fruit_nu $m]={ }^{\prime} 5^{\prime}$ | Organic waste: Fruit 4 | yesno, Required |  |
|  |  |  | 1 | Yes |
|  |  |  | 0 | No |

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| 114 | fruit_pack_4 <br> Show the field ONLY if: <br> [fruit_num] = '4' or [fruit_nu $\mathrm{m}]=$ ' 5 ' | Packaging: Fruit 4 | yesno, Required |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | Yes |  |
|  |  |  | 0 | No |  |
| 115 | fruit_pack_4_descr <br> Show the field ONLY if: [fruit_pack_4] = '1' | Packaging Description: Fruit 4 | checkbox |  |  |
|  |  |  | 1 | fruit_pack_4_descr__1 Reus | ables |
|  |  |  | 2 | fruit_pack_4_descr__ 2 Orga | nics |
|  |  |  | 3 | fruit_pack_4_descr_3 3 Recy | lables |
|  |  |  | 4 | fruit_pack_4_descr__4 Sing | e-use or landfill |
| 116 | reusable_type_fruit_4 <br> Show the field ONLY if: <br> [fruit_pack_4_descr(1)] = '1' | Reusable Type: Fruit 4 | checkbox |  |  |
|  |  |  | 1 | reusable_type_fruit_4__1 Se | parate container |
|  |  |  | 2 | reusable_type_fruit_4__2 ${ }^{\text {St }}$ | tainless steel food ask |
|  |  |  | 3 | reusable_type_fruit_4_3 ${ }^{\text {a }}$ B | eeswax (or other <br> ax) wrap |
|  |  |  | 4 | reusable_type_fruit_4__4 C | oth or cotton bag |
|  |  |  | 5 | reusable_type_fruit_4__5 Si | icone bag |
|  |  |  | 6 | reusable_type_fruit_4__6 Si | icone cups |
|  |  |  | 7 | reusable_type_fruit_4__7 Re | usable cutlery |
| 117 | organics_type_fruit_4 <br> Show the field ONLY if: <br> [fruit_pack_4_descr(2)] = '1' | Organics Type: Fruit 4 | checkbox |  |  |
|  |  |  | 1 | organics_type_fruit_4__1 | per (wrapper/bag) |
|  |  |  | 2 | organics_type_fruit_4__2 Pa | per towel or tissue |
|  |  |  | 3 | organics_type_fruit_4_3 3 | tified mpostable ckaging |
|  |  |  | 4 | organics_type_fruit_4__4 ${ }^{\text {co }}$ | mpostable cutlery |
| 118 | recycle_type_fruit_4 <br> Show the field ONLY if: <br> [fruit_pack_4_descr(3)] = '1' | Recyclables Type: Fruit 4 | checkbox |  |  |
|  |  |  | 1 | recycle_type_fruit_4__1 $\begin{aligned} & 10 \\ & \text { con }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_fruit_4__2 Gla | Glass jar or bottle |
|  |  |  | 3 | recycle_type_fruit_4_3 3 Car | Cardboard or carton |
|  |  |  | 4 | recycle_type_fruit_4__4 Har | Hard plastic container |
|  |  |  | 5 | recycle_type_fruit_4__5 ${ }^{\text {Alu }}$ (lan | Aluminium/steel tin or can |
| 119 | singleuse_type_fruit_4 <br> Show the field ONLY if: [fruit_pack_4_descr(4)] = '1' | Single-use or landfill Type: Fruit 4 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_fruit_4__1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_fruit_4__2 | Cling wrap |
|  |  |  | 3 | singleuse_type_fruit_4_3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_fruit_4__4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_fruit_4 _ 5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_fruit_4__6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_fruit_4__7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_fruit_4__8 | Plastic straw |
|  |  |  | 9 | singleuse_type_fruit_4__9 | Plastic cutlery |
|  |  |  | 10 | Singleuse_type_fruit_4_10 | Small tins or cans |
|  |  |  | 11 | singleuse_type_fruit_4__11 | Mixed ( $\geq 2$ packaging elements) |
|  |  |  | 12 | Singleuse_type_fruit_4_12 | Non-certified compostable bag |












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| 165 | grain_pack_4_descr <br> Show the field ONLY if: [grain_pack_4] = '1' | Packaging Description: Grain 4 | checkbox |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | grain_pack_4_descr__1 | usables |
|  |  |  | 2 | grain_pack_4_descr__2 Orga | ganics |
|  |  |  | 3 | grain_pack_4_descr__3 Recy | yclables |
|  |  |  | 4 | grain_pack_4_descr__4 Sing\| | gle-use or landfill |
| 166 | reusable_type_grain_4 <br> Show the field ONLY if: <br> [grain_pack_4_descr(1)] = '1' | Reusable Type: Grain 4 | checkbox |  |  |
|  |  |  | 1 | reusable_type_grain_4_-1 | Separate container |
|  |  |  | 2 | reusable_type_grain_4__2 ${ }^{\text {S }}$ Sta | Stainless steel food flask |
|  |  |  | 3 | reusable_type_grain_4_3 ${ }^{\text {a }}$ ( $\begin{aligned} & \text { B } \\ & \text { w }\end{aligned}$ | Beeswax (or other wax) wrap |
|  |  |  | 4 | reusable_type_grain_4__4 Clo | Cloth or cotton bag |
|  |  |  | 5 | reusable_type_grain_4__5 Sil | Silicone bag |
|  |  |  | 6 | reusable_type_grain_4__6 Sil | Silicone cups |
|  |  |  | 7 | reusable_type_grain_4__7 Re | Reusable cutlery |
| 167 | organics_type_grain_4 <br> Show the field ONLY if: <br> [grain_pack_4_descr(2)] = '1' | Organics Type: Grain 4 | checkbox |  |  |
|  |  |  | 1 | organics_type_grain_4__1 Pa | Paper (wrapper/bag) |
|  |  |  | 2 | organics_type_grain_4__2 $\begin{aligned} & \text { Pa } \\ & \text { Pis }\end{aligned}$ | Paper towe or issue |
|  |  |  | 3 | organics_type_grain_4_3 ${ }^{\text {a }} \begin{aligned} & \text { Ce } \\ & \text { co } \\ & \text { pa }\end{aligned}$ | Certified comoostable packaging |
|  |  |  | 4 | organics_type_grain_4_4 ${ }^{\text {Co }}$ | Compostable cutlery |
| 168 | recycle_type_grain_4 <br> Show the field ONLY if: <br> [grain_pack_4_descr(3)] = '1' | Recyclables Type: Grain 4 | checkbox |  |  |
|  |  |  | 1 | recycle_type_grain_4_1 ${ }^{10} \begin{aligned} & 10 \\ & \text { con }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_grain_4__2 Glas | Glass jar or bottle |
|  |  |  | 3 | recycle_type_grain_4__3 Card | Cardboard or carton |
|  |  |  | 4 | recycle_type_grain_4__4 Hard | Hard plastic container |
|  |  |  | 5 | recycle_type_grain_4_5 ${ }^{\text {Alu }}$ Ald | Aluminium/steel tin or can |
| 169 | singleuse_type_grain_4 <br> Show the field ONLY if: <br> [grain_pack_4_descr(4)] = '1' | Single-use or landfill Type: Grain 4 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_grain_4_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_grain_4__2 | Cling wrap |
|  |  |  | 3 | singleuse_type_grain_4_3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_grain_4_4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_grain_4_5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_grain_4_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_grain_4__7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_grain_4__8 | Plastic straw |
|  |  |  | 9 | singleuse_type_grain_4__9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_grain_4_10 | Small tins or cans |
|  |  |  | 11 | singleuse_type_grain_4__11 | $\begin{aligned} & \text { Mixed ( } \geq 2 \\ & \text { packaging } \\ & \text { elements) } \end{aligned}$ |
|  |  |  | 12 | singleuse_type_grain_4_12 | Non-certified compostable bag |






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| :---: | :---: | :---: | :---: | :---: | :---: |
| 188 | protein | PROTEIN AND ALTERNATIVES |   <br> 1 Yes <br> 0 No |  |  |
| 189 | protein_num <br> Show the field ONLY if: [protein] = '1' | How many types of protein are in the lunchbox? | rad  <br> 1 1 <br> 2  <br> 3  <br> 4  <br> 4  <br> 5  | do  <br> 2  <br> 3  <br>  4 <br> 5  <br> stom alignment: RH |  |
| 190 | protein_descr_1 <br> Show the field ONLY if: [protein_num] = '1' or [protei n_num] = '2' or [protein_num] $=$ '3' or [protein_num] = '4' or [protein_num] = '5' | Description: Protein 1 | dropdown |  |  |
|  |  |  | 1 | Plain/cooked seafood |  |
|  |  |  | 2 | Canned or processed fish (tuna, salmon, sardines) |  |
|  |  |  | 3 | Crumbed fish product |  |
|  |  |  | 4 | Plain/cooked lean poultry (chicken meat without skin, turkey) |  |
|  |  |  | 5 | Plain/cooked lean red meat (beef, lamb, veal, pork, goat, kangaroo) |  |
|  |  |  | 6 | Processed meats (bacon, ham, salami, meatoalls, fritz, sausages) |  |
|  |  |  | 7 | Crumbed meat product |  |
|  |  |  | 8 | Eggs (boiled, omelette, scrambled) |  |
|  |  |  | 9 | Dishes where egg is the major ingredient (frittata) |  |
|  |  |  | 10 | Mature legumes/beans/pulses (chickpeas, lentils, baked beans) |  |
|  |  |  | 11 | Mature legumes/beans/pulse products (lentil patties, falafel balls) |  |
|  |  |  | 12 | Soybean derived products (plain tofu/beancurd, tempeh) |  |
|  |  |  | 13 | Meat substitutes (Quorn, textured vegetable protein) |  |
|  |  |  | 14 | Other |  |
| 191 | protein_other_1 <br> Show the field ONLY if: [protein_descr_1] = '14 | Other Protein 1 | text |  |  |
| 192 | protein_waste_1 <br> Show the field ONLY if: ([photo_status] = '1') and ([pr otein_num] = '1' or [protein_n um] = '2' or [protein_num] = '3' or [protein_num] = '4' or [p rotein_num] = '5') | Waste: Protein 1 | radio |  |  |
|  |  |  | 1 | No waste |  |
|  |  |  | 2 | Some waste |  |
|  |  |  | 3 | All waste |  |
|  |  |  | 4 | Unidentifiable |  |
|  |  |  | 5 | Missing data |  |
| 193 | protein_pack_1 <br> Show the field ONLY if: <br> [protein_num] = ' 1 ' or [protei <br> n_num] = '2' or [protein_num] <br> $=$ '3' or [protein_num] = '4' or <br> [protein_num] = '5' | Packaging: Protein 1 | yes <br> 1 <br> 1 <br> 0 | sno, Required |  |
| 194 | protein_pack_1_descr <br> Show the field ONLY if: [protein_pack_1] = '1' | Packaging Description: Protein 1 | checkbox |  |  |
|  |  |  | 1 | protein_pack_1_descr__1 | Reusables |
|  |  |  | 2 | protein_pack_1_descr__2 | Organics |
|  |  |  | 3 | protein_pack_1_descr__3 | Recyclables |
|  |  |  | 4 | protein_pack_1_descr__4 | Single-use or landfill |



| 199 | protein_descr_2 <br> Show the field ONLY if: [protein_num] = '2' or [protei n_num] = '3' or [protein_num] $={ }^{\prime} 4$ ' or [protein_num] $=$ '5' | Description: Protein 2 | dropdown |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | Plain/cooked seafood |  |
|  |  |  | 2 | Canned or processed fish (tuna, salmon, sardines) |  |
|  |  |  | 3 | Crumbed fish product |  |
|  |  |  | 4 | Plain/cooked lean poultry (chicken meat without skin, turkey) |  |
|  |  |  | 5 | Plain/cooked lean red meat (beef, lamb, veal, pork, goat, kangaroo) |  |
|  |  |  | 6 | Processed meats (bacon, ham, salami, meatoalls, fritz, sausages) |  |
|  |  |  | 7 | Crumbed meat product |  |
|  |  |  | 8 | Eggs (boiled, omelette, scrambled) |  |
|  |  |  | 9 | Dishes where egg is the major ingredient (frittata) |  |
|  |  |  | 10 | Mature legumes/beans/pulses (chickpeas, lentils, baked beans) |  |
|  |  |  | 11 | Mature legumes/beans/pulse products (lentil patties, falafel balls) |  |
|  |  |  | 12 | Soybean derived products (plain tofu/beancurd, tempeh) |  |
|  |  |  | 13 | Meat substitutes (Quorn, textured vegetable protein) |  |
|  |  |  | 14 | Other |  |
| 200 | protein_other_2 | Other Protein 2 | text |  |  |
|  | Show the field ONLY if: [protein_descr_2] = '14' |  |  |  |  |
| 201 | protein_waste_2 <br> Show the field ONLY if: ([photo_status] = '1') and ([pr otein_num] = '2' or [protein_n um] = '3' or [protein_num] = '4' or [protein_num] = '5') | Waste: Protein 2 | radio |  |  |
|  |  |  | 1 | No waste |  |
|  |  |  | 2 | Some waste |  |
|  |  |  | 3 | All waste |  |
|  |  |  | 4 | Unidentifiable |  |
|  |  |  | 5 | Missing data |  |
| 202 | protein_pack_2 <br> Show the field ONLY if: [protein_num] = '2' or [protei n_num] = '3' or [protein_num] $={ }^{\prime} 4$ ' or [protein_num] $=$ '5' | Packaging: Protein 2 | yesno, Required |  |  |
|  |  |  | 1 | Yes |  |
|  |  |  | 0 | No |  |
| 203 | protein_pack_2_descr <br> Show the field ONLY if: [protein_pack_2] = '1' | Packaging Description: Protein 2 | checkbox |  |  |
|  |  |  | 1 | protein_pack_2_descr__1 Re | Reusables |
|  |  |  | 2 | protein_pack_2_descr__ 2 O | Organics |
|  |  |  | 3 | protein_pack_2_descr__3 Re | Recyclables |
|  |  |  | 4 | protein_pack_2_descr__4 Si | Single-use or landfill |
| 204 | reusable_type_proten_2 <br> Show the field ONLY if: <br> [protein_pack_2_descr(1)] = '1' | Reusable Type: Protein 2 | checkbox |  |  |
|  |  |  | 1 | reusable_type_protein_2__1 | Separate container |
|  |  |  | 2 | reusable_type_protein_2__2 | Stainless stee food flask |
|  |  |  | 3 | reusable_type_protein_2__3 | Beeswax (or other wax) wrap |
|  |  |  | 4 | reusable type protein 2__4 | Cloth or cotton bag |
|  |  |  | 5 | reusable_type_protein_2__5 | Silicone bag |
|  |  |  | 6 | reusable_type_protein 2 - 6 | Silicone cups |
|  |  |  | 7 | reusable_type_protein_2__7 | Reusable cutlery |


| 205 | organics_type_protein_2 <br> Show the field ONLY if: <br> [protein_pack_2_descr(2)] = '1' | Organics Type: Protein 2 | checkoox |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | organics_type_protein_2_1 ${ }^{\text {Pa }}$ (W | Paper (wrapper/bag) |
|  |  |  | 2 | organics_type_protein_2 2 $2 \begin{aligned} & \text { Pa } \\ & \text { tis }\end{aligned}$ | Paper towel or tissue |
|  |  |  | 3 | organics_type_protein_2_3 ${ }^{\text {Ce }}$ | Certified comoostable packaging |
|  |  |  | 4 | organics_type_protein_2_4 ${ }^{\text {Co }}$ | Compostable cutlery |
| 206 | recycle_type_protein_2 <br> Show the field ONLY if: [protein_pack_2_descr(3)] = '1' | Recyclables Type: Protein 2 | checkoox |  |  |
|  |  |  | 1 | recycle_type_protein_2_110 <br> con | 10 cent drink container |
|  |  |  | 2 | recycle_type_protein_2_2 Glas | Glass jar or bottle |
|  |  |  | 3 | recycle_type_protein_2_3 $\begin{aligned} & \text { Car } \\ & \text { carto }\end{aligned}$ | Cardboard or carton |
|  |  |  | 4 | recycle_type_protein_2_4 $\begin{aligned} & \text { Hard } \\ & \text { con }\end{aligned}$ | Hard plastic container |
|  |  |  | 5 | recycle_type_protein_2_5 ${ }^{\text {Alu }}$ Al | Aluminium/steel tin or can |
| 207 | singleuse_type_protein_2 <br> Show the field ONLY if: <br> [protein_pack_2_descr(4)] = '1' | Single-use or landfill Type: Protein 2 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_protein_2_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_protein_2_2 ${ }^{2}$ | Cling wrap |
|  |  |  | 3 | singleuse_type_protein_2_3 | $\begin{array}{\|l} \hline \begin{array}{l} \text { Soft plastic or } \\ \text { silver lined } \\ \text { wrapper } \end{array} \\ \hline \end{array}$ |
|  |  |  | 4 | singleuse_type_protein_2_4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_protein_2_5 | Squeeze pouches |
|  |  |  | $\sigma$ | singleuse_type_protein_2_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_protein_2_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_protein_2_8 | Plastic straw |
|  |  |  | 9 | singleuse_type_protein_2_9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_protein_2_10 | $\begin{array}{l\|l} \hline 10 & \begin{array}{l} \text { Small tins or } \\ \text { cans } \end{array} \\ \hline \end{array}$ |
|  |  |  | 11 | singleuse_type_protein_2_11 | 1Mixed (2 2 <br> packaging <br> elements) |
|  |  |  | 12 | singleuse_type_protein_2_12 | $\begin{array}{\|l\|l} \hline 12 & \begin{array}{l} \text { Non-certified } \\ \text { compostable } \\ \text { bag } \end{array} \\ \hline \end{array}$ |





