



**From information to action: towards context-specific nutrition and
noncommunicable disease research, interventions, and policies in
Sri Lanka**

A thesis submitted for the degree of Doctor of Philosophy in Population Health

by

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Declaration of authorship

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Abstract

From information to action: towards context-specific nutrition and noncommunicable disease research, interventions, and policies in Sri Lanka

Background: Suboptimal diet is the leading risk factor for global morbidity and mortality, and an important preventable risk factor for noncommunicable diseases (NCDs). As urbanisation, economic development, and income growth lead to shifts in diet, many low- and middle-income countries, including Sri Lanka, are increasingly exposed to foods and diets that increase the risk of developing NCDs. Although improving population diets is recognised as a global health priority, there is an increasing awareness that one size does not fit all when it comes to intervention development and implementation. Effective action therefore requires context-specific solutions informed by context-specific data collected by context-specific tools.

Aim: The overarching aim of this thesis is to improve the assessment of nutrition-related behaviours so as to target interventions better and inform policy in Sri Lanka.

Methods: This thesis follows a mixed methods approach to address diverse study objectives. Data were collected through: 1) a systematic review of the published literature; 2) semi-structured interviews conducted with 23 policymakers, researchers, and research funders working in the areas of NCDs, nutrition, and urban health; 3) dietary surveys (a novel brief dietary survey instrument and a 24-hour Dietary Recall) conducted with 94 Sri

Lankan adults residing in Colombo, Kalutara, and Trincomalee; and 4) semi-structured interviews conducted with 93 of the participants in the dietary survey study.

Results and discussion: This thesis identifies and describes the barriers to and facilitators of evidence generation, communication, and uptake in the areas of NCDs, nutrition, and urban health in the Sri Lankan context. Whilst many of the study findings confirm that much of what is known about the barriers to and facilitators of evidence-based policymaking from the ‘global’ literature applies to the Sri Lankan context, important context-specific differences also emerge. Some of the context-specific barriers include: English language communication barriers between evidence generators and users; the strong involvement of clinicians and ‘medical mindsets’ in public health research and policymaking; and a lack of context-specific research tools. Based on stakeholders’ needs revealed through these interviews, this thesis then describes the development and relative validation of a context-specific dietary survey instrument, the Sri Lankan Brief Dietary Survey (SLBDS). The findings from this study show that the SLBDS demonstrates promise as a fit for purpose research tool. Through semi-structured interviews, factors that might impact SLBDS participation, engagement, and social validity are revealed. These factors include the time of day interviews occur, recall ease, level of commitment required, perceived survey value, emotional response to surveys, and interviewer positionality. Finally, this thesis explores some of the context-specific factors that might impact the success of dietary interventions aimed at influencing day-to-day practice. The findings from this study recommend that the promotion of healthier diets should not be targeted at women exclusively, but rather directed to all family members – especially men and children whose attitudes and preferences are a crucial determinant of what and how family members eat.

Conclusion: The central message of this thesis is that *context is everything*. What works to improve health depends on context, but context is complex. This thesis responds to a need for setting-specific mixed-methods research to inform the appropriate, effective, and equitable development and implementation of dietary improvement interventions in Sri Lanka.

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List of abbreviations

24DR	24-hour Dietary Recall
7DWR	7-Day Weighed-Intake Dietary Record
BK	Buwaneka Kalupahana
CKD	Chronic Kidney Disease
DALYs	Disability Adjusted Life Years
DBM	Double Burden of Malnutrition
FFQ	Food Frequency Questionnaire
GAT	Gender Assessment Tool
GND	Grama Niladhari Division
LA	Limits of Agreement
LB	Lauren Bandy
LLA	Lower Limit of Agreement
LMIC	Low- and Middle-Income Country
MoH	Ministry of Health, Nutrition and Indigenous Medicine
MR	Mike Rayner
MRI	Medical Research Institute
NCD	Noncommunicable Disease
NT	Nick Townsend
PI	Principal Investigator
PS	Peter Scarborough
SDG	Sustainable Development Goal
SF	Santhushya Fernando

SLBDS	Sri Lankan Brief Dietary Survey
SLFBDGs	Food Based Dietary Guidelines for Sri Lankans
SLFFQ	Food Frequency Questionnaire for Sri Lankan Adults
SLNCDS	Sri Lankan Noncommunicable Disease Survey
STEPS	WHO STEPwise Approach to Surveillance
ULA	Upper Limit of Agreement
UN	United Nations
UNICEF	United Nations Children’s Emergency Fund
WHO	World Health Organization

Chapter 1. Introduction

1.1 Chapter summary

Suboptimal diet is the leading risk factor for global morbidity and mortality, and an important preventable risk factor for noncommunicable diseases (NCDs). As urbanisation, economic development, and income growth lead to shifts in diet, many low- and middle-income countries are increasingly exposed to foods and diets that increase the risk of developing NCDs. Although improving population diets is recognised as a global health priority, there is an increasing awareness that one size does not fit all when it comes to intervention development and implementation. Effective action therefore requires context-specific solutions informed by context-specific data collected by context-specific tools. This thesis places particular emphasis on the contextual factors and requirements in Sri Lanka that might impede or improve the collection and use of dietary data for enhanced population health outcomes.

This introductory chapter begins by providing an overview of the links between suboptimal diets, urbanisation, and noncommunicable diseases; the burden of diet-related diseases in Sri Lanka; and the events that influenced and inspired this thesis. It also introduces the importance of context-specific approaches to public health research and interventions. The chapter concludes by presenting the aim, objectives, and structure of this thesis.

1.2 Background

1.2.1 Noncommunicable diseases

Noncommunicable diseases are the single greatest cause of death and disability in the world and pose a major threat to economic and social development. In 2016, 71% of deaths globally were attributed to NCDs, disproportionately burdening low- and middle-income countries (LMICs) where 85% of premature NCD deaths (below 70 years of age) occurred (1). The main types of NCDs include cardiovascular diseases, cancers, chronic respiratory diseases, diabetes, and mental and neurological conditions. Among the many NCD risk factors and determinants, five key modifiable behavioural risk factors, including physical inactivity, tobacco use, harmful use of alcohol, unhealthy diet, and air pollution all increase the risk of developing NCDs. These chronic diseases and their risk factors are driven by underlying socioeconomic, cultural, political, and environmental forces including population ageing, globalisation, and urbanisation (2, 3).

In response to this global health problem, the United Nations (UN) have set a goal of reducing premature mortality attributable to NCDs by one third by 2030 (4). The World Health Organization (WHO) recommends that country-level NCD risk factor and disease surveillance activities that inform effective NCD prevention and control programmes, and monitor their progress, are essential to achieving this goal (5).

1.2.2 Unhealthy diets

Of the five modifiable NCD risk factors mentioned above, unhealthy diet is responsible for the majority of deaths globally (6, 7). In 2017, diet-related diseases accounted for 11 million

deaths and 255 million disability adjusted life years (DALYs). The majority of this morbidity and mortality was linked to three dietary risk factors: high intake of sodium, low intake of whole grains, and low intake of fruits (7). While the global rate of premature deaths from NCDs has declined somewhat since 2000, the prevalence of obesity, a key NCD risk factor resulting from energy imbalance, has continued to rise with no signs of slowing. This increase, among other factors, is associated with rising mortality rates from diabetes (8).

Recent evidence suggests that increasing uptake of healthy diets could prevent one in every five premature deaths globally (7). Progress toward achieving global nutrition and diet-related NCD targets, however, has been slow-moving and unequally distributed across and within countries (9). More and better dietary data could help to accelerate effective action (7, 9).

1.2.3 Urbanisation

“Health is created and lived by people within the settings of their everyday life; where they learn, work, play, and love” (The Ottawa Charter) (10). For most people, these settings are urban. At the start of the 20th century, 10% of the global population lived in urban environments. Between 2000 and 2014, these environments grew by more than one billion inhabitants. Today, over 54% of the global population are urban dwellers, with this proportion expected to increase to 66% by 2050. This growth in urban populations and environments is the result of migration from rural to urban areas, natural urban population growth, and the process of areas becoming more urban (for example, towns becoming

cities) (11). Nowhere is this phenomenon more pronounced than in LMICs, where 90% of urban growth is rapidly occurring, and often in an unplanned fashion (12).

Whilst urbanisation can bring about positive changes to people's lives, such as greater access to healthcare, education, and job opportunities, it is also associated with many negative health outcomes and changing patterns of disease. This has led the WHO to identify urbanisation both as one of the most important challenges and opportunities for public health this century (11, 13).

1.2.4 Urbanisation and diet

In many countries around the world, the prevalence of NCDs and their modifiable behavioural risk factors are higher in urban versus rural areas (14). With respect to dietary risks, this phenomenon can be explained in part by the nutrition transition – the process by which population diets become more 'Westernised' (low in fibre and high in saturated fats, sugar, and processed foods) and lifestyles become more sedentary as societies become more 'developed' (15, 16). The process of urbanisation is only one of the multiple interlinked factors that drive the nutrition transition. Other factors include increases in food marketing, increases in per capita disposable incomes, trade liberalisation, and the commercialisation of food and agricultural markets (17). Over the past 15 years, this transition – which is far more complex than a rapid, uniform progression from food scarcity to food abundance – has occurred at pace in LMICs. Across the globe, particularly in LMICs, the double burden of malnutrition (DBM) – characterised by the coexistence of undernutrition along with overweight and obesity, or diet-related NCDs – is now prevalent

within individuals, households, and populations (18). A better understanding of the association between urban environments and their impact on diets is therefore critical to inform well-targeted dietary interventions. This requires, however, the use of measurement methods that can account for the complex and varied nature of urbanisation (19, 20).

1.3 Study setting

The research described in this thesis took place in Sri Lanka, a lower-middle-income island country in South Asia with a population of approximately 21,803,000 (21, 22). The country is divided into nine provinces and 25 districts. In recent history, Sri Lanka has experienced dramatic demographic, epidemiological, and nutrition transitions alongside rapid urbanisation, resulting in a high DBM and NCD burden (23, 24). Recent cross-sectional research indicates that one in five adults has diabetes or pre-diabetes, one in 10 adults are obese, and that less than 4% of the population meet the daily intake of fruits and vegetables recommended by the Ministry of Health (25-28).