| 223 | organics_type_protein_4 <br> Show the field ONLY if: [protein_pack_4_descr(2)] = '1' | Organics Type: Protein 4 | checkoox |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | organics_type_protein_4_1 ${ }^{\text {Pa }}$ (wa | Paper (wrapper/bag) |
|  |  |  | 2 | organics_type_protein_4_2 $\begin{aligned} & \text { Pa } \\ & \text { tiss }\end{aligned}$ | Paper towe or tissue |
|  |  |  | 3 | organics_type_protein_4_3 ${ }^{\text {a }}$. ${ }^{\text {Cen }}$ | Certfied comoostable packaging |
|  |  |  | 4 | organics_type_protein_4_4 ${ }^{\text {co }}$ co | Compostable cutlery |
| 224 | recycle_type_protein_4 <br> Show the field ONLY if: [protein_pack_4_descr(3)] = '1' | Recyclables Type: Protein 4 | checkoox |  |  |
|  |  |  | 1 | recycle_type_protein_4_1 $\begin{aligned} & 10 \\ & 10 \\ & \text { con }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_protein_4_2 Glas | Glass jar or botile |
|  |  |  | 3 | recycle_type_protein_4_3 $\begin{aligned} & \text { Car } \\ & \text { carto }\end{aligned}$ | Cardboard or carton |
|  |  |  | 4 | recycle_type_protein_4_4 $\begin{aligned} & \text { Hard } \\ & \text { con }\end{aligned}$ | Hard plastic container |
|  |  |  | 5 | recycle_type_protein_4_5 ${ }^{\text {Alu }}$ | Aluminium/steel tin or can |
| 225 | singleuse_type_protein_4 <br> Show the field ONLY if: <br> [protein_pack_4_descr(4)] = '1' | Single-use or landfill Type: Protein 4 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_protein_4_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_protein_4__2 | Cling wrap |
|  |  |  | 3 | singleuse_type_protein_4_3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_protein_4_4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_protein_4_5 | Squeeze pouches |
|  |  |  | $\sigma$ | singleuse_type_protein_4_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_protein_4_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_protein_4_-8 | Plastic straw |
|  |  |  | 9 | singleuse_type_protein_4_-9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_protein_4_10 | $\begin{array}{l\|l} 10 & \begin{array}{l} \text { Small tins or } \\ \text { cans } \end{array} \end{array}$ |
|  |  |  | 11 | singleuse_type_protein_4__11 | $\begin{array}{\|l\|l} \hline 1 & \begin{array}{l} \text { Mixed (2 2 } \\ \text { packaging } \\ \text { elements) } \end{array} \\ \hline \end{array}$ |
|  |  |  | 12 | singleuse_type_protein_4_12 | $\begin{array}{\|l\|l} \hline 2 & \begin{array}{l} \text { Non-certified } \\ \text { compostable } \\ \text { bag } \end{array} \\ \hline \end{array}$ |




| 237 | dairy_descr_1 <br> Show the field ONLY if: [dairy_num] = '1' or [dairy_nu m ] = '2' or [dairy_num] = 3' or [dairy_num] = '4' or [dairy_nu $\mathrm{m}]={ }^{\prime} 5$ ' | Description: Dairy 1 | dropdown |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | Plain milk |  |
|  |  |  | 2 | Flavoured milk and milkshakes (iced coffee, iced chocolate) |  |
|  |  |  | 3 | Plain yoghurt |  |
|  |  |  | 4 | Flavoured yoghurt |  |
|  |  |  | 5 | Yoghurt with mix-ins snack pack |  |
|  |  |  | 6 | Plain fermented milk drinks (natural kefir) |  |
|  |  |  | 7 | Flavoured fermented milk drinks (Yakult) |  |
|  |  |  | 8 | Hard cheese (Cheese slices, Cheddar, Cheese strings or pods) |  |
|  |  |  | 9 | Soft cheese (Cheese wedges, cottage cheese, cream cheese) |  |
|  |  |  | 10 | Dairy desserts (Custard, flavoured dairy snack) |  |
|  |  |  | 11 | Frozen milk products (ice creams) |  |
|  |  |  | 12 | Plain dairy milk alternatives (soy, rice, coconut) |  |
|  |  |  | 13 | Flavoured dairy milk alternatives (soy, rice, coconut) |  |
|  |  |  | 14 | Other |  |
| 238 | dairy_other_1 <br> Show the field ONLY if: [dairy_descr_1] = '14' | Other Dairy 1 | text |  |  |
| 239 | dairy_waste_1 <br> Show the field ONLY if: ([photo_status] = '1') and ([dai ry_num] = '1' or [dairy_num] = '2' or [dairy_num] = '3' or [dai ry_num] = '4' or [dairy_num] = '5') | Waste: Dairy 1 | radio |  |  |
|  |  |  | 1 | No waste |  |
|  |  |  | 2 | Some waste |  |
|  |  |  | 3 | All waste |  |
|  |  |  | 4 | Unidentifiable |  |
|  |  |  | 5 | Missing data |  |
| 240 | dairy_pack_1 <br> Show the field ONLY if: <br> [dairy_num] = '1' or [dairy_nu <br> m ] = '2' or [dairy_num] = '3' or <br> [dairy_num] = '4' or [dairy_nu $\mathrm{m}]=$ '5' | Packaging: Dairy 1 | $\|c\|$   <br> 1   <br> 0   <br> 0   | No |  |
| 241 | dairy_pack_1_descr <br> Show the field ONLY if: [dairy_pack_1] = '1' | Packaging Description: Dairy 1 | checkbox |  |  |
|  |  |  | 1 | dairy_pack_1_descr__1 Re | Reusables |
|  |  |  | 2 | dairy_pack_1_descr__ 2 O | Organics |
|  |  |  | 3 | dairy_pack_1_descr__3 Re | Recyclables |
|  |  |  | 4 | dairy_pack_1_descr__4 Si | Single-use or landfill |
| 242 | reusable_type_dairy_1 <br> Show the field ONLY if: <br> [dairy_pack_1_descr(1)] = '1' | Reusable Type: Dairy 1 | checkbox |  |  |
|  |  |  | 1 | reusable_type_dairy_1__1 | 1 Separate container |
|  |  |  | 2 | reusable_type_dairy_1__ 2 | $2 \begin{aligned} & \text { Stainless steel food } \\ & \text { flask }\end{aligned}$ |
|  |  |  | 3 | reusable_type_dairy_1__3 | Beeswax (or other <br> wax) wrao |
|  |  |  | 4 | reusable_type_dairy_1__4 | 4 Cloth or cotton bag |
|  |  |  | 5 | reusable_type_dairy_1__5 | 5 Silicone bag |
|  |  |  | 6 | reusable_type_dairy_1__6 | 6 Silicone cups |
|  |  |  | 7 | reusable_type_dairy_1__7 | 7 Reusable cutlery |
| 243 | organics_type_dairy_1 <br> Show the field ONLY if: <br> [dairy_pack_1_descr(2)] = '1' | Organics Type: Dairy 1 | checkbox |  |  |
|  |  |  | 1 | organics_type_dairy_1__1 | 1 Paper (wrapper/bag) |
|  |  |  | 2 | organics_type_dairy_1__2 | Paper towel or tissue |
|  |  |  | 3 | organics_type_dairy_1__3 | $\begin{array}{\|l\|} \hline \text { Certified } \\ \text { comoostable } \\ \text { packaging } \\ \hline \end{array}$ |
|  |  |  | 4 | organics_type_dairy_1__4 | Compostable cutlery |


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| :---: | :---: | :---: | :---: | :---: | :---: |
| 244 | recycle_type_dairy_1 <br> Show the field ONLY if: [daiy_pack_1_descr(3)] = '1' | Recyclables Type: Dairy 1 | checkbox |  |  |
|  |  |  | 1 | recycle_type_dary_1_1 ${ }^{10} \begin{aligned} & 10 \\ & \text { con }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_dary_1_2 Gla | Glass jar or botile |
|  |  |  | 3 | recycle_type_dary_1__3 Car | Cardboard or carton |
|  |  |  | 4 | recycle_type_dary_1_-4 Hard | Hard plastic container |
|  |  |  | 5 | recycle_type_dary_1__5 $\begin{aligned} & \text { Alu } \\ & \text { Orcan }\end{aligned}$ | Aluminium/steel tin or can |
| 245 | singleuse_type_dairy_1 | Single-use or landfill Type: Dairy 1 | checkoox |  |  |
|  | Show the field ONLY if: [dairy_pack_1_descr(4)] = '1' |  | 1 | singleuse_type_dairy_1__1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_tyoe_dairy_1__2 | Cling wrap |
|  |  |  | 3 | singleuse_type_dairy_1_3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_dairy_1_4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_dairy_1__5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_dairy_1_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_dair__1_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_dair__1_8 | Plastic straw |
|  |  |  | 9 | singleuse_type_dairy_1_-9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_dair__1_10 | Small tins or cans |
|  |  |  | 11 | singleuse_type_dair__1_11 | Mixed ( $\geq 2$ packaging elements) |
|  |  |  | 12 | singleuse_type_dairy_1__12 | Non-certified compostable bag |
| 246 | dairy_descr_2 | Description: Dairy 2 | dropdown |  |  |
|  | Show the field ONLY if: |  | 1 | Plain milk |  |
|  | [dairy_num] = '2' or [dairy_nu $\mathrm{m}]=$ '3' or [dairy_num] = 4 ' or |  | 2 | Flavoured milk and milkshakes (iced coffee, iced chocolate) |  |
|  |  |  | 3 | Plain yoghurt |  |
|  |  |  | 4 | Flavoured yoghurt |  |
|  |  |  | 5 | Yoghurt with mix-ins snack pack |  |
|  |  |  | 6 | Plain fermented milk drinks (natural kefir) |  |
|  |  |  | 7 | Flavoured fermented milk drinks (Yakult) |  |
|  |  |  | 8 | Hard cheese (Cheese slices, Cheddar, Cheese strings or pods) |  |
|  |  |  | 9 | Soft cheese lCheese wedges, cottage cheese, cream cheese) |  |
|  |  |  | 10 | Dairy desserts (Custard, flavoured dairy snack) |  |
|  |  |  | 11 | Frozen milk products (ice creams) |  |
|  |  |  | 12 | Plain dairy milk alternatives (soy, rice, coconut) |  |
|  |  |  | 13 | Flavoured dairy milk alternatives (soy, rice, coconut) |  |
|  |  |  | 14 | Other |  |
| 247 | dairy_other_2 <br> Show the field ONLY if. [dair__descr_2] = '14 | Other Dairy 2 | text |  |  |


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| 248 | dairy_waste_2 <br> Show the field ONLY if: ([photo_status] = ' 1 ') and ([dai ry_num] = '2' or [dairy_num] = '3' or [dairy_num] = '4' or [dai ry_num] = 5 ') | Waste: Dairy 2 | radio |  |  |
|  |  |  | 1 | No waste |  |
|  |  |  | 2 | Some waste |  |
|  |  |  | 3 | All waste |  |
|  |  |  | 4 | Unidentifiable |  |
|  |  |  | 5 | Missing data |  |
| 249 | dairy_pack_2 <br> Show the field ONLY if: [daiy_num] = '2' or [dairy_nu $\mathrm{m}]=$ ' 3 ' or [dairy_num] $=4{ }^{\prime}$ or [dairy_num] = '5' | Packaging: Dairy 2 | yesno, Required  <br> 1 Yes <br> 0 No |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 250 | dairy_pack_2_descr <br> Show the field ONLY if: [daiy_pack_2] = '1' | Packaging Description: Dairy 2 | checkbox |  |  |
|  |  |  | 1 | dairy_pack_2_descr_1 1 R | Reusables |
|  |  |  | 2 | dairy_pack_2_descr__2 O | Organics |
|  |  |  | 3 | dairy_pack_2_descr__3 R | Recyclables |
|  |  |  | 4 | dairy_pack_2_descr__4 ${ }^{\text {S }}$ | Single-use or landfill |
| 251 | reusable_type_dairy_2 <br> Show the field ONLY if: <br> [dairy_pack_2_descr(1)] = '1' | Reusable Type: Dairy 2 | checkbox |  |  |
|  |  |  | reusable_type_dairy_2__1 |  | 1 Separate container |
|  |  |  |  | reusable_type_dairy_2_2 | $2 \begin{aligned} & \text { Stainless steel food } \\ & \text { flask }\end{aligned}$ |
|  |  |  | 3 | reusable_type_dair_2_3 | $\begin{array}{l\|l} 3 & \begin{array}{l} \text { Beeswax (or other } \\ \text { wax) wrap } \end{array} \\ \hline \end{array}$ |
|  |  |  | 4 | reusable_type_dairy_2_-4 | 4 Cloth or cotton bag |
|  |  |  | 5 | reusable_type_dair__2_-5 | 5 Silicone bag |
|  |  |  | 6 | reusable_type_dair_2_-6 | 6 Silicone cups |
|  |  |  | 7 | reusable_type_dairy_2_-7 | 7 Reusable cutlery |
| 252 | organics_type_dairy_2 <br> Show the field ONLY if: [dairy_pack_2_descr(2)] = '1' | Organics Type: Dairy 2 | checkbox |  |  |
|  |  |  | 1 | organics_type_dairy_2_1 | 1 Paper (wrapper/bag) |
|  |  |  | 2 | organics_type_dairy_2__2 | $\begin{array}{l\|l} 2 & \begin{array}{l} \text { Paper towel or } \\ \text { tissue } \end{array} \\ \hline \end{array}$ |
|  |  |  | 3 | organics_type_dairy_2_3 | $\begin{array}{\|l\|l} \hline 3 & \begin{array}{l} \text { Certified } \\ \text { compostable } \\ \text { packaging } \end{array} \\ \hline \end{array}$ |
|  |  |  | 4 | organics_type_dairy_2_4 | $\begin{array}{\|l\|l} \hline 4 & \begin{array}{l} \text { Compostable } \\ \text { cutlery } \end{array} \\ \hline \end{array}$ |
| 253 | recycle_type_dary_2 <br> Show the field ONLY if: [dairy_pack_2_descr(3)] = '1' | Recyclables Type: Dairy 2 | checkbox |  |  |
|  |  |  | 1 | recycle_type_dairy_2_1 | 10 cent drink container |
|  |  |  | 2 | recycle_type_dary_2 2 | Glass jar or bottle |
|  |  |  | 3 | recycle_type_dary_2_3 | Cardboard or carton |
|  |  |  | 4 | recycle_type_dary_2_-4 | Hard plastic container |
|  |  |  | 5 | recycle_type_dary_2_-5 | Aluminium/steel tin or can |






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| :---: | :---: | :---: | :---: | :---: | :---: |
| 275 | dairy_waste_5 <br> Show the field ONLY if: <br> ([photo_status] = '1') and ([dai <br> ry_num] $=$ '5') | Waste: Dairy 5 | radio |  |  |
|  |  |  | 1 | No waste |  |
|  |  |  | 2 | Some waste |  |
|  |  |  | 3 | All waste |  |
|  |  |  | 4 | Unidentifiable |  |
|  |  |  | 5 | Missing data |  |
| 276 | dairy_pack_5 <br> Show the field ONLY if: [dairy_num] = '5' | Packaging: Daiy 5 | yesno, Required$\begin{array}{\|l\|l\|} \hline 1 & \text { Yes } \\ \hline 0 & \text { No } \\ \hline \end{array}$ |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 277 | dairy_pack_5_descr <br> Show the field ONLY if: [dairy_pack_5] = '1 | Packaging Description: Dairy 5 | checkoox |  |  |
|  |  |  | 1 | dairy_pack_5_descr__1 R | Reusables |
|  |  |  | 2 | dair__pack_5_descr_2 2 | Organics |
|  |  |  | 3 | dairy_pack_5_descr__3 R | Recyclables |
|  |  |  | 4 | dairy_pack_5_descr__4 S | Single-use or landfill |
| 278 | reusable_type_dairy_5 <br> Show the field ONLY if. <br> [dairy_pack_5_descr(1)] = '1' | Reusable Type: Dairy 5 | checkbox |  |  |
|  |  |  | 1 | reusable_type_dairy_5_1 | 1 Separate container |
|  |  |  | 2 | reusable_type_daiy_5_2 ${ }^{2}$ | $2 \begin{aligned} & \text { Stainless steel food } \\ & \text { flask }\end{aligned}$ |
|  |  |  | 3 | reusable_type_dairy_5_3 | $\begin{array}{\|l\|l} \hline 3 & \begin{array}{l} \text { Beeswax for other } \\ \text { wax) wrap } \end{array} \\ \hline \end{array}$ |
|  |  |  | 4 | reusable_type_dairy_5_4 | 4 Cloth or cotton bag |
|  |  |  | 5 | reusable_type_daiy_5__5 | 5 Silicone bag |
|  |  |  | 6 | reusable_type_dairy_5_6 | 6 Silicone cups |
|  |  |  | 7 | reusable_type_daiy_5_7 | 7 Reusable cutlery |
| 279 | organics_type_dairy_5 <br> Show the field ONLY if: <br> [dairy_pack_5_descr(2)] = '1' | Organics Type: Dairy 5 | checkoox |  |  |
|  |  |  | 1 | organics_type_dairy_5_1 | 1 Paper (wrapper/bag) |
|  |  |  | 2 | organics_type_dairy_5_2 | $2 \begin{aligned} & \text { Paper towe or } \\ & \text { tissue }\end{aligned}$ |
|  |  |  | 3 | organics_type_dairy_5_3 | $\begin{array}{\|l\|l} \hline 3 & \begin{array}{l} \text { Certtied } \\ \text { compostable } \\ \text { packaging } \end{array} \\ \hline \end{array}$ |
|  |  |  | 4 | organics_type_dairy_5_4 | $\begin{array}{l\|l} -4 & \begin{array}{l} \text { Compostable } \\ \text { cutlery } \end{array} \\ \hline \end{array}$ |
| 280 | recycle_type_dary_5 <br> Show the field ONLY if: <br> [dairy_pack_5_descr(3)] = '1' | Recyclables Type: Dairy 5 | checkbox |  |  |
|  |  |  | 1 | recycle_type_dairy_5_1 | $\begin{array}{\|l} 10 \text { cent drink } \\ \text { container } \end{array}$ |
|  |  |  | 2 | recycle_type_dairy_5_2 | Glass jar or bottle |
|  |  |  | 3 | recycle_type_dary_5_3 | Cardboard or carton |
|  |  |  | 4 | recycle_type_dary_5_-4 | Hard plastic container |
|  |  |  | 5 | recycle_type_dary_5_5 | $\begin{aligned} & \text { Aluminium/steel tin } \\ & \text { or can } \\ & \hline \end{aligned}$ |




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| 289 | reusable_type_snack_1 <br> Show the field ONLY if: <br> [snack_pack_1_descr(1)] = '1' | Reusable Type: Snack 1 | checkbox |  |  |
|  |  |  | 1 | reusable_type_snack_1__1 Sep | Separate container |
|  |  |  | 2 | reusable_type_snack_1__2 $\begin{aligned} & \text { Sta } \\ & \text { fla }\end{aligned}$ | Stainless steel food flask |
|  |  |  | 3 | reusable_type_snack_1__3 $\begin{aligned} & \text { Be } \\ & \text { wax }\end{aligned}$ | Beeswax (or other wax) wrap |
|  |  |  | 4 | reusable_type_snack_1__4 Clo | Cloth or cotton bag |
|  |  |  | 5 | reusable_type_snack_1__5 Silic | Silicone bag |
|  |  |  | 6 | reusable_type_snack_1__6 Sili | Silicone cups |
|  |  |  | 7 | reusable_type_snack_1__7 Re | Reusable cutlery |
| 290 | organics_type_snack_1 <br> Show the field ONLY if: [snack_pack_1_descr(2)] = '1' | Organics Type: Snack 1 | checkbox |  |  |
|  |  |  | 1 | organics_type_snack_1__1 $\begin{aligned} & \text { Paper } \\ & \text { (wr }\end{aligned}$ | Paper <br> (wrapper/bag) |
|  |  |  | 2 | organics_type_snack_1__2 $\begin{aligned} & \text { Pap } \\ & \text { tiss }\end{aligned}$ | Paper towel or tissue |
|  |  |  | 3 | organics_type_snack_1__3 $\begin{aligned} & \text { Cer } \\ & \text { com } \\ & \text { pac }\end{aligned}$ | Certified compostable packaging |
|  |  |  | 4 | organics_type_snack_1__4 $\begin{aligned} & \text { Co } \\ & \text { cut }\end{aligned}$ | Compostable cutlery |
| 291 | recycle_type_snack_1 <br> Show the field ONLY if: [snack_pack_1_descr(3)] = '1' | Recyclables Type: Snack 1 | checkbox |  |  |
|  |  |  | 1 | recycle_type_snack_1__1 $\begin{aligned} & 10 \text { ce } \\ & \text { cont }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_snack_1__2 2 Glas | Glass jar or bottle |
|  |  |  | 3 | recycle_type_snack_1__3 Card | Cardboard or carton |
|  |  |  | 4 | recycle_type_snack_1__4 $\begin{aligned} & \text { Hard } \\ & \text { cont }\end{aligned}$ | Hard plastic container |
|  |  |  | 5 | recycle_type_snack_1__5 $\begin{aligned} & \text { Alum } \\ & \text { or can }\end{aligned}$ | Aluminium/steel tin or can |
| 292 | singleuse_type_snack_1 <br> Show the field ONLY if: [snack_pack_1_descr(4)] = '1' | Single-use or landfill Type: Snack 1 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_snack_1__1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_snack_1__ 2 | Cling wrap |
|  |  |  | 3 | singleuse_type_snack_1__3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_snack_1__4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_snack_1__5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_snack_1__6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_snack_1_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_snack_1__8 | Plastic straw |
|  |  |  | 9 | singleuse_type_snack_1__9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_snack_1__10 | $0 \begin{aligned} & \text { Small tins or } \\ & \text { cans }\end{aligned}$ |
|  |  |  | 11 | singleuse_type_snack_1__11 | 1Mixed ( $\geq 2$ <br> packaging <br> elements) |
|  |  |  | 12 | singleuse_type_snack_1__12 | $\begin{array}{\|l\|l} \hline 2 & \begin{array}{l} \text { Non-certified } \\ \text { compostable } \\ \text { bag } \end{array} \\ \hline \end{array}$ |




| 302 | snack_descr_3 <br> Show the field ONLY if: [snack_num] = '3' or [snack_n um] = '4' or [snack_num] = '5' or [snack_num] = '6' or [snack _num] = '7' or [snack_num] = '8' | Description: Snack 3 | dropdown |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | Savoury sauces and condiments (tomato, mustard, barbecue sauce) |  |
|  |  |  | 2 | Pickles, chutneys and rei ishes |  |
|  |  |  | 3 | Salad dressings (mayonnaise, cream-style, italian and french-style) |  |
|  |  |  | 4 | Dips (dairy, vegetable, legume based) |  |
|  |  |  | 5 | Potato or other vegetable snacks/crisps/chips |  |
|  |  |  | 6 | Grain or legume based snacks/crisps/chips |  |
|  |  |  | 7 | Extruded products (puffy snacks) |  |
|  |  |  | 8 | Popcorn |  |
|  |  |  | 9 | Cheese and cracker snack pack |  |
|  |  |  | 10 | Tuna and cracker snack pack |  |
|  |  |  | 11 | Meat and cracker snack pack |  |
|  |  |  | 12 | Dip and cracker snack pack |  |
|  |  |  | 13 | Muesli or cereal style bars |  |
|  |  |  | 14 | Fruit, nuts, or seeds bars |  |
|  |  |  | 15 | Fruit leathers, straps, or snacks |  |
|  |  |  | 16 | Plain nuts or seeds |  |
|  |  |  | 17 | Salted/coated dried fruits, nuts, or seeds |  |
|  |  |  | 18 | Trail mixes (dried fruit, nuts, or seeds mix) |  |
|  |  |  | 19 | Sugar-based desserts (jelly, pudding, mousse) |  |
|  |  |  | 20 | Water ice confection, geiato, sorbet |  |
|  |  |  | 21 | Chocolate and chocolate-based confectionery |  |
|  |  |  | 22 | Other confectionery (lollies, chewing gum, mints) |  |
|  |  |  | 23 | Other |  |
|  |  |  | 24 | Fruit filled cereal bars |  |
| 303 | snack_other_3 | Other Snack 3 | text |  |  |
|  | Show the field ONLY if: [snack_descr_3] = '23' |  |  |  |  |
| 304 | snack_waste_3 <br> Show the field ONLY if: ([photo_status] = '1') and ([sn ack_num] = '3' or [snack_nu $\mathrm{m}]={ }^{\prime} 4$ ' or [snack_num] $=15^{\prime}$ o r [snack_num] = '6' or [snack_ num] = '7' or [snack_num] = '8') | Waste: Snack 3 | radio |  |  |
|  |  |  | 1 | No waste |  |
|  |  |  | 2 | Some waste |  |
|  |  |  | 3 | All waste |  |
|  |  |  | 4 | Unidentifiable |  |
|  |  |  | 5 | Missing data |  |
| 305 | snack_pack_3 <br> Show the field ONLY if: [snack_num] = '3' or [snack_n um] = '4' or [snack_num] = '5' or [snack_num] = '6' or [snack _num] = '7' or [snack_num] = '8' | Packaging: Snack 3 | yesno, Required |  |  |
|  |  |  | 1 |  |  |
|  |  |  |  | No |  |
| 306 | snack_pack_3_descr <br> Show the field ONLY if: [snack_pack_3] = '1' | Packaging Description: Snack 3 | checkbox |  |  |
|  |  |  |  |  |  |
|  |  |  | 1 | snack_pack_3_descr__1 | Reusables |
|  |  |  | 2 | snack_pack_3_descr__2 | Organics |
|  |  |  | 3 | snack_pack_3_descr__3 | Recyclables |
|  |  |  | 4 | snack_pack_3_descr__4 | Single-use or landfill |


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| :---: | :---: | :---: | :---: | :---: | :---: |
| 307 | reusable_type_snack_3 <br> Show the field ONLY if: <br> [snack_pack_3_descr(1)] = '1' | Reusable Type: Snack 3 | checkbox |  |  |
|  |  |  | 1 | reusable_type_snack_3__1 Sep | Separate container |
|  |  |  | 2 | reusable_type_snack_3__2 $\begin{aligned} & \text { Sta } \\ & \text { fla }\end{aligned}$ | Stainless steel food flask |
|  |  |  | 3 | reusable_type_snack_3_33 $\begin{aligned} & \text { Be } \\ & \text { wax }\end{aligned}$ | Beeswax (or other wax) wrap |
|  |  |  | 4 | reusable_type_snack_3__4 Clo | Cloth or cotton bag |
|  |  |  | 5 | reusable_type_snack_3__5 Silic | Silicone bag |
|  |  |  | 6 | reusable_type_snack_3__6 Sili | Silicone cups |
|  |  |  | 7 | reusable_type_snack_3__7 Re | Reusable cutlery |
| 308 | organics_type_snack_3 <br> Show the field ONLY if: [snack_pack_3_descr(2)] = '1' | Organics Type: Snack 3 | checkbox |  |  |
|  |  |  | 1 | organics_type_snack_3_1 1 $\begin{aligned} & \text { Pap } \\ & \text { (wr }\end{aligned}$ | Paper <br> (wrapper/bag) |
|  |  |  | 2 | organics_type_snack_3_2 $2 \begin{aligned} & \text { Pap } \\ & \text { tiss }\end{aligned}$ | Paper towel or tissue |
|  |  |  | 3 | organics_type_snack_3_3 3 l $\begin{aligned} & \text { Cer } \\ & \text { com } \\ & \text { pa }\end{aligned}$ | Certified compostable packaging |
|  |  |  | 4 | organics_type_snack_3_4 $48 \begin{aligned} & \text { Co } \\ & \text { cut }\end{aligned}$ | Compostable cutlery |
| 309 | recycle_type_snack_3 <br> Show the field ONLY if: [snack_pack_3_descr(3)] = '1' | Recyclables Type: Snack 3 | checkbox |  |  |
|  |  |  | 1 | recycle_type_snack_3__1 $\begin{aligned} & 10 \text { ce } \\ & \text { cont }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_snack_3__2 2 Glas | Glass jar or bottle |
|  |  |  | 3 | recycle_type_snack_3__3 Card | Cardboard or carton |
|  |  |  | 4 | recycle_type_snack_3_4 $4 \begin{aligned} & \text { Hard } \\ & \text { cont }\end{aligned}$ | Hard plastic container |
|  |  |  | 5 | recycle_type_snack_3__5 Alum | Aluminium/steel tin or can |
| 310 | singleuse_type_snack_3 <br> Show the field ONLY if: [snack_pack_3_descr(4)] = '1' | Single-use or landfill Type: Snack 3 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_snack_3_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_snack_3__2 | Cling wrap |
|  |  |  | 3 | singleuse_type_snack_3_3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_snack_3_4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_snack_3__5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_snack_3_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_snack_3_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_snack_3_8 | Plastic straw |
|  |  |  | 9 | singleuse_type_snack_3__9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_snack_3_10 | 0 <br> Small tins or cans |
|  |  |  | 11 | singleuse_type_snack_3__11 | $\begin{array}{l\|l} 1 & \begin{array}{l} \text { Mixed ( } \geq 2 \\ \text { packaging } \end{array} \\ \text { elements) } \end{array}$ |
|  |  |  | 12 | singleuse_type_snack_3__12 | $\begin{array}{\|l\|l} \hline 2 & \begin{array}{l} \text { Non-certified } \\ \text { compostable } \\ \text { bag } \end{array} \\ \hline \end{array}$ |


| 311 | snack_descr_4 <br> Show the field ONLY if: [snack_num] = '4' or [snack_n um] = '5' or [snack_num] = '6' or [snack_num] = 7' or [snack num] $=$ ' 8 ' | Description: Snack 4 | dropdown |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | Savoury sauces and condiments (tomato, mustard, barbecue sauce) |  |
|  |  |  | 2 | Pickles, chutneys and reishes |  |
|  |  |  | 3 | Salad dressings (mayonnaise, cream-style, italian and french-style) |  |
|  |  |  | 4 | Dips (dairy, vegetable, legume based) |  |
|  |  |  | 5 | Potato or other vegetabe snacks/crisps/chips |  |
|  |  |  | 6 | Grain or legume based snacks/crisps/chios |  |
|  |  |  | 7 | Extruded products (puffy snacks) |  |
|  |  |  | 8 | Popcorn |  |
|  |  |  | 9 | Cheese and cracker snack pack |  |
|  |  |  | 10 | Tuna and cracker snack pack |  |
|  |  |  | 11 | Meat and cracker snack pack |  |
|  |  |  | 12 | Dip and cracker snack pack |  |
|  |  |  | 13 | Muesil or cereal style bars |  |
|  |  |  | 14 | Fruit, nuts, or seeds bars |  |
|  |  |  | 15 | Fruit leathers, straps, or snacks |  |
|  |  |  | 16 | Plain nuts or seeds |  |
|  |  |  | 17 | Salted/coated dried fruits, nuts, or seeds |  |
|  |  |  | 18 | Trail mixes (dried fruit, nuts, or seeds mix) |  |
|  |  |  | 19 | Sugar-based desserts (jelly, pudding, mousse) |  |
|  |  |  | 20 | Water ice confection, gelato, sorbet |  |
|  |  |  | 21 | Chocolate and chocolate-based confectionery |  |
|  |  |  | 22 | Other confectionery (lollies, chewing gum, mints) |  |
|  |  |  | 23 | Other |  |
|  |  |  | 24 | Fruit filled cereal bars |  |
| 312 | snack_other_4 | Other Snack 4 | text |  |  |
|  | Show the field ONLY if: [snack_descr_4] = '23' |  |  |  |  |
| 313 | snack_waste_4 <br> Show the field ONLY if: ([photo_status] = '1') and ([sn ack_num] = '4' or [snack_nu m ] = '5' or [snack_num] = '6' o r [snack_num] = '7' or [snack_ numb $=$ ' 8 ') | Waste: Snack 4 | radio |  |  |
|  |  |  | 1 | No waste |  |
|  |  |  | 2 | Some waste |  |
|  |  |  | 3 | All waste |  |
|  |  |  | 4 | Unidentifiable |  |
|  |  |  | 5 | Missing data |  |
| 314 | snack_pack_4 <br> Show the field ONLY if: [snack_num] = '4' or [snack_n um] = '5' or [snack_num] = '6' or [snack_num $=7$ ' or [snack _num] = '8' | Packaging: Snack 4 |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 315 | snack pack 4 descr <br> Show the field ONLY if: [snack_pack_4] = '1' | Packaging Descriotion: Snack 4 | checkbox |  |  |
|  |  |  | 1 | snack_pack_4_descr__1 | Reusables |
|  |  |  | 2 | snack_pack_4_descr__2 | Organics |
|  |  |  | 3 | snack_pack_4_descr__3 | Recyclables |
|  |  |  | 4 | snack_pack_4_descr__4 | Single-use or landill |