Given these alarming findings, many in Sri Lanka have advocated for the collection of more representative and systematic data on both dietary risks and NCDs in order to inform public health initiatives tailored to Sri Lankan populations (25-28). Studying the NCD burden in the North and East of the country, as well as at the district-level, has been identified as being particularly important in this regard. These northern and eastern areas, which were previously war zones (during the country's civil war which took place between 1983 and 2009) and as a result excluded from NCD research, have since fast developed with potential negative impacts on population health (25, 29). Alongside these data coverage issues, there

are also limitations to the type of data collected. For example, research in Sri Lanka into the impact of urbanisation on diets and NCDs has almost exclusively relied on administrative definitions of 'urban' and 'rural' (30). The following administrative definitions have been used:

- **Urban sector:** all areas administered by municipal and urban councils constitute the urban sector.
- **Plantation/Estate sector:** estate sector consists of all plantations which are 20 acres or more in extent and with ten or more resident labourers.
- **Rural sector:** all areas other than urban and estate comprise the rural sector.

Such definitions have been criticised for their inadequacy to determine the impact of urban and rural living on health outcomes, especially in contexts where urbanisation is occurring rapidly (19, 31).

The Sri Lankan government has demonstrated commitment to tackling NCDs and their associated risk factors by developing the National Multisectoral Action Plan for the Prevention and Control of Noncommunicable Diseases 2016-2020 and setting ten national NCD targets to be achieved by 2025 (32, 33). A 2018 Ministry of Health report, moreover, identified the need to continue to expand the national evidence base in order to support the development, adaptation, and implementation of effective and cost-effective interventions; and to support the evaluation of current strategies and achievement of national NCD targets (33).

1.4 Moving towards context-specific approaches to research, interventions, and policies in Sri Lanka

“If an intervention is the ‘seed’ then context is the ‘soil’” (The Health Foundation) (34).

Population health interventions and policies that seek to modify the determinants of disease by either altering environments or directly influencing health behaviours must be sensitive to context. Research that aims to inform the development, implementation, and evaluation of these interventions and policies must therefore also be equally sensitive to context (35). This involves taking context – *“a range of factors such as the study setting, existing health or other systems, available resources, social norms, community supports, relationships between different actors, political context, and many others, which can all have a critical impact on applicability, viability, and effectiveness”* (36) – into account during key stages of the research process (35):

- Defining the problem and the research questions.
- Developing, selecting, and adapting data collection and analysis tools.
- Developing and adapting interventions and policies.
- Implementing interventions and policies.
- Evaluating interventions and policies.
- Reporting findings and engaging in knowledge translation and exchange.

Achieving the integration of contextual considerations into every step of the research process requires engagement with key stakeholders – not only to generate relevant research, but also to help ensure that this research is utilised (37-39). In many settings, the underutilisation of evidence in public health decision-making is not always only due to a lack

of evidence or its poor internal validity, but rather to the lack of attention paid to the needs of decision-makers and the contextual factors that help or hinder successful evidence translation (38, 40). The WHO has recognised this issue and is increasingly advocating for the contextualisation of their guidelines and recommended interventions and policies as a key strategy to accelerate country progress towards health goals (specifically Sustainable Development Goal (SDG) target 3.4) (41-43). The achievement of this ‘contextualisation ambition’, however, is heavily reliant on local and country-level research initiatives, specifically monitoring and surveillance activities, that are joined up to policy action.

Moving from the general to the particular: effectively addressing the burden of diet-related diseases in Sri Lanka therefore requires context-specific solutions informed by context-specific data collected by context-specific tools. It also requires knowledge of the local research and decision-making environments in which these problems and solutions are studied, communicated, and acted upon – information that helps map the intersection between what is needed and what is possible and to close the gap between research production and use. The one theme that therefore inspired, informed, and connects all of the studies undertaken in this thesis is the importance of context. Some of the contextual factors that influenced the thesis aim, objectives, and research methods are outlined in section 1.5 below.

1.5 Additional background and contextual information

The history of this thesis begins in 2017 with an ambitious response to the NCD risk factor evidence gaps outlined above: the Sri Lankan Noncommunicable Disease Survey (SLNCDS). It

was both the development and sudden collapse of this project that gave birth to another – my DPhil project. The section below describes these events and their influence on this thesis.

1.5.1 The Sri Lankan Noncommunicable Disease Survey

The Sri Lankan Noncommunicable Disease Survey, conceived in 2015 by researchers at the University of Colombo, was intended to address many of the information gaps discussed in section 1.3. The aim of this study involving 14,200 participants was to provide, for the first time, a comprehensive and up-to-date picture of NCDs and their determinants at national, provincial, and district levels in Sri Lanka in order to inform NCD interventions and policies. Researchers also intended to use this study as an opportunity to establish the first biobank to support further research on the association between various biomarkers and NCDs in the Sri Lankan population.

Of the six stated SLNCDS study objectives, three related to measuring the prevalence and impact of diet and urbanisation on NCD outcomes:

1. To determine the national, province-specific, and district level prevalence of NCDs and their risk factors.
2. To investigate the influence of demographic and socioeconomic factors (including urbanicity) on the prevalence of NCDs and their risk factors.
3. To study patterns of diet among the Sri Lankan population and evaluate the effects of these dietary patterns on NCDs.

In 2017, my supervisors and I met with SLNCDS researchers to discuss a collaboration around the SLNCDS – including a DPhil project that I would undertake that would analyse the associations between level of urbanisation, diet, and NCDs (objectives 2 and 3 above). At this point, the type of dietary survey to be included in the wider study was still up for debate, and ‘urbanicity’ was going to be measured using administrative definitions of urban and rural. Given the potential implications of using these definitions for informing effective interventions (discussed in more detail in Chapter 2), I advocated for the inclusion of a more descriptive multicomponent urbanicity measurement tool. Identifying the most appropriate tool for this particular study, however, required further systematic investigation (30). Further discussions with the SLNCDS team also revealed that they were struggling to identify a validated dietary survey that met the criteria of: 1) context suitability; 2) low administration burden for participants and researchers; 3) rapid and straightforward analysis; 4) suitability for repeat assessments in a large-scale follow-up study; 5) low respondent fatigue in a multi-risk factor survey; and 6) ability to provide useful health-related information to inform population-level policy and interventions. A lack of context-specific and informative research tools was therefore identified as a key barrier to achieving the study objectives outlined above. As a result, my early contributions to the SLNCDS project included: undertaking a systematic review of the association between urbanicity and dietary intake and the urbanicity measurement methods used to investigate this association (presented in Chapter 2); improving and extending an existing urbanicity measurement method (30); and identifying an appropriate dietary survey tool. These research activities were intended to facilitate data collection that would allow for the calculation of the association between level of urbanisation, diet, and NCDs in the SLNCDS population.

A year later, the SLNCDS project encountered funding issues which led to its premature termination. As described below, this meant that important questions remained unanswered and that new, and equally important ones, were raised. It also meant that I had to reconsider and reconceive my DPhil project.

1.5.2 Questions that remained unanswered and were raised by the termination of the SLNCDS

The SLNCDS was primarily concerned with the question: *what and how big is the NCD problem in different populations in Sri Lanka?* In trying to answer these questions, two additional questions were raised: *what should be measured and how should it be measured?* An additional, central question raised by a combination of the prevailing evidence gaps that inspired the SLNCDS, the difficulties encountered in identifying appropriate research tools for use in this multi-risk factor study conducted in a LMIC, and the subsequent termination of the SLNCDS was: *what are the barriers to and facilitators of evidence generation in the Sri Lankan context?*

The untimely and protracted end to the SLNCDS also provided an opportunity to improve on the original project protocol and strategy for impact in preparation for a new SLNCDS (or similar). Achieving the overarching aim of such a study – to generate policy-relevant research for improved population health outcomes in Sri Lanka – requires considering the context-specific barriers to and facilitators of evidence communication and use. Before this thesis, no study had been conducted on this topic in the Sri Lankan context. Some of the key questions that remained unanswered and were raised by the termination of the SLNCDS are addressed by the aim and objectives of this thesis.

1.6 Thesis aim and objectives

Using a mixed-methods research approach, this thesis aims to improve the assessment of nutrition-related behaviours so as to target interventions better and inform policy in Sri Lanka. The achievement of this aim is supported by five objectives addressed by each of the five analysis chapters (Chapters 2 to 6) in this thesis:

1. **To conduct** a systematic review of the association between urbanicity and dietary intake and **describe** the urbanicity measurement methods used to investigate this association.
2. **To explore** the facilitators of and barriers to evidence-based public health policymaking in Sri Lanka, with a focus on nutrition, noncommunicable diseases, and urban health.
3. **To validate** a newly developed brief dietary survey to estimate food intake and adherence to the Food Based Dietary Guidelines for Sri Lankans, using a 24-hour Dietary Recall as reference.
4. **To explore** the factors that might impact Sri Lankan Brief Dietary Survey participation, engagement, and social validity among study participants.
5. **To investigate** how food labour, consumption hierarchies, and diet decision-making dynamics in Sri Lankan households might influence how and for whom interventions aimed at promoting healthy eating might work.

1.7 Structure of this thesis

This thesis comprises seven chapters. Chapters 2 to 6 follow a similar structure: chapter summary, introduction, methods, results, discussion, and conclusion. In instances where there is an overlap between the methods used or the ethics obtained for the studies presented in each chapter, I refer back to the relevant sections in previous chapters rather than duplicating this information.

Chapter 2

Chapter 2 presents a systematic review of the literature on the association between urbanicity and dietary intake and describes the urbanicity measurement methods used to investigate this association. Although the findings from this review did not directly inform the proceeding chapters due to circumstances discussed in section 1.5.1, this review identifies important avenues for future investigation that could further support NCD and nutrition research in Sri Lanka.

Chapter 3

This chapter uses semi-structured interviews conducted with 23 researchers, research funders, and policy makers to explore the factors that act as facilitators of and barriers to evidence generation, communication, and uptake in public health policymaking in Sri Lanka, with a focus on nutrition, noncommunicable diseases, and urban health. Whilst the chapter's findings confirm that many of the barriers and facilitators identified in the literature on English-speaking high-income countries apply to the Sri Lankan context, they also reveal that important contextual differences and nuances exist. Chapters 4, 5, and 6 present studies that respond to specific contextual barriers identified by interviewees.

Chapter 4

The absence of a dietary survey developed for and validated with the study population in question (Sri Lankan adults) was cited as a key barrier to the development and evaluation of effective dietary interventions by both SLNCDS staff and Chapter 3 interviewees. Chapter 4 responds to this barrier by developing and validating a context-specific dietary survey, the Sri Lankan Brief Dietary Survey (SLBDS), with 94 Sri Lankan adults living in Colombo (Western Province), Kalutara (Western Province), and Trincomalee (Eastern Province).

Chapter 5

Whilst Chapter 4 presents the results from a quantitative validation exercise to assess Sri Lankan diets, Chapter 5 explores other dimensions of tool validation that may increase the validity and representativeness of data collected. This chapter employs semi-structured interviews conducted with Chapter 4 participants to identify the various factors that might impact SLBDS participation, engagement, and social validity.

Chapter 6

Chapter 3 interviewees identified a skew towards ‘what’s the problem’ research over ‘what should we do about it and how’ evidence as a barrier to the successful promotion of healthy diets. While Chapters 4 and 5 in this thesis develop, validate, and seek to improve measures of dietary intake to inform and evaluate interventions, this chapter explores the context-specific factors that might impact the success of such interventions. Through semi-structured interviews conducted with Chapter 4 participants, Chapter 6 investigates who is

responsible for, who is able to perform, and who influences targeted dietary behaviours at a household level.

Chapter 7

This discussion chapter reviews the thesis aim and objectives and summarises the main findings from each of the analysis chapters. It also discusses the strengths and limitations of this dissertation as a whole and suggests avenues for future research.

Chapter 2. What is the association between urbanicity and dietary intake? A systematic review of the literature

2.1 Chapter summary

As both urbanisation and the prevalence of dietary risk factors increase globally, there is a need to understand better the association between urban environments and their impact on diets to inform well-targeted dietary interventions. The objective of this chapter is therefore to investigate the association between urbanicity and dietary intake and to describe the urbanicity measurement methods used in studies that investigate this association. In May 2018, eight electronic databases were searched for studies published in peer-reviewed journals that had investigated the association between level of urbanicity and a measure of dietary intake. Of the 520 studies identified, 12 conducted in China, India, the Philippines, and Uganda were included in this review. A total of 19 associations between level of urbanicity and dietary intake were reported, of which 16 were in agreement with the hypothesis that there is a relationship between increases in urbanicity and convergence toward a Western-style diet (the nutrition transition hypothesis). Four multicomponent urbanicity measurement methods were used to investigate these associations, with notable similarities and differences between them. Heterogeneity in the outcome variables reported and the diet data collection methods used was also identified. Whilst the findings from this review largely confirm the nutrition transition hypothesis, they do not give a clear indication of which elements of urbanisation in different contexts contribute to dietary changes and disease risks. Improved urbanicity measurement methods may therefore be required to identify specific targets for dietary improvement interventions.

2.2 Introduction

Addressing the burden of NCDs is an urgent global priority, and as discussed in Chapter 1, living in an urban environment has been identified as a key risk factor for the development of NCDs (13, 44). This relationship is of particular concern in low- and middle-income countries experiencing rapid urbanisation. There is far less known, however, about how exposure to urban or urbanising environments impacts specific NCD risk factors both across and within countries (45). This knowledge gap is in part due to the fact that many health researchers have and continue to rely on oversimplified, dichotomous, and often outdated definitions of ‘urban’ and ‘rural’ that do not account for the multiple characteristics that define and distinguish urban environments or measure the dynamic process of urbanisation (45, 46). Additionally, as there are no universally accepted definitions of ‘urban’ and ‘rural’, urban health research conducted in different contexts is difficult to compare (20).

To develop appropriate and effective policy responses to the health problems posed by urbanisation, researchers need to investigate the association between urbanisation and key NCD risk factors using more informative and comparable measures (45, 47). This requires moving away from oversimplified and sometimes arbitrary definitions toward measurement methods that account for the complex and varied nature of urbanisation (19, 20, 46, 48).

Urbanicity is a reflection of the elements and characteristics that are particular to, or present to a greater extent in, urban areas compared to non-urban areas at any given point in time (20). Multicomponent urbanicity scales define the degree to which an area is urban on a scale from low to high. Unlike rural-urban dichotomies, they are able to detect fine-grained differences in urbanicity and are particularly well-suited to assessing changes in

urbanicity in single areas over time (20, 46). This means that they are better placed to help us understand and address the relationship between urbanisation and the leading global risk factor for the development of NCDs: suboptimal diet (7). To date, however, the global evidence on the associations between urbanicity measured by multicomponent scales and dietary intake has not been systematically reviewed or collated.

2.2.1 Chapter objectives and additional background information

This chapter addresses thesis objective 1: to identify, collate, summarise, and report the evidence on the association between urbanicity and dietary intake and to describe the urbanicity measurement methods that have been used in studies that investigate this association. As discussed in Chapter 1, this systematic review was conducted to support a thesis that would assess the relationship between urbanicity and diet in Sri Lanka. When these plans were made, the SLNCDS team were planning to measure urbanicity as part of their country-wide multi-risk factor NCD survey. However, the project ended before a context-specific measure of urbanicity could be included and data collected. By the time the SLNCDS project termination was confirmed, this systematic review was already complete. It has been included in this thesis because its findings and recommendations remain useful and relevant for nutrition research in Sri Lanka.

2.3 Methods

2.3.1 Search strategy

The protocol for this review has been published in the international prospective register of systematic reviews (PROSPERO protocol CRD42018100549). In May 2018, eight electronic

databases (MEDLINE, Embase, CAB Abstracts, Global Health, CINAHL, Web of Science, ProQuest, and The Avery Index to Architecture Periodicals) were searched for terms relating to urbanicity and dietary intake. Table A1 outlines the full list of terms searched in each database. The reference lists of articles included at the full-text screening stage were also hand-searched for additional relevant papers.

2.3.2 Inclusion and exclusion criteria

There were no restrictions placed on study date, language or population parameters (including age, gender, and nationality). Only studies that were published in peer-reviewed journals or as digital dissertations and met the following inclusion and exclusion criteria were included:

- Study contains the exposure of interest: urbanicity. The definition and measurement of urbanicity was expected to vary between studies. To be included, however, urbanicity had to be measured in a multicomponent (considers two or more clearly defined urban features) fashion and be presented as a scale (with three or more levels/degrees of urbanicity).
- Study contains the outcome of interest: diet (intake). Outcome(s) must be directly linked to level of intake:
 - Food intake. For example, food group intake, food item intake, macronutrient intake, micronutrient intake, dietary pattern, and food diversity.
 - Beverage intake. For example, sugar sweetened beverages, coffee, tea, and energy drinks.

- Blood measures of nutrients, such as iron or glucose, will not be included if they are not converted into a measure of intake.
- Study contains a measure of association between the exposure and outcome of interest.
- Study describes how exposure and outcome(s) were measured.

2.3.3 Screening and data extraction

Identified records were exported to EndNote (version X8.2 for Windows) and duplicates removed. The deduplicated records were then exported to Microsoft Excel for screening where all records were screened by title and abstract. A 10% independent check was conducted by another researcher (NT). Uncertainties and discrepancies were discussed and resolved together. Based on this first stage of screening, a full-text screening was conducted and the following data from included studies were extracted using a standardised form:

- Study information: title, author(s), date, journal, setting (geographical location), country income level (based on World Bank classifications), and research aims/questions.
- Study population and sample: study population, number of participants, and sample characteristics (for example, age and gender).
- Exposure of interest: urbanicity score/index.
- Exposure measurement characteristics: measurement tool name and level applied (individual, community, national), validation process, components included, data sources used.
- Outcome(s) of interest: dietary intake variable(s) measured.

- Outcome measurement: measurement tool(s) and level applied (individual, community, national).
- Study design.
- Key results: associations measured and key statistics (for example odds ratio (OR) or p-value).

A third researcher (LB) independently cross-checked data extraction from a random 50% sample of included papers. Disagreements were resolved together. Study authors were contacted by email if more information was required.

2.3.4 Quality assessment

Included studies were assessed for risk of bias and quality using the National Institutes of Health's (NIH) 14-question Quality Assessment Tool for Cohort and Cross-Sectional Studies (49). LB also independently cross-checked the risk of bias assessment for 50% of included papers.

2.3.5 Data analysis

The studies included in this review were heterogenous in terms of study design, measurement of urbanicity, and outcome variables reported (measures of dietary intake), so this chapter follows a narrative approach to evidence synthesis (50). This narrative approach focusses on the direction and strength of reported associations: positive (if the diet variable of interest increases with increasing urbanicity), negative (if the diet variable of interest decreases with increasing urbanicity), and statistically significant if $p < 0.05$.

Associations are also compared based on their agreement with the hypothesis that

population diets tend toward a more Western-style dietary pattern as urbanicity increases. This hypothesis is based on the global nutrition transition theory, which links shifts towards modern Western-style dietary patterns – characterised by diets that are high in saturated fats, sugar, and refined foods but low in fibre – in urbanising communities to increases in NCD prevalence (15, 16).

2.4 Results

The initial search returned 520 articles, of which 256 duplicates were excluded immediately. The remaining article titles and abstracts were screened, and a further 227 were excluded because they did not meet the review inclusion criteria. At this stage, the reference lists of 37 full-text articles were hand searched and an additional two studies were identified. A total of 39 articles were read in their entirety and 23 were subsequently excluded because they did not report a measure of association ($n = 11$); measure urbanicity in a multicomponent fashion ($n = 8$); or measure dietary intake ($n = 4$). A further four records were excluded because they were not published in peer-reviewed journals or as open-access theses. In total, 12 studies were considered in this review. Figure 2.1 illustrates the study selection process.