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| :---: | :---: | :---: | :---: | :---: | :---: |
| 325 | reusable_type_snack_5 <br> Show the field ONLY if: <br> [snack_pack_5_descr(1)] = '1' | Reusable Type: Snack 5 | checkbox |  |  |
|  |  |  | 1 | reusable_type_snack_5__1 Sep | Separate container |
|  |  |  | 2 | reusable_type_snack_5_2 $2 \begin{aligned} & \text { Sta } \\ & \text { fla }\end{aligned}$ | Stainless steel food flask |
|  |  |  | 3 | reusable_type_snack_5_3 ${ }^{\text {a }} \begin{aligned} & \text { Be } \\ & \text { wax }\end{aligned}$ | Beeswax (or other wax) wrap |
|  |  |  | 4 | reusable_type_snack_5__4 Clo | Cloth or cotton bag |
|  |  |  | 5 | reusable_type_snack 5__ 5 Silic | Silicone bag |
|  |  |  | 6 | reusable_type_snack_5__6 Sili | Silicone cups |
|  |  |  | 7 | reusable_type_snack_5__7 Re | Reusable cutlery |
| 326 | organics_type_snack_5 <br> Show the field ONLY if: [snack_pack_5_descr(2)] = '1' | Organics Type: Snack 5 | checkbox |  |  |
|  |  |  | 1 | organics_type_snack_5_1 1 $\begin{aligned} & \text { Paper } \\ & \text { (wr }\end{aligned}$ | Paper <br> (wrapper/bag) |
|  |  |  | 2 | organics_type_snack_5__2 ${ }^{\text {Pap }}$ Pat | Paper towel or tissue |
|  |  |  | 3 | organics_type_snack_5_3 3 $\begin{aligned} & \text { Cer } \\ & \text { com } \\ & \text { pac }\end{aligned}$ | Certified compostable packaging |
|  |  |  | 4 | organics_type_snack_5_4 $48 \begin{aligned} & \text { Co } \\ & \text { cut }\end{aligned}$ | Compostable cutlery |
| 327 | recycle_type_snack_5 <br> Show the field ONLY if: [snack_pack_5_descr(3)] = '1' | Recyclables Type: Snack 5 | checkbox |  |  |
|  |  |  | 1 | recycle_type_snack_5__1 $\begin{aligned} & 10 \text { ce } \\ & \text { cont }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_snack_5__2 2 Glas | Glass jar or bottle |
|  |  |  | 3 | recycle_type_snack_5__3 Card | Cardboard or carton |
|  |  |  | 4 | recycle_type_snack_5_4 $4 \begin{aligned} & \text { Hard } \\ & \text { cont }\end{aligned}$ | Hard plastic container |
|  |  |  | 5 | recycle_type_snack_5__5 $\begin{aligned} & \text { Alum } \\ & \text { or can }\end{aligned}$ | Aluminium/steel tin or can |
| 328 | singleuse_type_snack_5 <br> Show the field ONLY if: [snack_pack_5_descr(4)] = '1' | Single-use or landfill Type: Snack 5 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_snack_5_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_snack_5__2 | Cling wrap |
|  |  |  | 3 | singleuse_type_snack_5_3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_snack_5__4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_snack_5__5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_snack_5_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_snack_5_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_snack_5_8 | Plastic straw |
|  |  |  | 9 | singleuse_type_snack_5_9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_snack_5__10 | $0 \begin{aligned} & \text { Small tins or } \\ & \text { cans }\end{aligned}$ |
|  |  |  | 11 | singleuse_type_snack_5__11 | 1Mixed ( $\geq 2$ <br> packaging <br> elements) |
|  |  |  | 12 | singleuse_type_snack_5__12 | $\begin{array}{\|l\|l} \hline 2 & \begin{array}{l} \text { Non-certified } \\ \text { compostable } \\ \text { bag } \end{array} \\ \hline \end{array}$ |



| 335 | organics_type_snack_6 <br> Show the field ONLY if: [snack_pack_6_descr(2]] = '1' | Organics Type: Snack 6 | checkoox |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | organics_type_snack_6_1 $1 \begin{aligned} & \text { Pa } \\ & \text { (wr }\end{aligned}$ | Paper (wrapper/bag) |
|  |  |  | 2 | organics_type_snack_6 2 $20 \begin{aligned} & \text { Pa } \\ & \text { tiss }\end{aligned}$ | Paper towel or tissue |
|  |  |  | 3 | organics_type_snack_6_3 $3 \begin{aligned} & \text { Ce } \\ & \text { con } \\ & \text { pa }\end{aligned}$ | Certified compostable packaging |
|  |  |  | 4 | organics_type_snack_6_4 ${ }^{\text {a }}$ Co | Compostable cutlery |
| 336 | recycle_type_snack_6 <br> Show the field ONLY if: [snack_pack_6_descr(3)] = '1' | Recyclables Type: Snack 6 | checkbox |  |  |
|  |  |  | 1 | recycle_type_snack_6_1 $\begin{array}{l}10 \mathrm{ce} \\ \text { cont }\end{array}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_snack_6_2 2 Glas | Glass jar or bottle |
|  |  |  | 3 | recycle_type_snack_6_3 3 Card | Cardboard or carton |
|  |  |  | 4 | recycle_type_snack_6_4 ${ }^{\text {Hard }}$ cont | Hard plastic container |
|  |  |  | 5 | recycle_type_snack_6_5 5 | Aluminium/steel tin or can |
| 337 | singleuse_type_snack_6 <br> Show the field ONLY if: <br> [snack_pack_6_descr(4)] = '1' | Single-use or landfill Type: Snack 6 | checkoox |  |  |
|  |  |  | 1 | singleuse_type_snack_6_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_snack_6_-2 | Cling wrap |
|  |  |  | 3 | singleuse type_snack_6 3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_tyoe_snack_6_4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_snack_6_5 | $\begin{array}{\|l\|} \hline \text { Squeeze } \\ \text { pouches } \end{array}$ |
|  |  |  | 6 | singleuse_type_snack_6_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_snack_6_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_snack_6_8 | Plastic straw |
|  |  |  | 9 | singleuse_type_snack_6_-9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_snack_6_10 | 0 $\begin{aligned} & \text { Small tins or } \\ & \text { cans }\end{aligned}$ |
|  |  |  | 11 | singleuse_type_snack_6_11 | $\begin{array}{l\|l} 11 & \begin{array}{l} \text { Mixed ( } 2 \\ \text { packaging } \\ \text { elements) } \end{array} \\ \hline \end{array}$ |
|  |  |  | 12 | singleuse type snack_6_12 | $\begin{array}{\|l\|l} \hline 12 & \begin{array}{l} \text { Non-certified } \\ \text { compostable } \\ \text { bag } \end{array} \\ \hline \end{array}$ |


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| :---: | :---: | :---: | :---: | :---: | :---: |
| 338 | snack_descr_7 <br> Show the field ONLY if: [snack_num] = '7' or [snack_n um] = ' 8 ' | Description: Snack 7 | dropdown |  |  |
|  |  |  | 1 | Savoury sauces and condiments (tomato, mustard, barbecue sauce) |  |
|  |  |  | 2 | Pickles, chutneys and relishes |  |
|  |  |  | 3 | Salad dressings (mayonnaise, cream-style, italian and french-style) |  |
|  |  |  | 4 | Dips (dairy, vegetable, legume based) |  |
|  |  |  | 5 | Potato or other vegetable snacks/crisps/chips |  |
|  |  |  | 6 | Grain or legume based snacks/crisps/chips |  |
|  |  |  | 7 | Extruded products (puffy snacks) |  |
|  |  |  | 8 | Popcorn |  |
|  |  |  | 9 | Cheese and cracker snack pack |  |
|  |  |  | 10 | Tuna and cracker snack pack |  |
|  |  |  | 11 | Meat and cracker snack pack |  |
|  |  |  | 12 | Dip and cracker snack pack |  |
|  |  |  | 13 | Muesli or cereal style bars |  |
|  |  |  | 14 | Fruit, nuts, or seeds bars |  |
|  |  |  | 15 | Fruit leathers, straps, or snacks |  |
|  |  |  | 16 | Plain nuts or seeds |  |
|  |  |  | 17 | Salted/coated dried fruits, nuts, or seeds |  |
|  |  |  | 18 | Trail mixes (dried fruit, nuts, or seeds mix) |  |
|  |  |  | 19 | Sugar-based desserts (jelly, pudding, mousse) |  |
|  |  |  | 20 | Water ice confection, gelato, sorbet |  |
|  |  |  | 21 | Chocolate and chocolate-based confectionery |  |
|  |  |  | 22 | Other confectionery (lollies, chewing gum, mints) |  |
|  |  |  | 23 | Other |  |
|  |  |  | 24 | Fruit filled cereal bars |  |
| 339 | snack_other_7 <br> Show the field ONLY if: [snack_descr_7] = '23' | Other Snack 7 | text |  |  |
| 340 | snack_waste_7 <br> Show the field ONLY if: ([photo_status] = '1') and ([sn ack_num] = '7' or [snack_nu $\mathrm{m}]={ }^{\prime} 8{ }^{\prime}$ ) | Waste: Snack 7 | radio |  |  |
|  |  |  | 1 | No waste |  |
|  |  |  | 2 | Some waste |  |
|  |  |  | 3 | All waste |  |
|  |  |  | 4 | Unidentifiable |  |
|  |  |  | 5 | Missing data |  |
| 341 | snack_pack_7 <br> Show the field ONLY if: [snack_num] = '7' or [snack_n um] = ' 8 ' | Packaging: Snack 7 | yesno, Required |  |  |
|  |  |  | 1 | Yes |  |
|  |  |  | 0 | No |  |
| 342 | snack_pack_7_descr <br> Show the field ONLY if: [snack_pack_7] = '1' | Packaging Description: Snack 7 | checkbox |  |  |
|  |  |  | 1 | snack_pack_7_descr__1 Re | Reusables |
|  |  |  | 2 | snack_pack_7_descr__ 2 Or | Organics |
|  |  |  | 3 | snack_pack_7_descr__3 Re | Recyclables |
|  |  |  | 4 | snack_pack_7_descr__4 ${ }^{\text {Sin }}$ | Single-use or landfill |
| 343 | reusable_type_snack_7 <br> Show the field ONLY if: <br> [snack_pack_7_descr(1)] = '1' | Reusable Type: Snack 7 | checkbox |  |  |
|  |  |  | 1 | reusable_type_snack_7__1 | 1 Separate container |
|  |  |  | 2 | reusable_type_snack_7_2 | Stainless steel food flask |
|  |  |  | 3 | reusable_type_snack_7_3 | Beeswax for other wax) wrap |
|  |  |  | 4 | reusable_type_snack_7__4 | 4 Cloth or cotton bag |
|  |  |  | 5 | reusable_type_snack_7__5 | 5 Silicone bag |
|  |  |  | 6 | reusable_type_snack_7__6 | 6 Silicone cups |
|  |  |  | 7 | reusable_type_snack_7__7 | 7 Reusable cutlery |


| 2, 1:53 PM Lunchbox Audit Tool \|REDCap |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 344 | organics_type_snack_7 <br> Show the field ONLY if: [snack_pack_7_descr(2)] = '1' | Organics Type: Snack 7 | checkbox |  |  |
|  |  |  | 1 | organics_type_snack_7_1 ${ }^{\text {Pa }}$ (wa | Paper <br> (wrapper/bag) |
|  |  |  | 2 | organics type_snack 7 7 $22 \begin{aligned} & \text { Pa } \\ & \text { tis }\end{aligned}$ | Paper towel or tissue |
|  |  |  | 3 | organics_type_smack___3 ${ }^{3} \begin{aligned} & \text { Cer } \\ & \text { co } \\ & \text { pa }\end{aligned}$ | Certified compostable packaging |
|  |  |  | 4 | organics_type_snack_7_4 $\begin{aligned} & \text { Co } \\ & \text { cu }\end{aligned}$ | Compostable cutlery |
| 345 | recycle_type_snack_7 <br> Show the field ONLY if. [snack_pack_7_descr(3)] = '1' | Recyclables Type: Snack 7 | checkbox |  |  |
|  |  |  | 1 r | \| recycle_type_snack_7_1 $\begin{aligned} & 10 \mathrm{c} \\ & \text { con }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_snack_7__2 Glass | Glass jar or bottle |
|  |  |  | 3 | recycle_type_snack_7__3 Card | Cardboard or carton |
|  |  |  | 4 | recycle_type_snack_7_4 $\begin{aligned} & \text { Hard } \\ & \text { con }\end{aligned}$ | Hard plastic container |
|  |  |  | 5 |  | Aluminium/steel tin or can |
| 346 | singleuse_type_snack_7 <br> Show the field ONLY if: <br> [snack_pack_7_descr(4]] = '1' | Single-use or landfill Type: Snack 7 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_snack_7_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_snack_7__2 | Cling wrap |
|  |  |  | 3 | singleuse_type_snack_ 7 _ 3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_snack_7_-4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_snack_7_5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_snack_7_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_snack_7_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_snack_7__8 | Plastic straw |
|  |  |  | 9 | singleuse_type_snack_7_-9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_snack_7_10 | $\begin{array}{\|l\|l} 10 & \begin{array}{l} \text { Small tins or } \\ \text { cans } \end{array} \\ \hline \end{array}$ |
|  |  |  | 11 | singleuse_type_snack_7_11 | 1Mixed ( $\geq 2$ <br> packaging <br> elements) |
|  |  |  | 12 | singleuse_tyoe snack_ 7 _ 12 | $12 \begin{array}{l\|l} \text { Non-certified } \\ \text { compostable } \\ \text { bag } \end{array}$ |



| 353 | organics_type_snack_8 <br> Show the field ONLY if: <br> [snack_pack_8_descr(2)] = '1' | Organics Type: Snack 8 | checkbox |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | organics_type_snack_8__1 | Paper (wrapper/bag) |
|  |  |  | 2 | organics_type_snack_8_2 $28 \begin{aligned} & \text { Pa } \\ & \text { tis }\end{aligned}$ | Paper towel or tissue |
|  |  |  | 3 | organics_type_snack_8_3 $3 \|$Cer <br> co <br> pa | Certified compostable packaging |
|  |  |  | 4 | organics_type_snack_8_4 4 | Compostable cutlery |
| 354 | recycle_type_snack_8 <br> Show the field ONLY if: <br> [snack_pack_8_descr(3)] = '1' | Recyclables Type: Snack 8 | checkbox |  |  |
|  |  |  | 1 | recycle_type_snack_8_1 $10 \begin{aligned} & 10 \\ & \text { con }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_snack_8__2 Glas | Glass jar or bottle |
|  |  |  | 3 | recycle_type_snack_8__3 Card | Cardboard or carton |
|  |  |  | 4 | recycle_type_snack_8__4 $\begin{aligned} & \text { Har } \\ & \text { con }\end{aligned}$ | Hard plastic container |
|  |  |  | 5 | recycle_type_snack_8_55 $\begin{aligned} & \text { Alu } \\ & \text { or can }\end{aligned}$ | Aluminium/steel tin or can |
| 355 | singleuse_type_snack_8 <br> Show the field ONLY if: <br> [snack_pack_8_descr(4)] = '1' | Single-use or landfill Type: Snack 8 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_snack_8__1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_snack_8__2 | Cling wrap |
|  |  |  | 3 | singleuse_type_snack_8_3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_snack_8__4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_snack_8_5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_snack_8__6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_snack_8_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_snack_8__8 | Plastic straw |
|  |  |  | 9 | singleuse_type_snack_8__9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_snack_8__10 | 0 |
|  |  |  | 11 | singleuse_type_snack_8__11 | $\begin{array}{l\|l} 1 & \begin{array}{l} \text { Mixed }(\geq 2 \\ \text { packaging } \end{array} \\ \text { elements) } \end{array}$ |
|  |  |  | 12 | singleuse_type_snack_8_12 | $2 \begin{aligned} & \text { Non-certified } \\ & \text { compostable } \\ & \text { bag }\end{aligned}$ |
| 356 | mixed | MIXED MEALS | 1 Yes <br> 0 No |  |  |
| 357 | mixed_num <br> Show the field ONLY if: [mixed] $=11$ | How many mixed meal items are in the lunchbox? | rad  <br> 1  <br> 2  <br> 3  <br>   <br> Cus  | stom a lignment: RH |  |
| 358 | mixed_descr_1 <br> Show the field ONLY if: [mixed_num] = '1' or [mixed_ num] = '2' or [mixed_num] = '3' | Description: Mixed 1 | dropdown |  |  |
|  |  |  |  | Soup |  |
|  |  |  | 2 | Dry instant soup mix |  |
|  |  |  | 3 | Fast food item (unidentifiable) |  |
|  |  |  | 4 | Other |  |


| 359 | mixed_other_1 <br> Show the field ONLY if: [mixed_descr_1] = '4' | Other mixed 1 | text |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 360 | mixed_waste_1 <br> Show the field ONLY if: ([photo_status] = '1') and ([mi xed_num] = '1' or [mixed_nu $\mathrm{m}]=$ '2' or [mixed_num] = '3') | Waste: Mixed 1 | rad  <br> 1  <br> 2  <br> 3  <br> 3  <br> 4  <br> 5  | No waste <br> Some waste <br> All waste <br> Unidentifiable <br> Missing data |  |
| 361 | Show the field ONLY if: [mixed_num] = '1' or [mixed num] = '2' or [mixed_num] = '3' | Packaging: Mixed 1 | yes  <br> 1  <br> 1  <br> 0  | $\begin{array}{\|l\|} \hline \text { sno, Req } \\ \hline \text { Yes } \\ \hline \text { No } \\ \hline \end{array}$ |  |
| 362 | mixed_pack_1_descr <br> Show the field ONLY if: [mixed_pack_1] = '1' | Packaging Description: Mixed 1 | che  <br> 1 1 <br> 2  <br> 3  <br> 4  | $l$   <br>  mixed_pack_1_descr__1 R <br> mixed_pack_1_descr__2 O  <br> mixed_pack_1_descr__3 R  <br> mixed_pack_1_descr__4 S  | Reusables <br> Organics <br> Recyclables <br> Single-use or landfill |
| 363 | reusable_type_mixed_1 <br> Show the field ONLY if: <br> [mixed_pack_1_descr(1)] = '1' | Reusable Type: Mixed 1 |  | eckbox  <br>  reusable_type_mixed_1__1 <br> reusable_type_mixed_1__2  | 1 Separate container <br> 2 Stainless steel food <br> flask |
|  |  |  | 3 reusable_type_mixed_1_3 |  | 3 Beeswax for other wax) wrap |
|  |  |  | 4 reusable_type_mixed_1__4 |  | 4 Cloth or cotton bag |
|  |  |  | 5 reusable_type_mixed_1__5 |  | 5 Silicone bag |
|  |  |  | 6 reusable_type_mixed_1__6 |  | 6 Silicone cups |
|  |  |  | 7 reusable_type_mixed_1__7 |  | 7 Reusable cutlery |
| 364 | organics_type_mixed_1 <br> Show the field ONLY if: <br> [mixed_pack_1_descr(2)] = '1' | Organics Type: Mixed 1 | che | eckoox organics_type_mixed_1 1 | Paper <br> (wrapper/bag) |
|  |  |  | 2 | organics_type_mixed_1__2 | $2 \begin{aligned} & \text { Paper towel or } \\ & \text { tissue }\end{aligned}$ |
|  |  |  | 3 | organics_type_mixed_1__3 | $\begin{array}{\|l\|l} \hline 3 & \begin{array}{l} \text { Certified } \\ \text { compostable } \\ \text { packaging } \end{array} \\ \hline \end{array}$ |
|  |  |  | 4 | organics_type_mixed_1__4 | $4 \begin{aligned} & \text { Compostable } \\ & \text { cutlery }\end{aligned}$ |
| 365 | recycle_type_mixed_1 <br> Show the field ONLY if: <br> [mixed_pack_1_descr(3)] = '1' | Recyclables Type: Mixed 1 | checkbox |  |  |
|  |  |  | 1 | recycle_type_mixed_1__1 | 10 cent drink container |
|  |  |  | 2 | recycle_type_mixed_1__2 | Glass jar or bottle |
|  |  |  | 3 | recycle_type_mixed_1__3 | Cardboard or carton |
|  |  |  | 4 | recycle_type_mixed_1__4 | Hard plastic container |
|  |  |  | 5 | recycle_type_mixed_1 __5 | Aluminium/steel tin or can |



| 372 | reusable_type_mixed_2 <br> Show the field ONLY if: <br> [mixed_pack_2_descr(1)] = '1' | Reusable Type: Mixed 2 | checkbox |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | reusable_type_mixed_2_1 1 S | Separate container |
|  |  |  | 2 | reusable_type_mixed_2__2 ${ }^{\text {Sta }}$ | Stainless steel food flask |
|  |  |  | 3 | reusable_type_mixed_2_33 ${ }^{\text {B }}$ | Beeswax (or other wax) wrap |
|  |  |  | 4 | reusable_type_mixed_2_4 Cla | Cloth or cotton bag |
|  |  |  | 5 | reusable_type_mixed_2 5 Sil | Silicone bag |
|  |  |  | 6 | reusable_type_mixed_2_66 Si | Silicone cups |
|  |  |  | 7 | reusable_type_mixed_2__7 | Reusable cutlery |
| 373 | organics_type_mixed_2 <br> Show the field ONLY if: <br> [mixed_pack_2_descr(2)] = '1' | Organics Type: Mixed 2 | checkbox |  |  |
|  |  |  | 1 | organics_type_mixed_2_1 $1 \begin{aligned} & \text { Pa } \\ & \text { (W }\end{aligned}$ | Paper <br> (wrapper/bag) |
|  |  |  | 2 | organics_type_mixed_2_2 $2 \begin{aligned} & \text { Pa } \\ & \text { tis }\end{aligned}$ | Paper towel or tissue |
|  |  |  | 3 | organics_type_mixed_2_3 3 | Certified compostable packaging |
|  |  |  | 4 | organics_type_mixed_2_4 | Compostable cutlery |
| 374 | recycle_type_mixed_2 <br> Show the field ONLY if: [mixed_pack_2_descr(3)] = '1' | Recyclables Type: Mixed 2 | checkbox |  |  |
|  |  |  | 1 | recycle_type_mixed_2_1 $1 \begin{aligned} & 10 \\ & \text { con }\end{aligned}$ | 0 cent drink container |
|  |  |  | 2 | recycle_type_mixed_2_2 2 Gla | lass jar or bottle |
|  |  |  | 3 | recycle_type_mixed_2_3 Car | Cardboard or carton |
|  |  |  | 4 | recycle_type_mixed_2_4 $4 \begin{aligned} & \text { Har } \\ & \text { con }\end{aligned}$ | lard plastic container |
|  |  |  | 5 | recycle_type_mixed_2_5 5 Alu $\begin{aligned} & \text { Ald } \\ & \text { or ca }\end{aligned}$ | Aluminium/steel tin or can |
| 375 | singleuse_type_mixed_2 <br> Show the field ONLY if: <br> [mixed_pack_2_descr(4)] = '1' | Single-use or landfill Type: Mixed 2 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_mixed_2__1 | Foil (aluminum, paper lined) |
|  |  |  | 2 | singleuse_type_mixed_2__2 | Cling wrap |
|  |  |  | 3 | singleuse_type_mixed_2__3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_mixed_2__4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_mixed_2__5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_mixed_2_6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_mixed_2_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_mixed_2__8 | Plastic straw |
|  |  |  | 9 | singleuse_type_mixed_2__9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_mixed_2_10 | 0 Small tins or cans |
|  |  |  | 11 | singleuse_type_mixed_2_11 | $1 \begin{aligned} & \text { Mixed }(\geq 2 \\ & \text { packaging } \\ & \text { elements) }\end{aligned}$ |
|  |  |  | 12 | singleuse_type_mixed_2_12 | $\begin{array}{l\|l} \hline 12 & \begin{array}{l} \text { Non-certified } \\ \text { compostable } \\ \text { bag } \end{array} \\ \hline \end{array}$ |
| 376 | mixed_descr_3 <br> Show the field ONLY if: [mixed_num] = '3' | Description: Mixed 3 | dropdown |  |  |
|  |  |  | 1 | Soup |  |
|  |  |  | 2 | Dry instant soup mix |  |
|  |  |  | 3 | Fast food item (unidentifiable) |  |
|  |  |  | 4 | Other |  |


| 22, | : 53 PM |  | Ca |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 377 | mixed_other_3 <br> Show the field ONLY if: [mixed_descr_3] = '4' | Other Mixed 3 | text |  |  |
| 378 | mixed_waste_3 <br> Show the field ONLY if: ([photo_status] = '1') and ([mi xed_num] = '3') | Waste: Mixed 3 | radio |  |  |
|  |  |  | 1 | No waste |  |
|  |  |  | 2 | Some waste |  |
|  |  |  | 3 | All waste |  |
|  |  |  | 4 | Unidentifiable |  |
|  |  |  | 5 | Missing data |  |
| 379 | mixed_pack_3 <br> Show the field ONLY if: [mixed_num] = '3' | Packaging: Mixed 3 | $\begin{array}{\|l\|l\|} \hline \begin{array}{\|l\|l\|} \hline \text { yesno, Required } \\ \hline & 1 \end{array} \\ \hline 1 & \text { Yes } \\ \hline 0 & \text { No } \\ \hline \end{array}$ |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 380 | mixed_pack_3_descr <br> Show the field ONLY if: [mixed_pack_3] = '1 | Packaging Description: Mixed 3 | checkbox |  |  |
|  |  |  | 1 | mixed_pack_3_descr__1 | Reusables |
|  |  |  | 2 | mixed_pack_3_descr__2 | Organics |
|  |  |  | 3 | mixed_pack_3_descr__3 | Recyclables |
|  |  |  | 4 | mixed_pack_3_descr__4 | Single-use or landfill |
| 381 | reusable_type_mixed_3 <br> Show the field ONLY if. <br> [mixed_pack_3_descr(1)] = '1' | Reusable Type: Mixed 3 | checkbox |  |  |
|  |  |  | 1 | reusable_type_mixed_3 | 1 Separate container |
|  |  |  | 2 | reusable_type_mixed_3 | $2 \begin{aligned} & \text { Stainless steel food } \\ & \text { flask }\end{aligned}$ |
|  |  |  | 3 | reusable_type_mixed_3 _ | $\begin{array}{\|l\|l} \hline 3 & \begin{array}{l} \text { Beeswax (or other } \\ \text { wax) wrap } \end{array} \\ \hline \end{array}$ |
|  |  |  | 4 | reusable_type_mixed_3 | 4 Cloth or cotton bag |
|  |  |  | 5 | reusable_type_mixed_3 | 5 Silicone bag |
|  |  |  | 6 | reusable_type_mixed_3_6 | 6 Silicone cups |
|  |  |  | 7 | reusable_type_mixed_3_-7 | 7 Reusable cutlery |
| 382 | organics_type_mixed_3 <br> Show the field ONLY if: <br> [mixed_pack_3_descr(2)] = '1 | Organics Type: Mixed 3 | checkbox |  |  |
|  |  |  | 1 | organics_type_mixed_3_1 | $.1 \begin{aligned} & \text { Paper } \\ & \text { (wrapper/bag) } \end{aligned}$ |
|  |  |  | 2 | organics_type_mixed_3_-2 | $\begin{array}{l\|l} \hline 2 & \begin{array}{l} \text { Paper towel or } \\ \text { tissue } \end{array} \end{array}$ |
|  |  |  | 3 | organics_type_mixed_3_3 | 3Certified <br> compostable <br> packaging |
|  |  |  | 4 | organics_type_mixed_3_4 | $\begin{array}{\|l\|l} \hline 4 & \begin{array}{l} \text { Compostable } \\ \text { cutery } \end{array} \\ \hline \end{array}$ |
| 383 | recycle_type_mixed_3 <br> Show the field ONLY if: [mixed_pack_3_descr(3)] = '1' | Recyclables Type: Mixed 3 | checkoox |  |  |
|  |  |  | 1 | recycle_type_mixed_3_1 | 10 cent drink container |
|  |  |  | 2 | recycle_type_mixed_3_2 | Glass jar or bottle |
|  |  |  | 3 | recycle_type_mixed_3_3 | Cardboard or carton |
|  |  |  | 4 | recycle_type_mixed_3_4 | Hard plastic container |
|  |  |  | 5 | recycle_type_mixed_3_-5 | Aluminium/steel tin or can |





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| :---: | :---: | :---: | :---: | :---: | :---: |
| 401 | reusable_type_drink_2 <br> Show the field ONLY if: <br> [drink_pack_2_descr(1)] = '1' | Reusable Type: Drink 2 | checkbox |  |  |
|  |  |  | 1 | reusable_type_drink_2__1 Se | Separate container |
|  |  |  | 2 | reusable_type_drink_2_2 $2 \begin{aligned} & \text { Sta } \\ & \text { fla }\end{aligned}$ | Stainless steel food flask |
|  |  |  | 3 | reusable_type_drink_2_3 ${ }^{\text {Be }} \begin{aligned} & \text { Be } \\ & \text { wax }\end{aligned}$ | Beeswax (or other wax) wrap |
|  |  |  | 4 | reusable_type_drink_2__4 ${ }^{\text {Clo }}$ | Cloth or cotton bag |
|  |  |  | 5 | reusable_type_drink_2_5 Sill | Silicone bag |
|  |  |  | 6 | reusable_type_drink_2__6 Sil | Silicone cups |
|  |  |  | 7 | reusable_type_drink_2__7 Re | Reusable cutlery |
| 402 | organics_type_drink_2 <br> Show the field ONLY if: [drink_pack_2_descri(2)] = '1' | Organics Type: Drink 2 | checkbox |  |  |
|  |  |  | 1 | organics_type_drink_2_1 $1 \begin{aligned} & \text { Pa } \\ & \text { (W }\end{aligned}$ | Paper <br> (wrapper/bag) |
|  |  |  | 2 | organics_type_drink_2__2 $2 \left\lvert\, \begin{aligned} & \mathrm{Pa} \\ & \text { tis }\end{aligned}\right.$ | Paper towel or tissue |
|  |  |  | 3 | organics_type_drink_2_33 $\begin{aligned} & \text { Ce } \\ & \text { com } \\ & \text { pa }\end{aligned}$ | Certified compostable oackaging |
|  |  |  | 4 | organics_type_drink_2_4 $48 \begin{aligned} & \text { Co } \\ & \text { cu }\end{aligned}$ | Compostable cutlery |
| 403 | recycle_type_drink_2 <br> Show the field ONLY if: [drink_pack_2_descr(3)] = '1' | Recyclables Type: Drink 2 | checkbox |  |  |
|  |  |  | 1 | recycle_type_drink_2_11 $\begin{aligned} & 10 \mathrm{c} \\ & \text { cont }\end{aligned}$ | 10 cent drink container |
|  |  |  | 2 | recycle_type_drink_2__2 Glas | Glass jar or bottle |
|  |  |  | 3 | recycle_type_drink_2__3 Card | Cardboard or carton |
|  |  |  | 4 | recycle_type_drink_2_4 4 | Hard plastic container |
|  |  |  | 5 | recycle_type_drink_2_5 5 | Aluminium/steel tin or can |
| 404 | singleuse_type_drink_2 <br> Show the field ONLY if: [drink_pack_2_descr(4)] = '1' | Single-use or landfill Type: Drink 2 | checkbox |  |  |
|  |  |  | 1 | singleuse_type_drink_2_1 | Foil (aluminium, paper lined) |
|  |  |  | 2 | singleuse_type_drink_2__2 | Cling wrap |
|  |  |  | 3 | singleuse_type_drink_2_3 | Soft plastic or silver lined wrapper |
|  |  |  | 4 | singleuse_type_drink_2__4 | Ziplock bag |
|  |  |  | 5 | singleuse_type_drink_2_5 | Squeeze pouches |
|  |  |  | 6 | singleuse_type_drink_2__6 | Muffin or cupcake case/Parchment paper |
|  |  |  | 7 | singleuse_type_drink_2_7 | Small plastic or condiment packaging |
|  |  |  | 8 | singleuse_type_drink_2_8 | Plastic straw |
|  |  |  | 9 | singleuse_type_drink_2_-9 | Plastic cutlery |
|  |  |  | 10 | singleuse_type_drink_2__10 | O |
|  |  |  | 11 | singleuse_type_drink_2__11 | 1Mixed ( $\geq 2$ <br> packaging <br> elements) |
|  |  |  | 12 | singleuse_type_drink_2__12 | 2 Non-certifed compostable bag |


| 405 | drink_descr_3 <br> Show the field ONLY if: [drink_num] = '3' or [drink_nu $\mathrm{m}]=$ '4' or [drink_num] = '5' | Description: Drink 3 | dropdown |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1 | Plain water |  |
|  |  |  | 2 | Fruit or vegetable juices with no added sugar |  |
|  |  |  | 3 | Fruit or vegetable juices (reconstituted, made from concentrates, with added sugar) |  |
|  |  |  | 4 | Breakfast cereal beverages |  |
|  |  |  | 5 | Soft drinks, and flavoured mineral waters (iced tea, cola) |  |
|  |  |  | 6 | Electrolyte, energy and fortified drinks |  |
|  |  |  | 7 | Cordials |  |
|  |  |  | 8 | Other |  |
| 406 | drink_other_3 <br> Show the field ONLY if: [drink_descr_3] = '8' | Other Drink 3 | text |  |  |
| 407 | drink_waste_3 <br> Show the field ONLY if: ([photo_status] = '1') and ([dri nk_num] = '3' or [drink_num] = '4' or [drink_num] = '5') | Waste: Drink 3 | radio |  |  |
|  |  |  | 1 | No waste |  |
|  |  |  | 2 | Some waste |  |
|  |  |  | 3 | All waste |  |
|  |  |  | 4 | Unidentifiable |  |
|  |  |  | 5 | Missing data |  |
| 408 | drink_pack_3 <br> Show the field ONLY if: [drink_num] = '3' or [drink_nu $\mathrm{m}]=$ '4' or [drink_num] = '5' | Packaging: Drink 3 | yesno, Required |  |  |
|  |  |  |  | Yes |  |
|  |  |  | 0 | No |  |
| 409 | drink_pack_3_descr <br> Show the field ONLY if: [drink_pack_3] = '1' | Packaging Description: Drink 3 | checkbox |  |  |
|  |  |  | 1 | drink_pack_3_descr__1 Reusables |  |
|  |  |  | 2 | drink_pack_3_descr__2 Organics |  |
|  |  |  | 3 | drink_pack_3_descr__3 |  |
|  |  |  | 4 | drink_pack_3_descr__4 |  |
| 410 | reusable_type_drink_3 <br> Show the field ONLY if: <br> [drink_pack_3_descr(1)] = '1' | Reusable Type: Drink 3 | checkbox |  |  |
|  |  |  | 1 | reusable_type_drink_3_1 | 1 Separate container |
|  |  |  | 2 | reusable_type_drink_3_2 | $2 \begin{aligned} & \text { Stainless steel food } \\ & \text { flask }\end{aligned}$ |
|  |  |  | 3 | reusable_type_drink_3_3 | Beeswax (or other wax) wrap |
|  |  |  | 4 | reusable_type_drink_3_4 | 4 Cloth or cotton bag |
|  |  |  | 5 | reusable_type_drink_3_5 | 5 Silicone bag |
|  |  |  | 6 | reusable_type_drink_3_6 | 6 Silicone cups |
|  |  |  | 7 | reusable_type_drink_3__7 | 7 Reusable cutlery |
| 411 | organics_type_drink_3 <br> Show the field ONLY if: <br> [drink_pack_3_descr(2)] = '1 | Organics Type: Drink 3 | checkbox |  |  |
|  |  |  | 1 | organics_type_drink_3__1 | Paper (wrapper/bag) |
|  |  |  | 2 | organics_type_drink_3__2 | Paper towel or tissue |
|  |  |  | 3 | organics_type_drink_3__3 | Certified compostable packaging |
|  |  |  | 4 | organics_type_drink_3_4 | Compostable cutlery |
| 412 | recycle_type_drink_3 <br> Show the field ONLY if: <br> [drink_pack_3_descr(3)] = '1 | Recyclables Type: Drink 3 | checkbox |  |  |
|  |  |  | 1 | recycle_type_drink_3_1 | 10 cent drink container |
|  |  |  | 2 | recycle_type_drink_3__2 | Glass jar or bottle |
|  |  |  | 3 | recycle_type_drink_3__3 | Cardboard or carton |
|  |  |  | 4 | recycle_type_drink_3_4 | Hard plastic container |
|  |  |  | 5 | recycle_type_drink_3__5 | Aluminium/steel tin or can |