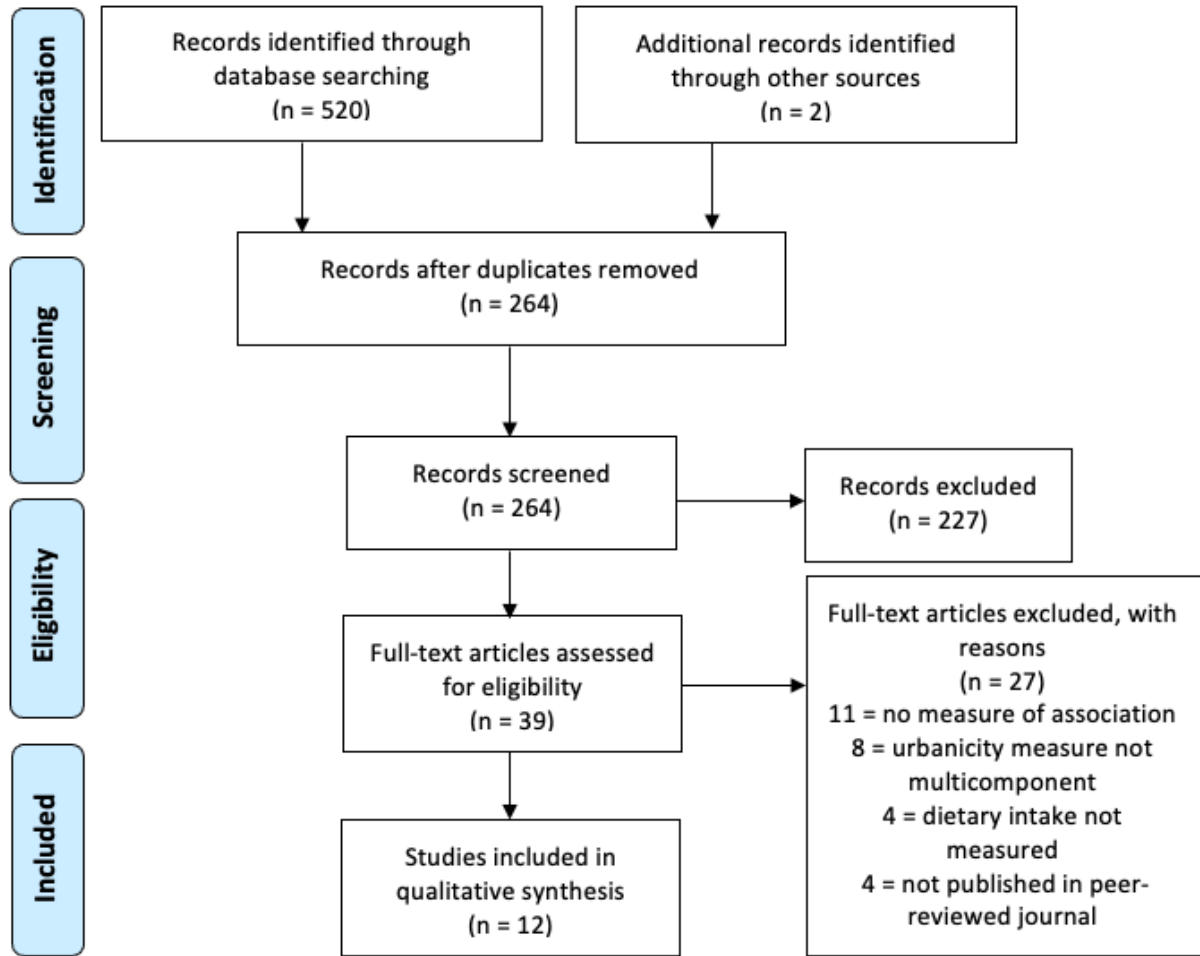


Figure 2.1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagram

2.4.1 Overview of included studies

A summary of included studies is presented in Table 2.2. Studies were conducted in China ($n = 8$), India ($n = 1$), the Philippines ($n = 2$), and Uganda ($n = 1$) between 1983 and 2011 and published between 2007 and 2018. This review did not identify any studies conducted in high-income countries. Study sample sizes ranged from 1,433 to 13,833 participants and included adult women and men, children, and older populations (>60 years old). Five studies were cross-sectional and seven were longitudinal, with the number of data collection time points ranging from one to eight. There was heterogeneity in both exposure and outcome measurement methods and variables, and the statistical tests used to measure associations.

Four studies measured the exposure variable (urbanicity) on a scale from 0 to 70 using a 7-item tool, and eight studies used a 12-item tool with possible urbanicity scores ranging from 0 to 120. Section 2.4.2 below explores these tools in more detail. Together, studies investigated the association between urbanicity and 19 dietary intake variables that were measured using 24-hour Dietary Recalls, household food inventory surveys, and STEPwise risk factor surveillance surveys.

2.4.2 Urbanicity measurement methods used in included studies

A summary of included urbanicity scales is presented in Table 2.1. The 12 studies used one of four multicomponent urbanicity measurement methods that included between 7 and 12 different components (quantifiable features that define and distinguish urban environments). Two of these methods were specifically developed for the context in question and two were adaptations of previously existing tools. Studies conducted in China used the 12-item urbanicity scale developed and comprehensively validated in the research context by Jones-Smith and Popkin (2010) and studies conducted in the Philippines used the 7-item scale developed and comprehensively validated in the research context by Dahly and Adair (2008). Allender et al. (2010) modified and face validated this 7-item scale for use in Tamil Nadu, India. Finally, Riha et al. (2014) adapted and face validated a 7-item scale, that was originally developed and validated in Ethiopia, India, and Peru, for use in the rural Ugandan context (51).

The maximum urbanity score for Jones-Smith and Popkin's (2010) tool was 120, with each of the 12 items being assigned a maximum of 10 points. Dahly and Adair (2008) and Allender et al.'s (2010) tools also assigned a maximum of 10 points to each of the seven items

assessed and scored level of urbanicity between 0 (no urbanicity) and 70 (high urbanicity).

Riha et al.'s (2014) tool scored level of urbanicity between 0 (very rural) and 61 (very urban).

Due to a lack of available and comparable data sources, however, study authors were unable to attribute a score for the proportion of households with a television or a mobile phone (4 points) in the communication services component of Novak et al.'s (2012) urbanicity scale, or for housing quality (5 points) in the diversity component of their scale.

With the exception of population size and density, each tool defined urbanicity components, including those similarly labelled, differently. Table A2 details these varying definitions. Of the 15 different tool items assessed by the four urbanicity measurement methods, only three considered data specific to the food environment (markets, traditional markets, and modern markets). Riha et al.'s (2014) tool did not account for any food-specific features of an urban environment.

All methods calculated level of urbanicity by using a combination of individual and area level data sourced from two or more of the following sources: the national census, municipal authority data, key informants, local electricity suppliers, participant surveys (individual and household), and community surveys.

Table 2.1. Characteristics of urbanicity scales used in identified studies

Scale name	Country				Type of validation in study context					No. of tool components	Tool components															Max. urbanicity score	Data sources					
	China	India	Philippines	Uganda	Face	Content	Construct	Criterion	Reliability		Population size	Population density	Communications	Transportation	Built environment	Healthcare services	Education	Market access/type	Traditional markets	Modern markets	Economic factors	Social services	Sanitation	Housing	Diversity		Census	Municipal authority	Key informants	Electricity supplier	Participant surveys	Community surveys
Adapted scale from Dahly & Adair, 2008 (Allender et al., 2010)										7																70						
Urbanicity scale (Dahly & Adair, 2008)										7																70						
Urbanicity scale (Jones-Smith & Popkin, 2010)										12																120						
Adapted scale from Novak et al., 2012 (Riha et al., 2014)										7																61						

2.4.3 Associations between urbanicity and dietary intake

The studies included in this review involved different dietary intake measurement methods and reported various outcomes measured by diverse urbanicity scores across four countries with different urban profiles. In total, 19 associations between composite urbanicity scores and various dietary patterns (52, 53), caloric and macronutrient intakes (46, 54-56), indicators of dietary diversity (57), indicators of diet quality (58-60), and fruit and vegetable consumption (61, 62) were investigated. A narrative review of these findings, grouped by study design type (cross-sectional and longitudinal), is presented in detail below and in Table 2.2 in summary form.

2.4.3.1 Cross-sectional studies

Five cross-sectional studies were included in this review. Two investigated the association between urbanicity measured by a 7-item scale and fruit and vegetable intake using dietary data collected from the STEPwise risk factor surveillance survey in India (average fruit and vegetable consumption in men and women aged 15-64) and Uganda (low intake, <5 portions of fruit or vegetables per day, in residents >13 years old) with mixed results. Whilst statistically significant positive associations were reported by both Allender et al. (2010) and Riha et al. (2014), the former study showed that average fruit and vegetable intake increased with urbanicity whilst the latter, measuring increases in low consumption, reported the opposite, which is in agreement with the Western diet hypothesis. Riha et al.'s (2014) study additionally demonstrates that even among rural communities, increasing urbanicity is associated with a higher prevalence of NCD risk factors.

Three studies investigated the association between urbanicity and the diet of older Chinese adults (>60 years old) using a 12-item urbanicity scale and data from 24-hour Dietary Recalls and household food inventory surveys. These studies investigated the associations between urbanicity and dietary imbalance, the Chinese Food Pagoda Score (CFPS), energy from carbohydrates (%), energy from fat (%), and energy from protein (%), and all provided evidence to support the Western diet hypothesis. Xu et al.'s (2015) three papers, using different samples from the same cohort study data, reported that people living in higher urbanicity areas had more diverse diets and consumed a greater amount of fat and protein than their more rural counterparts whose diets consisted of a greater portion of carbohydrates.

2.4.3.2 Longitudinal studies

Seven longitudinal studies were included in this review. Two of these studies used a 7-item urbanicity scale and sourced data from the Cebu Longitudinal Health and Nutrition Survey (CLHNS) conducted in metropolitan, small urban, mountainous, and coastal communities in the Philippines. The other five used a 12-item urbanicity scale and data from the China Health and Nutrition Survey (CHNS) conducted in nine provinces across four diverse regions in China. The two studies conducted in the Philippines measured urbanicity at various time points between 1983 and 2005 and the five studies conducted in China measured urbanicity at various time points between 1991 and 2011. Whilst urbanicity scores increased over time in both study settings (from 5 to 54 in the CLHNS study), it was not possible to quantify the amount of urbanisation that took place in China during this time period from the information available in study publications.