| 1/20/22, 1:53 PM Lunchbox Audit Tool \| REDCap |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 413 | singleuse_type_drink_3 <br> Show the field ONLY if: <br> [drink_pack_3_descr(4)] = '1 | Single-use or landfill Type: Drink 3 |  | checkbox |  |  |  |
|  |  |  |  | 1 | singleuse_type_drink |  | Foil (aluminium, paper lined) |
|  |  |  |  | 2 | singleuse_type_drink |  | Cling wrap |
|  |  |  |  | 3 | singleuse_type_drink |  | Soft plastic or silver lined wrapper |
|  |  |  |  | 4 | singleuse_type_drink_3 |  | Ziplock bag |
|  |  |  |  | 5 | singleuse_type_drink |  | Squeeze pouches |
|  |  |  |  | 6 | singleuse_type_drink |  | Muffin or cupcake case/Parchment paper |
|  |  |  |  | 7 | singleuse_type_drink_3 |  | Small plastic or condiment packaging |
|  |  |  |  | 8 | singleuse_type_drink_3 | 8 | Plastic straw |
|  |  |  |  | 9 | singleuse_type_drink_3 |  | Plastic cutlery |
|  |  |  |  | 10 | singleuse_type_drink_3 |  | Small tins or cans |
|  |  |  |  | 11 | singleuse_type_drink_3 |  | Mixed ( $\geq 2$ packaging elements) |
|  |  |  |  | 12 | singleuse_type_dr |  | Non-certified compostable bag |
| 414 | drink_descr_4 <br> Show the field ONLY if: [drink_num] = '4' or [drink_nu $m]=15 '$ | Description: Drink 4 |  | dropdown |  |  |  |
|  |  |  |  | $\begin{array}{\|l\|l} \hline 1 & \text { Plain water } \\ \hline \end{array}$ |  |  |  |
|  |  |  |  | 2 | Fruit or vegetable juices with no added sugar |  |  |
|  |  |  |  | 3 | Fruit or vegetable juices (reconstituted, made from concentrates, with added sugar) |  |  |
|  |  |  |  | 4 | Breakfast cereal beverages |  |  |
|  |  |  |  | 5 | Soft drinks, and flavoured mineral waters (iced tea, cola) |  |  |
|  |  |  |  | 6 | Electrolyte, energy and fortified drinks |  |  |
|  |  |  |  | 7 | Cordials |  |  |
|  |  |  |  | 8 | Other |  |  |
| 415 | drink_other_4 <br> Show the field ONLY if: [drink_descr_4] = '8' | Other Drink 4 |  | text |  |  |  |
| 416 | drink_waste_4 <br> Show the field ONLY if: ([photo_status] = '1') and ([dri nk_num] = '4' or [drink_num] $=$ ' 5 ') | Waste: Drink 4 |  | radio |  |  |  |
|  |  |  |  | 1 |  |  |  |
|  |  |  |  | 2 | Some waste |  |  |
|  |  |  |  | 3 | All waste |  |  |
|  |  |  |  | 4 | Unidentifiable |  |  |
|  |  |  |  | 5 | Missing data |  |  |
| 417 | drink_pack_4 <br> Show the field ONLY if: [drink_num] = '4' or [drink_nu $\mathrm{m}]={ }^{\prime} 5^{\prime}$ | Packaging: Drink 4 |  |  | no, Required $\begin{array}{\|l\|} \hline \text { Yes } \\ \hline \text { No } \\ \hline \end{array}$ |  |  |
| 418 | drink_pack_4_descr <br> Show the field ONLY if: [drink_pack_4] = '1' | Packaging Description: Drink 4 |  | checkbox |  |  |  |
|  |  |  |  | 1 | drink_pack_4_descr__1 | Reus | ables |
|  |  |  |  | 2 | drink_pack_4_descr__2 | Organ | nics |
|  |  |  |  | 3 | drink_pack_4_descr__3 | Recyc | clables |
|  |  |  |  | 4 | drink_pack_4_descr__4 | Single | e-use or landfill |





Development of a novel methodology to examine the food, packaging, and waste in Australian schoolchildren's lunchboxes

## REDCap Coding Manual

Guide to coding school lunchbox contents based photographic data into a lunchbox audit tool designed in REDCap

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### 1.0 Preamble

### 1.1 Objective of this audit tool

The objective of this lunchbox audit tool is to identify the contents of school children's lunchboxes coming from home, through photographic data captured on a standard school day, from a nutritional and packaging/waste perspective. This tool was developed with the guidance of nutrition and environment waste experts.

### 1.2 What does this tool capture?

The audit tool was designed to capture the range of unique food/beverage AND packaging items in lunchboxes, along with approximate food waste measures. The count will be for the number of distinct food items in the lunchbox. This tool is NOT designed to count the number of a particular food item, as it can be difficult to determine accurately, as would be seen when counting some packaged vs non packaged foods. For example, a packet of Tiny Teddies should be counted as $n=1$ and 6 Jatz biscuits (non-packaged) should also be counted as $n=1$ and not $n=6$.

List of information this tool captures:

1) Coder
2) Photo code [containing information on school type (preschool or primary school), year level (for primary schools), and school socioeconomic status (low, medium, high)]
3) Presence/absence of bento-style lunchbox or lunch bag.
4) Type(s) of food/beverage item
5) Description of food/beverage item
6) Presence/absence of packaging of food/beverage item
7) Type of packaging of food/beverage item
8) Description of packaging of food/beverage item
9) Presence/absence of food waste (approximate)
10) Presence/absence of unidentifiable item(s) with reasoning

Details of each of the listed items above have been elaborated in Section 4 of this coding manual.

### 1.3 Limitations of this tool

This tool and the data collection process, whilst beneficial in proposing the ratio of core ${ }^{1}$ and discretionary ${ }^{2}$ food items per lunchbox, it does not provide outcomes of servings and portion sizes. Interpreting how much of a food is a serving and therefore appropriate amount to provide per child is complex and an ongoing limitation across various studies in the literature.

### 1.4 How to use this manual?

This manual serves as a guide to code school lunchbox contents based photographic data into an audit tool designed in REDCap. This manual contains a list of all REDCap fields and list of choices, and hence can be scanned to find certain items more easily (use CTRL+F function). It also contains pictorial examples of lunchbox, food, beverage, and packaging items to guide coders. For certain

[^2]branded and packaged items with unclear content description, searching the product name online may be worthwhile to ensure the right food item is coded.

### 2.0 Data source

### 2.1 Type of data

The source of data required for this tool are photographs of lunchboxes, two photos more suitably, taken at two time points in the school day; i.e. one before consumption (typically captured at the start of the school day or just before recess/lunch break) and one after consumption (typically captured after lunch break is over).

Original photos are renamed to incorporate photos codes which also include school codes, for deidentification purposes. For ease of coding, collages of the before and after photos are recommended, so all data pertaining to a lunchbox is available in a single picture.

### 2.2 Lunchbox photo collages

Collages comprise of photos of lunchboxes before and after consumption. There may be 2 or more photos in a collage, depending on the photographs captured.

Note:
For collages comprising of 2 or 3 photos, look in order of top to bottom.
For collages comprising of 4 or more, look in order of LEFT top to bottom then RIGHT top to bottom.

### 2.3 School code

For the purposes of this study, de-identified data was used. Hence, school names were de-identified and codes were designated based on audit number, school type, and socioeconomic status (SES). This was integrated into the photo code.

School Code: [audit \#][school type][SES]

| audit \# | school type |  | SES |  |
| :---: | :---: | :---: | :---: | :---: |
| 01 | Pre | 1 | Low | 1 |
| 02 | Primary | 2 | Med | 2 |
| 03 |  |  | High | 3 |

### 2.4 Photo code

For the purposes of this study, de-identified data was used. Hence, files were renamed based on photo codes for data entry purposes. The photo code consisted of school code and photo number, and an additional year level element was included for primary schools as per below:

Preschool Photo Code: [school code]_[photo \#]
Primary School Photo Code: [school code]_[year level]_[photo \#]

### 2.4.1. Designating photo codes during data sorting and photo matching

 During data sorting and photo matching, the following mechanism for renaming files was used, to also capture snack time or lunch time foods, and pre- and post- snack/lunch.Preschool Photo Code (lunchbox only): [school code]_[photo \#][pre/post]
Preschool Photo Code (snack and lunch box separate): [school code]_[photo
\#\#.[snack/lunch][pre/post]
Primary School Photo Code (lunchbox only): [school code]_[year level]_[photo \#][pre/post]
Primary School Photo Code (snack and lunch box separate): [school code]_[year level]_[photo \#].[snack/lunch][pre/post]

| year level |  | photo \# |  | snack/lunch |  | pre/post |  |
| :---: | :---: | :---: | :--- | :--- | :--- | :--- | :---: |
| Year 1 | Y 1 | 01 | Snack | 1 | pre | a |  |
| Year $2 / 3$ <br> (composite <br> classes) | $\mathrm{Y} 2-3$ | 02 | Lunch | 2 | post | b |  |

## Notes:

- All photo \#s have leading zero numbering.
- Some photos will have information regarding eaten/attendance status and about certain food item not visible but was identified by the student research on field. Status will be in (round bracket) and food item will be in [square brackets]. If this information is not provided, then record food item as unidentifiable.
- If there were more than one pre/post photos, multiple letters were used for respective photos (e.g. aaa/bb).
- Some photos may not be in collage form due to missing data. These photos may will have $a / b$ lettering at the end.
- Even though post snack/lunch data may be missing, It is worth recording the photos available before consumption (those with photo codes ending with the letter a, as this will provide valuable data on the food and packaging supply from home. In these instances, record waste as Missing Data.

Other notes:
Any food items with an $X$ mark on it represent foods that were not brought from home (mostly food or leftovers from school canteen or events). These items are not to be coded.

### 3.0 Food, beverage, packaging, waste categories

### 3.1 Food and beverage categories

Eight categories have been established for food and beverages (see Table 1), based on the five core food groups ${ }^{3}$ as per the Australian Guides to Healthy Eating (AGHE) ${ }^{4}$. Slight modifications were made, whereby legumes and beans have been clubbed with Protein and alternatives instead of Vegetables. The three additional food groups include: Snacks (or extras), Mixed meals, and Drinks.

Table 1. Food and beverage categories inspired by the AGHE

| Food and beverage categories based on AGHE | Food and beverage categories for this tool |
| :--- | :--- |
| 1) Vegetables and Legumes / Beans | 1. Vegetables (excludes mature form of peas <br> and beans) |
| 2) Fruit | 2. Fruits |
| 3) Grain ( cereal ) foods, mostly wholegrain <br> and / or high cereal fibre varieties | 3. Grains or cereals |
| 4) Lean Meat and poultry, fish, eggs, tofu, nuts <br> and seeds and legumes/beans | 4. Protein and alternatives (includes meat, <br> seafood, poultry, eggs, and mature types of <br> legumes, beans and pulses) |
| 5) Milk, yoghurt, cheese and / or their <br> alternatives ( mostly reduced fat) | 5. Dairy and alternatives (includes milk, <br> yoghurt, cheese and their alternatives) |
| Discretionary food and drink choices ${ }^{5}$ | 6. Snacks (or extras) i.e. light foods eaten <br> between regular meals and also includes <br> many pre-packaged discretionary items |
|  | 7. Mixed meals i.e. items or dishes that <br> contain multiple core food ingredients |
|  | 8. Drinks (excluding reusable water bottle <br> from home) |

### 3.2 Waste record

Three broad brackets have been established to record lunchbox contents waste based on an estimated observable amount:

1) No waste
2) Some waste
3) All waste

Additionally, two options were included to consider unidentifiable items and missing data.
4) Unidentifiable (data available, but food item underneath something or in opaque container)
5) Missing data (post- snack/lunch photo unavailable)

[^3]
### 3.3 Packaging categories

Four categories have been established for the packaging aspect of lunchbox contents, three of them based on the current local three-bin system in South Australia ${ }^{6}$ i.e. Organics bin (green lid), recycling bin (yellow lid), general waste/single-use/landfill bin (red or blue lid)?


An additional category called Reusables has been included in this tool, noting that most children bring certain food items in boxes or containers that can be reused. This is in addition to or in place of bento-style lunchboxes, which are compartmentalised, containing multiple items waste free lunch items without needing to look for multiple containers and lids.

Packaging categories include:

1) Reusables
2) Organics
3) Recyclables
4) Single-use/Landfill

Notes regarding coding decisions:

- Packaging classifications into Organics, Recyclables, and Single-use/Landfill is based on the general bin and waste classification system available in most schools in South Australia.
- Although soft plastics are recyclable through the RedCycle $^{7}$ program (temporarily suspended as of 9 November $2022^{8}$ ), it is considered single-use/landfill item in this study's context. This is also because the collection of these single use packaging is far from universal and reliant on families or staff managing the collection and depositing at the right locations.
- Examples of mixed packaging that constitute of $\geq 2$ elements include plastic and foil (cheese cracker snack packs) or plastic cup and peel-offs (yoghurt or fruit tub packaging). Although parts of these items are recyclable, they are considered single-use/landfill waste in this study's context. This is because the elements need to be separated, and the plastic containers need to be rinsed to get rid of food residue before discarding into the yellow recycling bin. The foil component can be recycled by cleaning and adding to a scrunched ball until it is about the size of a small fist before placing it in the yellow recycling bin (as combining pieces of aluminium makes it easier for the machines at the recycling facility to pick it up, ensuring the material is recycled) ${ }^{9}$. The cleaning and collection of these types of packaging is not universally done across schools.

[^4]- Small plastic packaging although recyclable if placed within a larger container, is also going be a single-use/landfill waste as this is also not universally done across schools.
- Food scraps such as fruit peels, cores, seeds/stones, bread crusts, uneaten food that is unwrapped will be added to the Organics waste count.
- Any uneaten food that is wrapped will be recorded using this tool as food type, food waste, and packaging; but will not be designated as Organics waste due to the package element.


### 4.0 REDCap Fields

4.1 Initial information

Information about the school type, primary year level, and socioeconomic status can be found in the photo code, and will be extracted during data analysis. Initial coding for presence/absence of bento-style lunchbox and/or lunchbag will determine whether or not reusable containers need to be coded for separate food items.

| Field name | Description | Notes |
| :---: | :---: | :---: |
| Coder | Choose coder number/name |  |
| Photo Code | Input the code as per file name | E.g. <br> 1013_1 (for kindergarten) <br> 2022_Y4_1 (for primary school) |
| Photo Status | 1, Time 1 and Time 2 photos available <br> 2, Time 1 photo only (eaten and/or disposed) <br> 3, Time 1 photo only (non-attendance at photo) <br> 4, Time 1 photo only (other) <br> 5, Time 2 photo only (eaten and/or disposed) <br> 6 , Time 2 photo only (non-attendance at photo) <br> 7, Time 2 photo only (other) | Indicate presence/absence of Time 1 and Time 2 photos <br> Note: Only record waste of individual food items if option 1, Time 1 and Time $\mathbf{2}$ photos available is selected <br> - Some children may not bring a lunchbox or bag, and may only have packaged food items. Since children were habituated to throw away packaging of food items after consumption in bins, Time 2 photo for these cases are missing. Record these as $\mathbf{2}$, Time 1 photo only (eaten and/or disposed) <br> - Some children WITH lunchboxes may be early-leavers or were not present for Time 2 photos. <br> For these cases, select 3, Time 1 photo only (nonattendance at photo) <br> - Same reasoning apply for Time 2 photo only options |



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| How many separate <br> container(s) are there? | Provide numeric value |  |
| :--- | :--- | :--- |

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4.2 Food and beverage categories
4.2.1 Vegetables

| Vegetables | Yes/No | Note: Vegetables (excludes mature form of peas and beans <br> such as chickpeas and baked beans - they are recorded in <br> Protein and alternatives) |
| :--- | :--- | :--- | :--- |
| How many vegetables <br> are in the lunchbox? <br> Record individual vegetable(s), as well as mixed dishes <br> where vegetable is the major component such as <br> vegetable-based salads and stir fry vegetable dishes or <br> leftovers |  |  | Can list up to 5 | If it is a mix of vegetables that are not easily |
| :--- |
| distinguishable, then count as 1 i.e. Vegetable |
| combination (plain or salads with dressing or cream), |
| and type description in Mix vegetables description (e.g. |
| stir fried vegetables or coleslaw) if possible |


|  |  | Count 2 vegetables i.e. Carrot AND Celery. Don't record salad as it has pasta (grain) as major food component, hence record in Grains (cereals) |
| :---: | :---: | :---: |
| Vegetable Type \# | 1, Fresh (e.g. vegetable sticks, cherry tomatoes) <br> 2, Cooked (i.e. boiled, grilled, stir-fried, leftovers) <br> 3, Fried or oven-baked (e.g. vegetable fritters, battered/crumbed) <br> 4, Frozen <br> 5, Canned <br> 6, Preserved (dried, fermented, pickled) | Note: Frozen vegetables - highly unlikely to be known. Same case as canned unless packaging available. |
| Description: Vegetable \# | 1, Avocado <br> 2, Beans (green, French) <br> 3, Beetroot <br> 4, Broccoli or broccolini and cauliflower <br> 5, Cabbage and similar brassica vegetables <br> 6, Capsicums or bell peppers <br> 7, Carrots <br> 8, Celery (stalk vegetables) <br> 9, Corn <br> 10, Cucumbers <br> 11, Eggplant <br> 12, Leaf vegetables (lettuce, spinach) <br> 13, Mushrooms <br> 14, Onion, leek and garlic |  |


|  | 15, Peas and edible-podded peas <br> 16, Potatoes <br> 17, Potato mixed dishes (mashed, bake, filled) <br> 18, Potato products (french fries, wedges, hashbrowns, gems) <br> 19, Pumpkin <br> 20, Seaweed, nori (dried and flavoured) N/A <br> 21, Seaweed, nori (dried) <br> 22, Seaweed (fresh) <br> 23, Sweet potato <br> 24, Tomato (includes cherry variant) <br> 25 , Zucchini or squash <br> 26, Vegetable combination (plain or salads with dressing or cream) <br> 27, Stuffed vegetables or stir fry vegetable dishes <br> 28, Other |  |
| :---: | :---: | :---: |
| Mix vegetables description \# | If options $\underline{26,27}$ are selected, type the vegetable names (if easy to identify) or type of dish/salad (e.g. stir fried vegetables, stuffed capsicum, coleslaw) |  |
| Other vegetable \# | If option $\underline{28}$ Other is selected, type the name of the vegetable not in the list |  |
| Organic waste: Vegetable | $\begin{array}{\|l} \hline \text { 1, Yes } \\ \text { 2, No } \end{array}$ | Vegetable scraps will be considered organic waste. <br> This does not include uneaten vegetable waste which is recorded separately in Waste: Vegetable |
| Packaging: Vegetable | $\begin{aligned} & \text { 1, Yes } \\ & \text { 2, No } \end{aligned}$ | If vegetable has packaging, record yes |


| Fruits | Yes/No | - Record individual fruit(s) and fruit salads/kebabs |
| :---: | :---: | :---: |
| How many fruits are in the lunchbox? | Can list up to 5 | - If it is a mix of fruits that are not easily distinguishable, then count as 1 i.e. Fruit combination (plain or salads, dried fruit mix), and type description in Mix fruits description if possible |
| Fruit Type \# | 1, Fresh fruit <br> 2, Frozen fruit <br> 3, Canned or preserved fruit <br> 4, Tub or diced fruit <br> 5, Pureed fruit <br> 6, Dried fruit | Note: Frozen fruits - highly unlikely to be known. Same case as canned unless packaging available. |
| Description: Fruit \# | 1, Apples <br> 2, Apricots <br> 3, Bananas <br> 4, Berry fruit (strawberries) <br> 5, Berry fruit (blueberries) <br> 6, Berry fruit (raspberries) <br> 7, Berry fruit (blackberries) <br> 8, Citrus fruit (orange) <br> 9, Citrus fruit (mandarin) <br> 10, Cherries <br> 11, Dates <br> 12, Grapes (dried i.e. raisins, sultanas, and currants) <br> 13, Grapes (fresh) <br> 14, Kiwi <br> 15, Lychee <br> 16, Mangoes <br> 17, Melon (honeydew, rockmelon) <br> 18, Olives <br> 19, Papaya or paw paw <br> 20, Passionfruit |  |


|  | 21, Peaches and nectarines <br> 22, Pears <br> 23, Pineapples <br> 24, Plums <br> 25, Watermelon <br> 26 , Fruit combination (plain or salads, dried fruit mix) <br> 27, Other | - Record trail mix in Snacks as contains fruits and nuts and seeds |
| :---: | :---: | :---: |
| Mix fruits description \# | If option 26 is selected, type the names of fruits visible |  |
| Other fruit \# | If option 27 Other is selected, type the name of the fruit not in the list |  |
| Organic waste: Fruit | $\begin{aligned} & \hline \text { 1, Yes } \\ & \text { 2, No } \end{aligned}$ | Fruit scraps such as fruit peels, cores, seeds/stones will be considered organic waste. <br> This does not include uneaten fruit waste which is recorded separately in Waste: Fruit |
| Packaging: Fruit | $\begin{aligned} & \hline \text { 1, Yes } \\ & \text { 2, No } \end{aligned}$ | If vegetable has packaging, record yes |


| Grains (cereals) | Yes/No | - Record individual grain food(s), as well as mixed dishes where a grain is the major component such as rice or noodle-based dishes, pasta, pizza, etc <br> - Certain discretionary items are included here such as doughnuts, cakes, savoury/sweet biscuits, instant noodles, etc as per the AUSNUT 2011-13 Food and Dietary Supplement Classification System ${ }^{10}$ |
| :---: | :---: | :---: |
| How many grain foods are in the lunchbox? | Can list up to 6 |  |
| Description: Grains \# | 1, Regular breads, sandwiches, rolls, wraps <br> 2, Flat breads (Pita, Lavash, Lebanese) <br> 3, Savoury topped breads, buns, scrolls <br> 4, Sweet breads, buns, scrolls <br> 5, English-style muffins <br> 6, Croissants <br> 7, Savoury pastry products with crust (quiche, pies, rolls) <br> 8, Sweet pastry products (danishes, tarts) <br> 9, Pancakes, crepes, pikelets, waffles, crumpets <br> 10, Doughnuts <br> 11, Cakes, muffins, scones, slices, cake-type desserts <br> 12, Wholegrain biscuits, crackers, and puffed cakes <br> (multigrain, rice, corn varieties) <br> 13, Savoury biscuits and crackers (wheat/rye/rice flour based, pretzels) <br> 14, Sweet biscuits, cookies, crackers, and wafers <br> 15, Oatmeal or porridge <br> 16, Plain whole/multigrain cereal/flakes/muesli <br> 17 , Refined or sugary cereals | - No need to record the fillings and spreads in items like sandwiches/rolls/wraps <br> - If a wrap is unassembled (see example below), then record all individual items as count for packaging will apply |

[^5]

|  |  | - Note difference between <br> 16, Plain whole grain cereal/flakes/muesli <br> 17, Refined or sugary cereals (where sugar coating and colouring is visible) |
| :---: | :---: | :---: |
| Other grain \# | If option 34 Other is selected, type the name of Grains (cereals) item not in the list |  |


| Protein and alternatives | Yes/No | Note: Protein and alternatives (includes meat, seafood, poultry, eggs, and mature types of legumes, beans and pulses) |
| :---: | :---: | :---: |
| How many types of protein are in the lunchbox? | Can list up to 5 |  |
| Description: Protein \# | 1, Plain/cooked seafood <br> 2, Canned or processed fish (tuna, salmon, sardines) <br> 3, Crumbed fish product <br> 4, Plain/cooked lean poultry (chicken meat without skin, turkey) <br> 5, Plain/cooked lean red meat (beef, lamb, veal, pork, goat, kangaroo) <br> 6, Processed meats (bacon, ham, salami, meatballs, fritz, sausages) <br> 7, Crumbed meat product <br> 8, Eggs (boiled, omelette, scrambled) <br> 9, Dishes where egg is the major ingredient (frittata) <br> 10, Mature legumes/beans/pulses (chickpeas, lentils, baked beans) <br> 11, Mature legumes/beans/pulse products (lentil patties, falafel balls) <br> 12 , Soybean derived products (plain tofu/beancurd, tempeh) <br> 13, Meat substitutes (Quorn, textured vegetable protein) <br> 14, Other |  |
| Other protein \# | If option 14 Other is selected, type the name of the protein or alternative not in the list |  |


| Dairy and alternatives (includes milk, yoghurt, cheese) | Yes/No | Note: Dairy and alternatives (includes milk, yoghurt, cheese and their alternatives) <br> - Record milk in Dairy and alternatives, not in Drinks <br> - Record breakfast cereal beverages in Drinks |
| :---: | :---: | :---: |
| How many types of dairy items are in the lunchbox? | Can list up to 5 |  |
| Description: Dairy \# | 1, Plain milk <br> 2, Flavoured milk and milkshakes (iced coffee, iced chocolate) <br> 3, Plain yoghurt <br> 4, Flavoured yoghurt <br> 5, Yoghurt with mix-ins snack pack <br> 6, Plain fermented milk drinks (natural kefir) <br> 7, Flavoured fermented milk drinks (Yakult) <br> 8, Hard cheese (Cheese slices, Cheddar, Cheese strings or pods) <br> 9, Soft cheese (Cheese wedges, cottage cheese, cream cheese) <br> 10, Dairy desserts (Custard, flavoured dairy snack) <br> 11, Frozen milk products (ice creams) <br> 12, Plain dairy milk alternatives (soy, rice, coconut) <br> 13, Flavoured dairy milk alternatives (soy, rice, coconut) <br> 14, Other | - No differentiation between regular and reduced-fat varieties <br> - Differentiation is between flavoured and unflavoured varieties (packaging should indicate, otherwise colour for unpacked items) <br> 5, Yoghurt with mix-ins snack pack <br> 6, Plain fermented milk drinks (natural kefir) |



| Snack foods | Yes/No | Note: Snack food items are predominantly extra food items not part of the core food group; they are mostly light foods eaten between regular meals, and are usually pre-packaged items. |
| :---: | :---: | :---: |
| How many snack items are in the lunchbox? | Can list up to 8 |  |
| Description: Snack \# | 1, Savoury sauces and condiments (tomato, mustard, barbecue sauce) <br> 2, Pickles, chutneys and relishes <br> 3, Salad dressings (mayonnaise, cream-style, italian and french-style) <br> 4, Dips (dairy, vegetable, legume based) <br> 5, Potato or other vegetable snacks/crisps/chips <br> 6, Grain or legume based snacks/crisps/chips <br> 7, Extruded products (puffy snacks) <br> 8, Popcorn <br> 9, Cheese and cracker snack pack <br> 10, Tuna and cracker snack pack <br> 11, Meat and cracker snack pack <br> 12, Dip and cracker snack pack <br> 13, Muesli or cereal style bars <br> 14, Fruit, nuts, or seeds bars <br> 15, Fruit leathers, straps, or snacks <br> 16, Plain nuts or seeds <br> 17, Salted/coated dried fruits, nuts, or seeds <br> 18, Trail mixes (dried fruit, nuts, or seeds mix) <br> 19, Sugar-based desserts (jelly, pudding, mousse) <br> 20, Water ice confection, gelato, sorbet <br> 21, Chocolate and chocolate-based confectionery <br> 22, Other confectionery (lollies, chewing gum, mints) <br> 23, Other <br> 24, Fruit filled cereal bars | 5, Potato or other vegetable snacks/crisps/chips <br> 6, Grain or legume based snacks/crisps/chips |



|  |  | 15, Fruit leathers, straps, or snacks <br> 24, Fruit filled cereal bars |
| :---: | :---: | :---: |
| Other snack \# | If option 23 Other is selected, type the name of snack (or extras) item not in the list |  |


| Mixed meals | Yes/No | Note: Record mixed items here, where the main ingredient is hard to identify, or there may be multiple ingredients. These can also include homemade meals or leftovers. |
| :---: | :---: | :---: |
| How many mixed meals or items are in the lunchbox? | Can list up to 3 |  |
| Description: Mixed Meal \# | 1, Soup <br> 2, Dry instant soup mix <br> 3, Fast food item (unidentifiable) <br> 4, Other | 3, Fast food item (unidentifiable) <br> 4, If the main ingredient of the dish is hard to identify, or there may be multiple, record as 4 , Other and provide description. This can include homemade meals or leftover dishes. <br> Record as Mixed meal item i.e. 4, Other - Description: Unidentifiable |



| 4.2.8 Drinks |
| :--- |
| Drinks Yes/No Note: Since most water bottles come from home in reusable <br> bottles, no need to record water unless it is in a commercial <br> packaging found in the lunch bag <br> How many drinks are in <br> the lunchbox? Can list up to 5 Record milk in Dairy and alternatives, not Drinks |
| Description: Drink \# |
|  | | 1, Plain water |
| :--- |
| 2, Fruit or vegetable juices with no added sugar |
| 3, Fruit or vegetable juices (reconstituted, made from |
| concentrates, with added sugar) |
| 4, Breakfast cereal beverages* |
| 5, Soft drinks, and flavoured mineral waters (iced tea, cola) |
| 6, Electrolyte, energy and fortified drinks |
| 7, Cordials |
| 8, Other |, | If option 8 Other is selected, type the name of the drink not |
| :--- |
| in the list |

*Not coded as dairy as item is marketed as liquid breakfast and first ingredient is water
4.3 Waste categories

| Food Waste | 1, No waste <br> 2, Some waste <br> 3, All waste <br> 4, Unidentifiable <br> 5, Missing data | Note: <br> - If data is available, but food item is hidden underneath something, in opaque container or with a closed lid, or yoghurt pouches are not crumpled or rolled up, then record as 4, Unidentifiable <br> Children were asked to leave any uneaten items in their lunchboxes. However, since children were habituated to throw away packaging of food items after consumption in bins, some packaging might not appear in the after photo. <br> Record waste of these food items as 1 , No waste <br> - Most fruits such as bananas or apples that will yield fruit scraps such as peels or cores are thrown in the green bin by children, so they may not be found in the after photo. Record these items as 1, No waste This waste record will be accounted post data entry <br> Rule of thumb: <br> Choose 1, No waste If food is in a packaged item, and missing in the after photo, assume it is eaten. Same rule applies for whole fruits as most children discard scraps in compost bin. <br> Choose 4, Unidentifiable If food is in a lunchbox, and cannot be identified, make no assumptions. |
| :---: | :---: | :---: |

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4.4 Packaging categories

| Packaging | Yes/No | Note: For packaging in addition to the main or <br> supplementary bento-style lunchboxes or lunch bags, <br> select Yes |
| :--- | :--- | :--- |
| Packaging Description | 1, Reusables <br> 2, Organics <br> 3, Recyclables <br> 4, Single-use or landfill | Note: If food item is part of the compartmentalised bento- <br> style lunchbox, record packaging as No for that particular <br> food item |

4.3 Packaging categories
4.4.1 Reusables

| Reusables Type | 1, Separate container <br> 2, Stainless steel food flask <br> 3, Beeswax (or other wax) wrap <br> 4, Cloth or cotton bag <br> 5, Silicone bag <br> 6, Silicone cups <br> 7, Reusable cutlery | 1, Separate containers are not part of the master lunchbox. <br> These include sandwich boxes, snack boxes, screw top <br> containers with lids. |
| :--- | :--- | :--- |





|  |  | 4, Compostable cutlery includes wood/bamboo cutlery |
| :--- | :--- | :--- |
|  |  |  |

4.4.3 Recyclables


[^6]
4.4.4 Single-use or landfill

| Single-use or landfill Type | 1, Foil (aluminium, paper lined) <br> 2, Cling wrap <br> 3, Soft plastic or silver lined wrapper <br> 4, Ziplock bag <br> 5, Squeeze pouches <br> 6, Muffin or cupcake case/Parchment paper <br> 7, Small plastic or condiment packaging <br> 8, Plastic straw <br> 9, Plastic cutlery <br> 10, Small tins or cans <br> 11 , Mixed ( $\geq 2$ packaging elements) <br> 12, Non-certified compostable bag | 3, Soft plastic or silver lined wrapper <br> 4, Ziplock bag <br> 5, Squeeze pouches <br> 6, Muffin or cupcake case/Parchment paper |
| :---: | :---: | :---: |



|  |  | 11, Mixed ( $\geq 2$ packaging elements) Examples: <br> Plastic and foil <br> Cardboard, foil, plastic <br> Plastic tub and peel off <br> 12, Non-certified compostable bag |
| :---: | :---: | :---: |

### 5.0 Dual coding for inter-rater reliability measure

After the primary coder codes the lunchbox photos, a percentage of the main sample can be coded by another coder by selecting a different coder in Coder field in REDCap. This allows for blind coding individually.

Duplicate coded data can be downloaded from REDCap and indicator variables can be created. The STATA code to create those indicator variables can be found here. This code can be modified to suit particular statistical analysis softwares.