Batis et al. (2014) investigated the association between urbanicity and adherence to two different dietary patterns (traditional southern and modern high-wheat) in China between 1991 and 2009 in participants aged 18-65 years at seven time points. The traditional southern diet was characterised by high intakes of rice, fresh leafy vegetables, low-fat red meat, pork, offal, poultry and fish/seafood and low intakes of wheat flour and maize/coarse grains whereas the modern high-wheat diet was characterised by high intakes of wheat buns/breads, cakes/cookies/pastries, deep-fried wheat, nuts/seeds, starchy root/tuber products, fruits, eggs/egg products, soya milk, animal-based milk and instant noodles/frozen dumplings. The study's authors found that higher urbanicity levels were associated with both dietary patterns, although the modern high-wheat diet – composed of many more energy-dense foods – became more prominent in the population over time, with those in urban areas more likely to adhere to this dietary pattern. These results paint a mixed picture of the convergence toward a Western-style diet across urbanising China, with the availability of different food items (notably, rice versus wheat) in different regions being a key driver of food selection by Chinese adults.

With the aim of understanding dietary and staple food transitions in China, Chang et al. (2018) investigated the association between urbanicity and three metrics of dietary diversity – dietary diversity score (DDS), staple diversity score (SDS), and the proportion of coarse staple consumption (PoCS) – at five time points between 1997 and 2009. The positive associations reported for DDS and SDS and the negative associations reported for PoCS showed improving dietary diversity as environments urbanised. Study findings also showed a move away from coarse staples in highly urbanised communities. The authors refer to these results as “no surprise” given the greater availability and accessibility of diverse food

items in more urban study areas. Much like Batis et al. (2014), authors also pointed to the need to measure local food (for example, grain) production to help explain variations in the strength of associations reported across different geographical areas.

Huang, Wang & Tian (2017) investigated the association between urbanicity and the China diet quality index (DQI) score (a sum of the 10 DQI components, including diet variety, fruit and vegetables, protein, calcium, saturated fat, sodium, alcohol, energy, total carbohydrates, and total fat) in Chinese adults aged 20-59 years between 2004 and 2011. Negative DQI scores indicated undernutrition, positive scores indicated overnutrition, and a score of zero indicated a balanced diet. Although the majority of participants fell on the undernutrition spectrum, higher urbanicity was associated with higher DQI scores consisting of greater diet diversity and increased protein, saturated fat, sodium, and alcohol intake. These findings illustrate an association between urbanicity and a Western-style dietary pattern, which is viewed as a positive transition by study authors.

Wang et al. (2012) reported an association between increasing urbanicity and increasing snacking prevalence, where snacks were defined as 'all foods and drinks consumed outside the context of three main meals', among the Chinese population (>2 years old) between 1991 and 2009. Although steady increases in snacking were observed throughout the 18-year study period, the most significant changes in snacking occurred between 2004 and 2009. Notably, fruit (fresh and canned), grains, and beverages (milk and sugar-sweetened beverages) were the most popular snack items among adults, with children also snacking on more fast foods and animal products. These results indicate a move away from traditional meal structures and compositions and a progression toward a more Western-style diet over

time and increasing urbanisation, although study authors recommend future research investigate how modern food systems and food marketing environments can help explain this association.

Dahly and Adair (2007), Kelles and Adair (2009), and Jones-Smith and Popkin (2010) all studied the energy and macronutrient intakes of women, with Kelles and Adair (2009) also measuring the diets of their offspring. Dahly and Adair (2007) reported a positive association between urbanicity and total caloric intake in Filipino women between 1983 and 2002. Kelles and Adair (2009) also reported a positive association between urbanicity and the incidence of Filipino mothers and their offspring consuming more calories relative to their basal needs and a higher proportion of calories from fat. The same study, however, found a simultaneous negative association between urbanicity and the percent of calories consumed from carbohydrates. These findings are consistent with the nutrition transition and Western diet hypothesis. Jones-Smith and Popkin (2010), who studied adult women's diets in China between 1991 and 2004, also found a positive association between higher urbanicity and percentage of total energy from fat, but interestingly reported that these associations become smaller with larger changes in urbanicity.

Table 2.2. Summary of included studies

Short reference	Title	Country	Study years (data collection time points)	Sample size	Participant characteristics	Urbanicity levels reported (max score)	Dietary measurement methods	Dietary intake variable(s)	Statistical analysis method used	Association statistic reported	Significant (p<0.05)	Agrees with hypothesis*	Author(s) conclusions
Cross-sectional													
Allender et al., 2010	Level of urbanization and noncommunicable disease risk factors in Tamil Nadu, India	India	2003-2004 (1)	3705	Tamil Nadu residents aged 15-64yrs	14-68 (70)	STEPwise risk factor surveillance survey, self-reported fruit and vegetable intake	No. of servings of fruit and vegetables per day	Kruskal-Wallis one-way ANOVA	Positive association (statistic not specified)	Yes	No	Urbanicity is associated with the prevalence of several NCD risk factors in Tamil Nadu, India. Urbanicity is positively associated with smoking, BMI, blood pressure and physical activity.
Riha et al., 2014	Urbanicity and Lifestyle Risk Factors for Cardiometabolic Diseases in Rural Uganda: A Cross-Sectional Study	Uganda	2011 (1)	7340	Residents from 25 villages in rural communities >13yrs	8-32 (61)	Adapted STEPwise risk factor surveillance survey, self-reported intake	Low fruit and vegetable consumption	Poisson regression	1.17 (1.10, 1.23)	Yes	Yes	Even across rural communities, increasing urbanicity is associated with a higher prevalence of lifestyle risk factors for cardiometabolic diseases. This finding highlights the need to consider the health impact of urbanisation in rural areas.

Xu et al., 2015	Assessing Dietary Quality of Older Chinese People Using the Chinese Diet Balance Index (DBI)	China	2009 (1)	2745	>60yrs	Not specified (120)	3-day 24hr dietary recalls and household food inventory surveys	Diet Quality Distance (DQD), a measure of dietary imbalance	Multivariate linear regression	8.93 (8.02, 9.84)	Yes	Yes	The study suggests that unbalanced dietary consumption is a common problem among older Chinese people. Significant differences were found between DQD scores and the three levels of urbanicity ($p<0.001$), with people living in high urbanicity areas having lower scores than people living in low urbanicity areas. This is possibly due to the strong association between urbanicity and income levels.
Xu et al., 2015	Do older Chinese people's diets meet the Chinese Food Pagoda guidelines? Results from the China Health and Nutrition Survey 2009	China	2009 (1)	2745	>60yrs	Not specified (120)	3-day 24hr dietary recalls and household food inventory surveys	Chinese Food Pagoda Score (CFPS)	Univariate and multivariable linear regression	0.80 (0.67, 0.93)	Yes	Yes	Few older Chinese are meeting the intake of the various food groups based on recommendations. Different CFPS in the three urbanicity levels across four regions suggests that there are considerable variations in dietary habits. Preventing the increasing burden of NCDs requires a targeted approach that takes into account these differences.

Xu et al., 2015	Evaluation of older Chinese people's macronutrient intake status: Results from the China Health and Nutrition Survey.	China	2009 (1)	2746	>60yrs	Not specified (120)	3-day 24hr dietary recalls and household food inventory surveys	Energy from carbohydrates (%)	Multivariable linear regression (high urbanicity as reference rather than low)	8·07 (6·81, 9·33)	Yes	Yes	Few people were found to have carbohydrate, protein and fat intake levels that met recommendations. Most people had high fat intakes, particularly those living in high urbanicity areas. There were strong associations between macronutrient intakes and different urbanicity levels. Health interventions for older people should be adapted to regional contexts to maximise success.
								Energy from fat (%)		-3·30 (-4·49, -2·11)	Yes	Yes	
								Energy from protein (%)		-0·77 (-1·05, -0·48)	Yes	Yes	
Longitudinal													
Batis et al., 2014	Longitudinal Analysis of Dietary Patterns in Chinese Adults from 1991 to 2009	China	1991-2009 (7)	9253	Aged 18-65yrs	Not specified (120)	3-day 24hr dietary recalls and household food inventory surveys	Traditional southern diet	Multiple linear regression	0.43	Yes	No	Higher urbanicity levels were positively associated with both dietary patterns. The modern high-wheat diet has become more prominent in the population and those in urban areas are more likely to follow this pattern, which is cause of concern.
								Modern high-wheat diet		0.72	Yes	Yes	
Chang et al., 2018	Understanding dietary and staple food transitions in China from multiple scales	China	1997-2009 (5)	6093	From 9 provinces	Not specified (120)	3-day 24hr dietary recalls and household food	Dietary diversity score (DDS)	Multiple linear regression	0.073 (0.004)	Yes	Yes	Findings show improving dietary diversity in urban areas. This comes as no surprise as high urbanicity generally
								Staple diversity score (SDS)		0.066 (0.033)	No	Yes	

							inventory surveys	Proportion of coarse staple consumption (PoCS)		-0.013 (0.002)	Yes	Yes	means that a greater variety of food items are more available and accessible.
Dahly & Adair, 2007	Quantifying the urban environment: a scale measure of urbanicity outperforms the urban-rural dichotomy	Philippines	1983-2002 (5)	3327	Any woman giving birth between May 1 1983 to April 30 1984	5-39 (70)	24hr dietary recalls	Total caloric intake	Linear regression	9.8 (8.3 - 11.3)	Yes	Yes	The observed relationship between diet and the urbanicity scale is what we would predict: total calories consumed increase as the urbanicity score increases.
Huang, Wang & Tian, 2017	Changing Diet Quality in China during 2004–2011	China	2004-2011 (4)	13,833	Aged 20-59yrs	Not specified (120)	3-day 24hr dietary recalls and household food inventory surveys	China diet quality index (DQI)	Multivariate ordinary least squares regression	0.097 (0.071, 0.123)	Yes	Yes	Major determinants of dietary change in China are economic status and urbanisation. Therefore, Chinese residents' diet quality is estimated to improve as their income level rises and urbanisation progresses.
Jones-Smith & Popkin, 2010	Understanding Community Context and Adult Health Changes in China: Development of an Urbanicity Scale	China	1991-2004 (2)	1433	Adult women	Not specified (120)	3-day 24hr dietary recalls and household food inventory surveys	% calories from fat	Fixed-effects regression	0.27 (0.21, 0.32)	Yes	Yes	The urbanicity scale developed and validated for CHNS captures enormous changes in context across time and place. Change in community urbanicity is associated with increases in fat in the diet but this effect diminishes with the largest changes in urbanicity.

Kelles & Adair, 2009	Offspring consume a more obesogenic diet than mothers in response to changing socioeconomic status and urbanization in Cebu, Philippines	Philippines	1994-2005 (4)	1884	Filipino mothers and their offspring aged 8-55yrs	22-54 (70)	24hr dietary recalls	Estimated Energy Adequacy	Longitudinal random-effects regression models	0.006 (0.004, 0.008)	Yes	Yes	With increasing urbanisation, mothers and offspring were consistently more likely to consume more calories relative to basal needs as well as a higher percent of calories from fat and a lower percent from carbohydrates. This is consistent with dietary changes observed in settings experiencing rapid modernisation.
								% dietary calories from fat		0.08 (0.05, 0.12)	Yes	Yes	
								% dietary calories from carbohydrates		-0.09 (-0.12, -0.05)	Yes	Yes	
Wang et al., 2012	Trends in Chinese Snacking Behaviors and Patterns and the Social-Demographic Role between 1991 and 2009	China	1991-2009 (4)	10,526-12,504	>2yrs	43.9-64.1, median range (120)	3-day 24hr dietary recalls and household food inventory surveys	Snacking prevalence	Linear regression	0.02	Yes	Yes	The Chinese population is experiencing a dramatic increase in snacking, a marked transition away from a tradition of two or three main meals per day. Although urbanicity is positively associated with snacking prevalence, further research is needed to understand how marketing and food system changes have led to such dramatic changes in eating behaviour.

** Does the reported association agree with the hypothesis that increases in urbanicity level lead to increases in adherence to a more Western-style diet?*

2.4.4 Quality of included studies

The 12 included studies were assessed for risk of bias and quality using the National Institutes of Health's (NIH) 14-question Quality Assessment Tool for Cohort and Cross-Sectional Studies. All studies were found to be of a similar quality, ranging from fair to good. All studies, however, also had specific limitations. For example, none of the studies provided a detailed sample size justification and power calculation, and cross-sectional studies could not, by definition, satisfy the criteria of measuring the exposure of interest before outcome(s) or measuring the exposure more than once over time. As discussed above, urbanicity measurement methods also varied in their validity and reliability. A detailed summary of the risk of bias assessment, which should be considered within the context of review objectives, is provided in Table A3.

2.5 Discussion

2.5.1 Summary of key findings

This systematic review of the literature included 12 studies conducted in China, India, the Philippines, and Uganda that investigated associations between urbanicity and 19 measures of dietary intake (various dietary patterns, caloric and macronutrient intakes, indicators of dietary diversity, indicators of diet quality, and fruit and vegetable consumption). Seventeen of these associations were in a direction consistent with the hypothesis that urbanisation leads to more Western-style diets, 16 of which were statistically significant ($p < 0.05$), and 11 of which demonstrated a temporal association.

All 12 studies used one of four multicomponent urbanicity measurement methods that included a total of 15 different components (quantifiable features of urban environments), of which two methods were adaptations of previously existing tools. Urbanicity was measured on a scale of 0 to 61 in the Ugandan context, 0 to 70 in India and the Philippines, and 0 to 120 in China. The scales developed for China and the Philippines were comprehensively validated in their respective study contexts whereas those used in Tamil Nadu, India and across rural Uganda were adapted from existing tools and only face validated in their respective study contexts. The papers included in this review were published between 2007 and 2018, indicating the relatively recent application of urbanicity scales to dietary research.

Whilst the majority of studies did provide evidence to support the nutrition transition hypothesis, important contextual nuances that might help explain this evidence were not captured explicitly by urbanicity scales. As reported by the authors of included studies, these contextual nuances might include food marketing, social norms, and the presence of dominant local food industries (52, 53, 57, 60).

2.5.2 Strengths and limitations of this review in relation to other studies

This systematic review is the first to focus exclusively on the associations between urbanicity and dietary intake. The strengths of the approach taken include the systematic nature of the review and the lack of restrictions placed on study publication language, date, and context. The reliance on English search terms and published literature may have limited representation of global research.

The number of studies returned by the initial search (n = 520), might appear low, but is consistent with comparable reviews (45, 63). While the stringent study inclusion criteria produced a focussed review, it also limited the number of studies included (n = 12). This review did not consider studies that did not report a measure of association. To expand on findings, a less systematic approach could be employed whereby measures of association are calculated manually in cases where enough data are available to do so. An exclusive focus on dietary intake also meant that studies that considered the association between urbanicity and other diet-related NCD risk factors were not included. For example, a cross-sectional study conducted by Allender et al. (2011) that investigated the relationship between urbanisation (measured on a scale from 0 to 70) and the prevalence of high body mass index, diabetes mellitus, and high blood pressure in Sri Lanka provides evidence to support the urbanisation-Western dietary pattern hypothesis (30). This particular omission also reveals that this review did not uncover the full suite of urbanicity scales available for use – a result of exclusively focussing on the application of these tools in dietary research. It is also indicative of how many of the studies that investigate the relationship between urbanisation and NCD risk factors focus on physiological rather than diet-related behavioural risks, which are less informative for developing primary prevention policies and interventions (64-67). Whilst this review may have omitted certain urbanicity scales used outside of a dietary research context, it did uncover two scales – those developed by Novak et al. (2012) and adapted by Riha et al. (2014) – not considered in a previous review conducted in April 2012 that catalogued the different urbanicity scales that have been used in health research (63). This finding suggests that urbanicity and health research is expanding to new contexts and that maintaining an up-to-date repository of tools could support further best practice research.

The heterogeneity in exposure and outcome variables reported made it difficult to compare study findings directly. Interpreting findings in the context of the nutrition transition hypothesis helped, in part, to overcome this (16). The urbanicity scales used in included studies, as well as the way in which associations were calculated using aggregate scores only, meant that this review could not comment on how specific elements of urbanisation influence various dietary patterns and risks factors. A recent study of the association between urbanicity and physical activity conducted in Mexico City and Oaxaca demonstrates nicely the value of analysing urbanicity-NCD risk factor associations for both composite and urbanicity sub-scores (68). For example, study authors were able to conclude that the presence of household electronic media (measured by the communications component of their urbanicity tool) was negatively associated with active commuting and physical activity for leisure. This is an approach that is especially important to overcome the situation where different urban environments that may score highly on opposite tool components but produce the same or similar overall score are incorrectly considered to be alike and treated as such when developing and implementing interventions.

2.5.3 Avenues for further research

This review highlights the need for additional research on the associations between urbanicity and diet across a wider range of contexts. Specifically, research is required on the associations between diet and urbanicity sub-scores to provide further insight on which features of urban environments should be targeted for intervention, especially given that associations between sub-scores and diet quality are likely to be context-specific. Whilst cross-sectional studies are useful for establishing a baseline, and it is implausible to

randomise areas to receive urbanisation, longitudinal cohort studies are required to confirm the association between changing urbanicity and diet over time (45). As demonstrated by Batis et al. (2014) and Jones-Smith and Popkin (2010), some dietary patterns shift slowly and steadily, while others change rapidly over time before reaching a certain point where observed associations diminish.

This review also indicates that multicomponent urbanicity tools may require modification and improvement if they are to be used widely in NCD research. While it might not be possible to develop one single tool that is appropriate for universal use, it is important to ensure that tools measure at least a core set of informative components that are defined similarly and allow for comparison across contexts. Novak et al. (2014) have already demonstrated that it is possible to develop and validate a multi-country scale in at least three geographically, culturally, and economically diverse settings. The case of Riha et al.'s (2014) tool adaptation, however, is a reminder that multi-country scales must not only consider the applicability of scales across contexts, but also the availability of comparable data sources (62). To overcome simultaneously context-specific implementation barriers whilst also encouraging context-specific data exploration, urbanicity scales could adopt a similar model to that employed by the WHO STEPwise surveillance approach to data collection whereby core/recommended and expanded/optional versions of the tool are available (69). Core/recommended surveys would include urbanicity features most consistent across diverse contexts and for which data are readily available. Expanded versions might include additional food-related features of urban environments, such as those suggested by Batis et al. (2014), Chang et al. (2018), Jones-Smith and Popkin (2010), and Wang et al. (2012): presence of local food industry, food marketing, and diet-related

social norms. The availability of data to score such features would likely differ across contexts and so adding these characteristics to an optional tool component would allow researchers to explore factors that might help explain and intervene with context-specific urbanicity-diet associations whilst ensuring that scale comparability is not compromised.

To support passive and cost-effective surveillance activities, future iterations of multicomponent urbanicity measurement methods might also consider taking advantage of emerging technologies, increasing computing capabilities, and non-traditional data sources. For example, mobile phone data have been used to estimate population density and population mobility patterns in Estonia and the Netherlands (70, 71). Spatial mapping software, which is fast becoming more user-friendly and affordable, is also being used by the new Degree of Urbanisation method endorsed by the UN Statistical Commission to facilitate international statistical comparisons based on the population size and density of areas (72).

2.6 Conclusion

Whilst the findings from this chapter provide evidence to support the nutrition transition hypothesis, the urbanicity scales used in included studies and the way in which scores were calculated mean that this review cannot comment on how specific elements of urbanisation influence various dietary patterns and risks factors. This review also highlights that the current methods used to measure urbanicity are not directly comparable across contexts.

In the context of this thesis, the findings from this review were intended to inform the development of a contextually-appropriate multicomponent urbanicity measurement method to assess the associations between dietary intake and urbanicity over time in Sri Lanka. Although a tool appropriate for Sri Lanka was not identified, section 2.5.3 above outlines some important considerations for future tool development. Due to the premature termination of the SLNCDS discussed in Chapter 1, review findings and learnings were not used for this purpose, and this thesis accordingly took a different direction. To further support future context-specific nutrition, NCD, and urbanisation research in Sri Lanka, the next chapter explores the factors that act as facilitators of and barriers to evidence generation, communication, and uptake in public health policymaking in Sri Lanka, with a focus on these three areas.