Once the indicator variables are created, the following STATA code can be used to calculate intraclass correlation coefficients (ICC).

```
. * ICCs - two way mixed effects model (fixed coder effect,
random photo effect)
. foreach var of varlist veg_1 - veg_28 fruit_1 - fruit_27
grain_1 - grain_34 protein_1 _ protein_14 dairy_1 - dairy_14
snack_1 - snack_24 mixed_1 - mixed_4 drink_1 - drink_8 {
    display "** ICC Consistency 'var'
****"
    tab coder 'var'
        icc 'var' photo_code coder, mixed
level(95) consistency
```

```
display " "
```

display " "
display "****************"
display "****************"
display " " }

```
    display " " }
```

The inter-rater reliability between the two coders can be assessed using intraclass correlation coefficients (ICC) and $95 \%$ confidence intervals (CI). ICC values greater than 0.90 , between 0.75 and 0.9 , between 0.5 and 0.75 , and less than 0.5 are indicative of excellent, good, moderate, and poor reliability, respectively ${ }^{12}$.

[^7]
## APPENDIX C: Study 4 Supplementary Files

## Appendix C.1: Interview Schedule

## 1. INTRODUCTION

Hello! My name is Neha. Thank you for signing up for this interview (say to parent). What's your name? (Ask child)

Great, I would firstly like to thank you for participating in my PhD research study about school lunchboxes. I genuinely want to hear what you both think about lunchboxes and please note that there are no right or wrong answers here, so all answers are welcome.

This interview will be audio and video recorded. When we report the results of this study, your personal information will not be identified. You are also welcome to request for a copy of this interview's transcript for review and I will also be happy to send you a copy of the published research.

To the child: Did you have a look at the project flyer?
Do you understand what this interview is about?
Do any of you have any questions before we proceed?
Are you happy to join this interview?
Do I have both your consent to commence this recorded interview?

## 2. OPENING THE INTERVIEW

Participants introduction
Ask parents: How many children are in your family and how old are they?
Ask child(ren): Which year level are you in?
Which school do you go to?
3. TOPIC AREAS (in the context of packing and consuming low-waste nutritious foods) Question 1 for parents:

Who packs the children's lunches in your households?
Follow up with: Who decides what goes into the lunchboxes?

## Question 1 for children:

If parents pack: What sorts of things would you normally have in it?
If children pack: What do you like to pack in your lunchbox? Follow up with: Why is that?
Question 2 for parents:
What things are important for you when deciding what food is being packed?

## Question 2 for children:

What type of food do you like to eat in school? Follow up with: Why is that?
Follow up with: Would you like to eat a leftover meal from dinner the night before at school during lunch time? Why/Why not?

Question 3 for parents:
If no mention of nude food: What are your thoughts about nude food days?
If reference to nude foods has been made: I'm aware that some parents have troubles packing nude food lunches. What are your thoughts on or what has been your experience packing a lunchbox that has little or no packaging? OR Why do you think it's hard for parents to pack a lunchbox without packaged food items?

## Question 3 for children:

Are nude food days a good idea or not? Follow up with: Why is that? OR What are the good things about nude food? AND Is there anything you don't like about nude foods?

## Question 4 for parents:

If parent finds it hard to pack a nutritious and low-waste lunchbox: I'm aware that there's a lot of pressures on families to pack a nutritious lunchbox. Why do you think it's hard for parents to pack a nutritious lunchbox?

If parent is nutrition and eco-conscious: What are some tips you would like to share to inspire other parents to pack a nutritious and low-waste lunchbox?

Question 4 for children: Do you notice what other kids bring to school?

Follow up with: What do you think about their lunchboxes? What could be different? Why?

## Question 5 for children:

What do you think about the idea of packing your own lunchbox?
Question 5 for parents:
Would you support the idea of children packing their own lunchbox?

OTHER QUESTIONS TO ASK:
Parent: What do you think of reusable containers?
Parent: What are your concerns around reusable containers?
Child: What happens to the packaging after you finish eating something?
Child: What sort of bins are available at your school or in your class?
Parent/Child: Could schools do something different to help children eat better?
Parent: What do you remember from your school and lunchbox packing days? How different was it then to now?

Parent: From previous interviews, I noticed that eco-friendliness is not a priority in the lunchbox context. Why do you think that is the case?

## 4. CLOSING THE INTERVIEW

Do you have any final thoughts to share?
Is there anything else you'd like to say/add?

## 5. CONCLUSION

Thank you for taking the time out to do this interview. I really value your insights and appreciate this opportunity to have spoken with you. I am happy to send you a copy of this interview's transcript for review, and eventually the results of this research. I will also be sending you a $\$ 30$ voucher electronically as a token of gratitude for your time today.

## Appendix C.2: Ethics Approval from University HREC

RESEARCH SERVICES
OFFICE OF RESEARCHETHCS, COMPLIANCE AND INTEGRTY
THE UNVERSITY OF ADELAIDE
LEVEL 4, RUNDLE MALL PLAZA
50 RUNDLE MALL
ADELAIDE SA 5000 AUSTRALIA
TELEPHONE +61883135137
04 August 2022
FACSIMILE +61883133700
EMALL hrec@adelaide.edu.au

Dr Shona Crabb
Public Health
CRICOS Provider Number 00123 M

Dear Dr Crabb
ETHICS APPROVAL No: H-2022-127
PROJECT TITLE: Lunchbox Conversations: Perspectives of parents and children about food, packaging andwaste in lunchboxes

The ethics application for the above project has been reviewed by the Low Risk Human Research Ethics Review Group (Faculty of Health and Medical Sciences) and is deemed to meet the requirements of the National Statement on Ethical Conduct in Human Research 2007 (Updated 2018) involving no more than low risk for research participants.

You are authorised to commence your research on: 04/08/2022
The ethics expiry date for this project is: $31 / 08 / 2025$

## NAMED INVESTIGATORS:

| Chief Investigator: | Dr Shona Crabb |
| :--- | :--- |
| Student - Postgraduate <br> Doctorate by Research (PhD): | Ms Neha Kishan Lalchandani |
| Associate Investigator: | Dr Clare Hume |
| Associate Investigator: | Professor Caroline Miller |

CONDITIONS OF APPROVAL: The application is approved as submit on the 19th of July 2022. As children are providing verbal consent ensure all queries with a yes/no response are answered and the response to the query is recorded.

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled Annual Report on Project Status is to be used when reporting annual progress and project completion and can be downloaded at http://www.adelaide.edu.au/research-services/oreci/human/reporting/. Prior to expiry, ethics approval may be extended for a further period.

Participants in the study are to be given a copy of the information sheet and the signed consent form to retain. It is also a condition of approval that you immediately report anything which might warrant review of ethical approval including:

- serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical acceptability of the project,
- proposed changes to the protocol or project investigators; and
- the project is discontinued before the expected date of completion.

Yours sincerely,
Miss Sarah Harman
Secretary
The University of Adelaide

Appendix C.3: Project Flyer for Children


## Appendix C.4: Project Flyer for Parents

## LUNCHBOX CONVERSATIONS

ETHICS COMMITTEE APPROVAL NUMBER: H-2022-127


STUDENT RESEARCHER: Neha Lalchandani
Chief Investigator: Dr Showa Cab


What is the project about?
This research project aims to understand parents' and children's perspectives on school lunchboxes. We want to understand what the influential factors are affecting school lunchbox packing and consumption practices.

What are the potential benefits of the research project?
The study aims to be beneficial at a population level in the long term, to inform development of suitable programs and strategies to support families to pack nutritious and environmentally friendly school lunchboxes.
To thank you for your time and contribution you will receive a $\$ 30$ gift voucher
 electronically.

What will the research project involve?
You and your child(ren) are invited to participate in an audio and video-recorded interview for this study which will run for approximately 30-45 minutes.


During the interview, you will be asked about your thoughts on school lunchboxes, who packs the school lunchbox in your family, what types of food and packaging go into children's lunchboxes, and what influences lunchbox packing behaviours in your household. Your child(ren) will also be asked about their thoughts on school lunchboxes, and you can show them the project flyer to seek their interest.

All personal identifiers will be removed and replaced by pseudonyms (fake names) to protect the privacy and confidentiality of participants.

If you would like to participate in this research study, please fill this Google Form.

## Appendix C.5: Participant Information Sheet for Parents

## Participant information sheet

PROJECT TITLE: Lunchbox Conversations: Perspectives of parents and children about food, packaging and waste in lunchboxes
HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: H-2022-127
PRINCIPAL INVESTIGATOR: Dr Shona Crabb
STUDENT RESEARCHER: Neha Kishan Lalchandani
STUDENT'S DEGREE: Doctor of Philosophy (Public Health)

Dear Parent,

You are invited to participate in the research project described below.

What is the project about?
This research project aims to understand parents' and children's perspectives on school lunchboxes. We want to understand influential factors affecting school lunchbox packing and consumption practices.

Who is undertaking the project?
This project is being conducted by Neha Kishan Lalchandani as part of her PhD (Public Health) degree at the University of Ade laide. The project is being supervised by Dr Shona Crabb, Dr Clare Hume, and Professor Caroline Miller.

Why am I being invited to participate?
If you are the parent of a South Australian primary school child in years 3-6, you are able to participate in this study along with your child(ren). You must also be able to speak in English for the purpose of being interviewed for this study.

## What am I being invited to do?

You are invited to participate in an audio and video-recorded interview which will be conducted online via MS Teams. During the interview, you will be asked about your thoughts on school children's lunchboxes, who packs the school lunchbox in your family, what types of food and packaging go into children's lunchboxes, and what influences lunchbox packing behaviours in your household. Your child(ren) will also be asked about their thoughts on school lunchboxes, and you can show them the project flyer to seek their interest.

Multiple children are welcome to participate (for example, if you have more than one child in the specified age range), but the interview may be easier to manage with just one child and parent participating. We are particularly interested to include a parent that is usually responsible for the lunchbox shopping and packing.
You will also be emailed a copy of the interview transcript and will have seven days to revert with any comments/amendments you would like to provide.

How much time will my involvement in the project take?
The interview will run for $30-45$ minutes.

## Are there any risks associated with participating in this project?

You may feel a slight burden from the inconvenience of giving up time to participate in an interview. You may also feel a degree of social acceptability pressure relating to relating to the topic of lunchbox packing, provision, and consumption behaviours.

However, interviews will be private in nature, one-on-one with the student researcher only and all question responses are valid and welcome. Our approach to lunchbox contents is completely non-judgemental and we want to understand your perspectives. You and/or your child(ren) can choose to not answer questions, or to end the interview at any time. You are also provided with a list of supports that you may wish to access following the interview.

## Support resources you can access:

Parent Helpline: https://wow.cafhs.sa.gov.au/services/parent-helpline
Kids Helpline: https://kidshelpline.com.au/

## What are the potential benefits of the research project?

To thank you for your time and contribution you will receive a $\$ 30$ gift voucher electronically.
The study aims to be beneficial at a population level in the long term, to inform development of suitable programs and strategies to support families to pack nutritious and environmentally friendly school lunchboxes.

## Can I withdraw from the project?

Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study within seven days of the interview.

## What will happen to my information?

Confidentiality and privacy: Audio recordings of interviews will be transcribed by the student researcher. Personal identifiers will be removed and replaced by pseudonyms (fake names) to protect the privacy and confidentiality of research participants. The utmost care will be taken to ensure that no personally identifying details are revealed.
Storage: Data linking participant names with pseudonyms will be stored separately to transcript files in a secure location (hard copy materials in a locked filing cabinet and electronic materials within a password protected file on a secure server space approved by the University's IT Department) within the University of Adelaide's School of Public Health, only accessible to the researchers listed on this ethics application. The transcripts of audios along with any (non-identifiable) notes will remain as the data used for the study analysis and will be securely stored for at least 5 years after the completion of the project within the School of Public Health at the University of Adelaide.
Publishing: Findings from the research may be published as a book, thesis, journal article, news article, website, report and in conference presentations.

Sharing: A copy of the interview transcript will be sent to you (with pseudonyms included) and you will have a week to revert with any comments/amendments you would like to provide. A copy of the published research can be sent to you at your request. Transcripts (with all personal identifiers removed and replaced by pseudonyms) may be used in future for extensions of the original project, and my personal information will be removed when that happens.
Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

## Who do I contact if I have questions about the project?

If you would like to ask any questions about this project, or you would like us to explain these details to you, please contact:

Dr Shona Crabb
Principal Investigator / Supervisor
The University of Adelaide
shona.crabb@adelaide.edu.au
+61883131686
Neha Kishan Lalchandani Research Student
The University of Adelaide neha.lalchandani@adelaide.edu.au +61883131695

## Dr Clare Hume

Supervisor
The University of Adelaide
clare.hume@adelaide.edu.au
+61883139871

## Professor Caroline Miller

Supervisor
The University of Adelaide
caroline.miller@adelaide.edu.au
+61881284091

## What if I have a complaint or any

The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2022-127). This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research 2007 (Updated 2018). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Human Research Ethics Committee's Secretariat on:
Phone: +61883136028
Email: hrec@adelaide.edu.au
Post: Level 3, Rundle Mall Plaza, 50 Rundle Mall, ADELAIDE SA 5000
Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

## If I want to participate, what do I do?

If you would like to participate, please reply to the student researcher at neha.lalchandanicadelaide.edu.au indicating your availability. Prior to the interview, you will be asked to read and sign a consent form which is required to participate. You will also be asked you sign a third-party consent form on behalf of your child(ren). If you are unable to send the consent forms electronically, you may provide consent in writing via email.

Yours sincerely
Neha Kishan Lalchandani
Dr Shona Crabb
Dr Clare Hume
Professor Caroline Miller

## Appendix C.6: Consent Form for Participating Parents



## Human Research Ethics Committee (HREC) Consent Form

1. I have read the attached Information Sheet and agree to take part in the following research project:

| Title: | Lunchbox Conversations: Perspectives of parents and children about <br> food, packaging and waste in lunchboxes |
| :--- | :--- |
| Ethics Approval <br> Number: | $\mathrm{H}-2022-127$ |

2. I have read the attached Information Sheet and the research student has explained the project to me, including what I will be doing. I've been able to ask any questions about the project and what I will be asked to do. I freely agree to be part of this study.
3. I understand what this research is trying to find out, but also know that I may not gain any benefit from being part of it.
4. I agree to participate in the activities that were outlined in the participant information sheet.
5. I agree to be audio and video recorded: $\square$ Yes $\square$ No
6. I wish to receive a copy of the interview transcript: $\square$ Yes $\square$ No
7. I understand that participation in this study is voluntary and I am free to withdraw from the project within 7 days of the interview.
8. I know that the findings from this project might be published in a book/journal article/thesis/news article/website/report/conference presentations. Any of my personally identifying details will not be included in such publications.
9. I agree that the interview transcript can be used in other research projects that build on or are similar to this project by the same or other researchers, only if my personal information is removed before that.
10. I understand my information will only be disclosed according to the consent provided, except where disclosure is required by law.
11. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

## Participant to complete:

Name: $\qquad$ Signature: $\qquad$ Date: $\qquad$

## Appendix C.7: Third Party Consent Form for Participating Children



## Human Research Ethics Committee (HREC) - Consent Form

1. I give consent to $\qquad$ 's involvement in the following research project:

| Title: | Lunchbox Conversations: Perspectives of parents and children about <br> food, packaging and waste in lunchboxes |
| :--- | :--- |
| Ethics Approval <br> Number: | $\mathrm{H}-2022-127$ |

2. I have read the attached Information Sheet and the research student has explained the project to me, including what my child will be doing. I've been able to ask any questions about the project and what my child will be asked to do. I freely agree for my child to be a part of this study.
3. I understand what this research is trying to find out, but also know that my child may not gain any benefit from being part of it.
4. I agree for my child to participate in the activities that were outlined in the participant information sheet.
5. I agree for my child to be audio and video recorded: $\square$ Yes $\square$ No
6. I understand that participation in this study is voluntary and my child is free to withdraw from the project within 7 days of the interview.
7. I know that the findings from this project might be published in a book/journal article/thesis/news article/website/report/conference presentations. Any of their personally identifying details will not be included in such publications.
8. I agree that the interview transcript can be used in other research projects that build on or are similar to this project by the same or other researchers, only if my child's personal information is removed before that.
9. I understand my child's information will only be disclosed according to the consent provided, except where disclosure is required by law.
10. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

Third Party to Participant to complete:

Name: $\qquad$ Signature: $\qquad$

Relationship to participant: $\qquad$ Date: $\qquad$

Name and age of participant: $\qquad$


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[^2]:    ${ }^{1}$ https://www.eatforhealth.gov.au/food-essentials/five-food-groups
    ${ }^{2}$ https://www.eatforhealth.gov.au/food-essentials/discretionarv-food-and-drink-choices

[^3]:    ${ }^{3}$ https://www.eatforhealth.gov.au/food-essentials/five-food-groups
    ${ }^{4}$ https://www.eatforhealth.gov.au/guidelines/australian-guide-healthy-eating
    ${ }^{5}$ https://www.eatforhealth.gov.au/food-essentials/discretionarv-food-and-drink-choices

[^4]:    ${ }^{6}$ https://www.greenindustries.sa.gov.au/ media downloads/165434/Recycling\%20Education\%20ResourceZeroWasteSA.pdf
    ${ }^{7}$ https://redcycle.net.au/
    ${ }^{8}$ https://www.accc.gov.au/media-release/supermarkets-can-cooperate-in-soft-plastics-taskforce-after-redcycle-pauses-recycling-program
    ${ }^{9}$ https://www.whichbin.sa.gov.au/a-z-items

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[^6]:    ${ }^{11}$ https://www.epa.sa.gov.au/environmental info/waste recycling/container deposit

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