Chapter 3. Barriers to and facilitators of evidence generation, communication, and uptake in public health policymaking in Sri Lanka, with a focus on noncommunicable diseases, nutrition, and urban health

3.1 Chapter summary

This chapter addresses thesis objective 2: to investigate the factors that act as facilitators of and barriers to evidence-based NCD, nutrition, and urban health policymaking in Sri Lanka. Semi-structured interviews with 11 researchers, 11 policymakers, and one research funder were thematically analysed to achieve this objective. The chapter's findings confirm that many of the barriers and facilitators identified in the literature from English-speaking high-income countries also apply to the Sri Lankan context. At the same time, they also show that important contextual differences and nuances exist. The inclusion of both researchers and policymakers is a particular strength of this study. The findings from this study can inform future approaches to enhancing evidence-based policymaking in line with the aspirations of researchers and commitments set out by the Sri Lankan government, and suggest potential avenues for further investigation, including the studies conducted in Chapters 4, 5, and 6 of this thesis.

3.2 Introduction

3.2.1 Evidence-based health policymaking

In 2004, the World Health Organization's World Report on Knowledge for Better Health proclaimed that *"the future should ideally be one where research and evidence inform decisions made by policymakers"* (73). In 2005, the fifty-eighth World Health Assembly took an important step toward realising this vision by passing a resolution acknowledging the Mexico Statement on Health Research, which urged Member States *"to establish mechanisms to transfer knowledge in support of evidence-based public health...and evidence-based health-related policies"* (74). In 2008, 53 countries, including Sri Lanka, pledged to continue building on this commitment in the Bamako Call to Action on Research for Health, and again, in 2020, the World Health Report emphasised the ongoing need to uphold these commitments *"to supply decision makers with information to develop appropriate policies, allocate resources, and prioritise interventions"* (1, 75). It is therefore clear that evidence-based policymaking (EBPM) has been and continues to be a key strategy advocated by the global health community for achieving greater and more equitable health outcomes.

3.2.2 Issues surrounding the transferability of EBPM learnings from other contexts

The pervasive research-policy gap is considered a problem, and one which many policymakers and researchers have responded to by simply commissioning or producing more research evidence with policy-relevant outcomes (73, 76, 77). However, although the general concept of EBPM appears to be quite simple, we know from global experience that the processes through which individuals and groups exchange and utilise evidence are anything but straightforward (76, 78-80). Building and supporting EBPM mechanisms is

challenging and therefore requires an understanding of the complex realities of evidence production, flow, and uptake as experienced by both researchers and policymakers (81).

Updating a systematic review of the barriers and facilitators of evidence use in policymaking, Oliver et al. (2014) concluded that not much had changed in the intervening decade between reviews. More recent research, however, has highlighted the importance of contextual factors in determining the success of EBPM (76, 82, 83). Specifically, low- and middle-income settings may introduce new and different challenges – such as limited capacity and resources – that could render EBPM approaches directly imported from other contexts inappropriate and ineffective (84). What works in one policy context may, therefore, not work in another. The same is true for different areas of health (42). EBPM approaches for vaccine-preventable diseases might face new challenges when directly applied to the areas of NCDs or suboptimal nutrition, owing to the unique features of these problems, such as their complex social and commercial determinants (82, 85).

Understanding contextual barriers and facilitators to EBPM must therefore extend beyond country-specific considerations to also include health topic-specific considerations. Once known, these barriers can be appropriately addressed, and facilitators utilised to adapt existing global tools and interventions or create tailor-made ones (86).

3.2.3 Evidence-based health policymaking in Sri Lanka

In Sri Lanka, both researchers and policymakers have demonstrated commitment to supporting a more rigorous and systematic approach to health decision-making. In the National Multisectoral Action Plan for the Prevention and Control of Noncommunicable Diseases 2016-2020, for example, the achievement of desired outcome 4.3.1 – ‘Evidence

generated and used for national policy and programme development’ – relies on the achievement of six proposed actions for which two Ministry of Health units, academia, and the Post Graduate Institute of Medicine are assigned responsibility (32). Unfortunately, although the National Multisectoral Action Plan itself was described as being developed *“through a consultative process which ensured contributions of academia, professional colleges and officials of the Ministry of Health and other relevant Ministries”*, details of how and to what extent this EBPM process was successful are absent from this and other national NCD and nutrition policy documents. There is therefore little country-level insight into how to develop evidence-based policy. The actions proposed for increasing evidence-based decision-making in all of these documents, for example proposed action 4.3.1.d: Capacity building of officers on research, also highlight some of the current gaps in evidence generation and uptake opportunities, as well as capacity building initiatives (32, 87, 88). This lack of guidance and opportunities is reflected in how researchers approach engagement with the EBPM process. By way of example, the Sri Lankan Noncommunicable Disease Survey (SLNCDS) research protocol describes research outcomes that are *“very important for policy decisions”* and that the study team therefore hopes will influence policy change through the simple act of making their *“high-quality data”* available to relevant stakeholders.

To date, there is no national urban health policy in Sri Lanka, but precedent set in the policy documents mentioned above strongly indicates that researchers and policymakers would aspire to an evidence-based approach to urban health policymaking. The collection and analysis of empirical data on the barriers to and facilitators of EBPM would aid the appropriate and effective development and implementation of such approaches.

3.2.4 Chapter objective

The objective of this chapter is to investigate the barriers to and facilitators of evidence-based NCD, nutrition, and urban health policymaking in Sri Lanka using semi-structured interviews conducted with researchers, policymakers, and one research funder.

3.2.5 Key definitions

The terms evidence-based and evidence-informed are often used interchangeably. Although some people prefer to use the latter because they believe it to be a more accurate description of the role that evidence plays in the policymaking process (89), I have chosen to use the term evidence-based in this thesis. This decision was not rooted in any ideological judgment about the meaning and appropriate uses of these terms on my part; it was chosen because it is the term that was most familiar to study participants.

The literature is replete with assertions that EBPM is an ill-defined term made up of two distinct and equally ill-defined terms with no single, universal definitions: evidence and policy (90, 91). This chapter does not take any particular position with respect to these arguments but was sensitive to them by way of asking participants to define what evidence and EBPM mean to them, rather than imposing an outsider's interpretation. These definitions are discussed in the results section below.

3.3 Methods

3.3.1 Study design

This qualitative study involved one-to-one semi-structured interviews that were conducted in person from September to October 2018 and via Skype from November 2018 to March 2019. Detailed field notes documenting contextual information and researcher reflections were also used to aid and validate the interpretation of interview data.

Given the nature of this exploratory study that seeks to understand the views and experiences of people involved in the public health policy process in Sri Lanka, qualitative research methods were appropriate (92). Of the various qualitative research techniques available (for example, focus groups, participant observation, and open-ended questionnaires), semi-structured interviews were selected as the most desirable data collection method. This type of interview offers an appropriate and effective forum for deep exploration of underexplored and potentially sensitive topics, and additionally facilitates spontaneous and candid responses, topic guide flexibility and tailoring, directed probing, and follow-up questioning (93-96). Although the research topic under investigation in this chapter – evidence-based policymaking – is not what might be considered a typical sensitive subject in qualitative research, it does explore potentially delicate issues such as frustrations with superiors, colleagues, and systems that might otherwise not be vocalised for fear of professional or personal ramifications. For this reason, more public data collection methods such as focus groups would not have fostered similar candour, nor would they have guaranteed participant anonymity. Similarly, more structured methods or those that rely on written accounts (for example, surveys) may have imposed additional communication barriers for participants who spoke English as a second or third language.

Semi-structured interviews, however, are not without their limitations: namely, limited reliability and reproducibility of findings, and the potential impact of researcher bias and positionality on data production and interpretation (94, 95, 97). In most cases, however, participants shared what seemed like honest, thoughtful responses and a combination of member checking (discussed below) and detailed field notes were used to aid researcher objectivity.

3.3.2 Participant identification and recruitment strategy

The community of ‘expert’ or ‘influential’ NCD, nutrition, and urban health actors in Sri Lanka is relatively small, well-connected, and therefore somewhat defined. Acknowledging, however, both the lack of formal boundaries demarcating key actors and the multidisciplinary nature of these topics as well as my position as an outsider, it was prudent to employ a combination of purposive and snowball sampling so as to avoid overlooking more indirect or discrete influential actors (for example, researchers outside of the academy) (98, 99).

For this study, key local informants, the National Multisectoral Action Plan for the Prevention and Control of Noncommunicable Diseases 2016-2020 (32), and an organogram of the Ministry of Health, Nutrition and Indigenous Medicine (MoH) were consulted to generate a list of potential interviewees. Purposively selected interviewees were also asked to name individuals (researchers, policymakers, other) who they believed to be influential and/or knowledgeable and/or have experience in the NCD, nutrition, and urban health (EB)PM process in Sri Lanka. All potential respondents were either sent an

email invitation to participate in the study or telephoned by local informants. The email invitation included a participant information sheet describing the study and a copy of the consent form (Appendix IV). In the case of non-response, a maximum of two follow-up attempts were made.

3.3.3 Study participants

Of the 27 individuals approached for interview, 23 agreed to participate, of whom 20 provided informed consent for interviews to be recorded and their anonymised quotations used in academic publications. Eleven of these participants were researchers (including academics and researchers working outside of the academy), with the majority having expertise in NCDs (91%) and nutrition (82%), and only three (13%) in urban health. The eleven policymakers (including policy advisors, politicians, and government employees) that participated also reported a similar skew toward expertise or experience in NCDs (73%) and nutrition (55%) as opposed to urban health (18%). Of the potential participants approached from the 'other' category, which included members of national funding agencies and civil society organisations, only one (research funder), engaged in the areas of nutrition and NCDs, agreed to participate. Reasons provided for non-participation included: competing work/travel commitments; permission for participation not granted by relevant superior; and offense caused by not being included from the study outset. Anonymised characteristics of the interview sample are set out in Table 3.1 below.

Table 3.1. Characteristics of interview sample

Groups	No. of participants	No. of participants by area of expertise/influence (self-defined)*			How identified	
		NCDs	Nutrition	Urban health	Purposive	Snowballing
Researchers	11	10	9	3	8	3
Policymakers	11	8	6	2	9	2
Other	1	1	1	0	0	1

**Participants were able to select more than one area*

Enabled by the purposive-and-snowballing recruitment strategy used in this study, data saturation was monitored throughout the data collection process and used to determine the sample size (100, 101). Data saturation was assessed at the level of the dataset as a whole and was viewed as a continuum rather than a definitive event. Although saturation was reached before interview number 22, interviews 22 and 23 were nonetheless conducted because they had been previously re-scheduled on account of last-minute changes to interviewee availability. Of course, there always remains the possibility of new data emerging from continuing data collection, but there also comes a point at which a theory/narrative can be confidently and coherently constructed and further interviewing delivers diminishing returns (102, 103). Whilst acknowledging the problematic nature of using the term ‘saturation’ when referring to people’s diverse experiences (104) and the existence of alternative approaches to evaluating sample sizes in qualitative research, such as ‘information power’ (105), the more traditional method seemed appropriate for the type of research enquiry and less reliant on researcher experience and intuition.

3.3.4 Interviews

Interviews were scheduled at a time that was convenient for participants and conducted in a location (most often their place of work in Colombo) or via the virtual platform (most often Skype) of their choice. All interviews were conducted in English and ranged between 30 minutes to 1.5 hours in duration. Interview duration was primarily determined by participant availability and their level of engagement with the interview questions. Where consent was obtained to do so, both in-person and virtual interviews were audio recorded.

The flexible topic guide, which was peer reviewed and piloted with two participants to check relevance across different sectors (academia and policy), covered:

- Participant role and experience
- Department's/research group's goals and priorities
- Perceived value and role of evidence in policymaking
- Evidence gaps and/or requirements
- Participant experience with evidence-based policymaking, with a specific focus on the barriers and facilitators encountered
- Additional information and issues not covered by the topic guide

Definitions of 'evidence' were not prescribed, and participants were invited both to interpret this term as they saw fit and provide clarification for its use.

Whilst allowing for flexibility and participant-led discussion, each interview followed a similar format that included five stages:

1. Introductions and study explanation to remind participants of interview parameters.

2. Questions with a factual focus (for example, “how long have you been in this role?”) to help ease participants into the interview.
3. In-depth exploration of topic guide subjects through open-ended questions and use of probing techniques (for example, “That is interesting, could you tell me more about...”).
4. Invitation to participants to speak to any topics or issues they felt were relevant to the study that were otherwise not queried or covered in the interview (for example, “Is there anything else you would like to tell me that I have not asked you about?”).
5. Formal end of interview followed by informal conversation and expression of gratitude.

Member checking, also known as participant validation, was incorporated into each interview as a means of confirming accurate comprehension of participants’ accounts and enhancing the study’s internal validity (106). Where appropriate, participant responses were summarised and repeated, and where necessary, participants corrected the interpretation of their accounts and/or offered additional supporting information. This rigour-enhancing technique was especially useful when interviewing multilingual participants in sometimes noisy surrounds that were either distracting in the moment or interfered with the audio recording quality.

Prior to interview commencement, all participants were provided with an opportunity to review and discuss the study information sheet and consent form (Appendix IV), reminded of their right to withdraw from the study at any time, and required to give express, informed consent to participate in the study and have their quotations used anonymously in

academic publications. Participant anonymity was guaranteed to protect their reputations and encourage candid disclosure.

3.3.5 Ethical approval

Ethics approval for this study was received from the Faculty of Medicine Ethics Review Committee, University of Colombo (Ref: EC-18-082) and the Oxford Tropical Research Ethics Committee (OxTREC), University of Oxford (Ref: 529-18). Participants were not incentivised or compensated for their participation.

3.3.6 Data analysis

Interview transcripts were coded on the basis of salient issues and themes arising from the text. Informed by Attride-Stirling's thematic analysis methodology, codes were classified and consolidated into three classes of themes – basic, organising, and global – differentiated by the level of interpretation required for identification (107).

Basic themes: *The most self-evident themes that emerge from the textual data. Basic themes require the lowest order of researcher interpretation and are best understood in the context of other basic themes.*

Organising themes: *These themes fulfil a dual function as both an aggregate of similar basic themes and a breakdown of the global theme(s). Organising themes help build a case for the super-ordinate claim(s).*

Global theme(s): *The global theme(s) is the most abstracted from the text. It is both a summarisation and grand interpretation of lower order themes.*

Before coding each transcript, I familiarised myself with the data by listening to the audio recording, transcribing the interview, and reading the transcript. I then noted down all basic themes in NVivo and repeated this process for the next interview transcript. At the mid-point to completion, codes were aggregated into organising themes and discussed and refined with NT. Once all transcripts had been coded, I reviewed and refined the codes relevant to the research question before consolidating the organising and global themes. These thematic groupings were again discussed and revised with supervisors (NT, MR, and PS), before illustrating the findings as non-hierarchical thematic network maps (Figure 3.1).

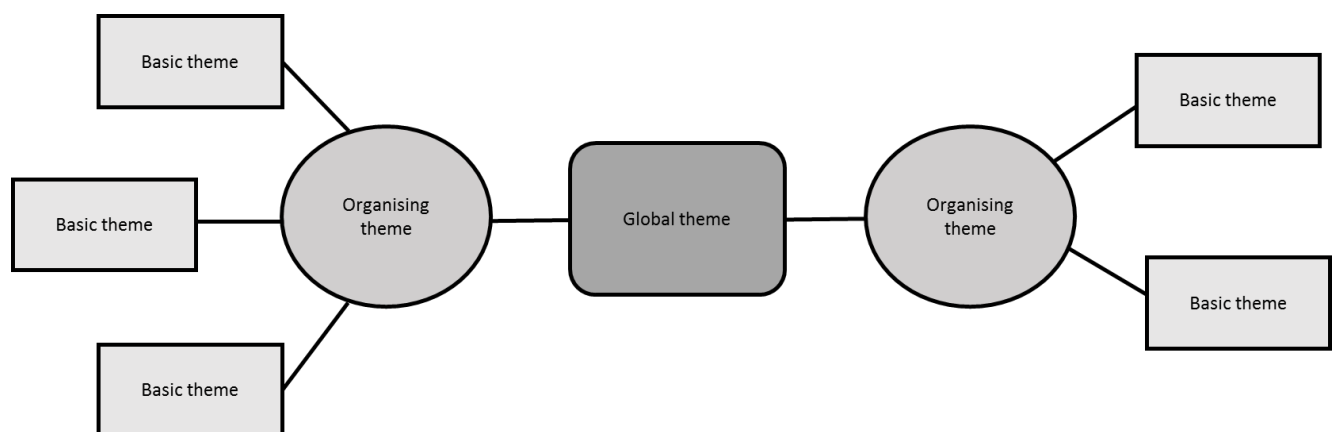


Figure 3.1. Thematic network structure from Attride-Stirling (2001)

3.4 Results

3.4.1 Introduction to results

Evidence-based policymaking means different things to different people. In this study, participants described EBPM as using *“research evidence as the basis for any kind of decision-making”* (Participant 9) to help *“make informed decisions”* (Participant 15) that ultimately *“the public will get some sort of advantage from”* (Participant 17). Participants

further defined research evidence as consisting of systematic reviews, research evidence based on primary data analysis, and research evidence from local data. A few participants also believed that the 'E' in EBPM could and should at times represent 'expert opinion'. For most, EBPM, was *"more of an aspiration"* (Participant 13) that they were actively working toward rather than an accurate description of the policymaking process. EBPM was seen as particularly important in the health sector and for issues such as NCDs and nutrition: *"Sri Lanka is transforming from infective diseases to non-communicable disease epidemic conditions"* (Participant 9) leading to *"NCDs having the biggest burden of disease...especially in the urban areas"* (Participant 13) with *"some of [these] issues [being] really unique to Sri Lanka"* (Participant 17) so *"to address [these]...we need evidence that says what we have to do"* (Participant 15).

The opportunity to speak with both researchers and policymakers working across NCDs, nutrition, and urban health produced an intricate picture of the various, and occasionally contradictory, barriers and facilitators to EBPM experienced by both groups. Whilst very few policymakers believed that a well-functioning EBPM pipeline relies exclusively on researchers *"coming and discussing [their findings] with us"* (Participant 5) and almost all researchers thought the exact opposite – that the policy community should make more of an effort to actively engage with the evidence and the evidence generation community – there was a surprising amount of overlap between the various barriers and facilitators discussed by participants. Many of the communication and uptake barriers and facilitators were born out of research and policy environments that were characterised by a formalised informality: that is, relationships and rules not visible to the eye of an outsider. As a result, not all participants experienced barriers and facilitators to the same degree, with one's

seniority or connectedness being a key determinant of whether the lack of formal structures and systems that could be utilised to support (or hinder) EBPM worked in their favour.

All barriers and facilitators rather neatly mapped onto three core elements of EBPM: the availability of evidence, the appropriate and timely communication of evidence, and the uptake of evidence. The results section below therefore focusses on three global themes: the barriers to and facilitators of 1) evidence generation; 2) evidence communication; and 3) evidence uptake that were perceived or encountered by participants.

3.4.2 Presentation of results

Results of the semi-structured interviews are presented by global themes: 1) Barriers to and facilitators of evidence generation; 2) Barriers to and facilitators of evidence communication; and 3) Barriers to and facilitators of evidence uptake. Each section includes a summary discussion of key findings, a diagrammatic overview (thematic network) of findings, and a discussion of the associated organising and basic themes supported by representative interview quotations. Each quotation is ascribed to a participant in the following format – (*Participant number*) – to protect their anonymity. At times, however, single words or short quotations (two to three words) from transcripts are used that are not ascribed to a single participant. The purpose of using these short phrases, that were commonly used by multiple participants, is to use their rather than my wording as much as possible when reporting and interpreting findings.

3.4.3 Barriers to and facilitators of evidence generation

“Well, the first thing is that the research evidence needs to be available” (Participant 15).

Many participants, especially researchers, spoke to the barriers to and facilitators of a wholly necessary but not entirely sufficient element of EBPM: evidence generation (Figure 3.2). Participants spoke to six key facilitators that they felt should be further scaled and four key barriers that they felt limited the quality and quantity of locally relevant evidence production. These facilitators, followed by the barriers, are presented below.

3.4.3.1 Facilitators of evidence generation

The six key facilitators of evidence generation discussed by participants were: 1) Available and accessible data and literature; 2) Research requirements; 3) Training and capacity building opportunities; 4) Individuals motivated to do research; 5) Research collaborations; and 6) Funding for locally important research.

Available and accessible data and literature

Good data availability and accessibility were viewed as key facilitators of evidence generation. The *“pretty good health information and disease surveillance system”* in Sri Lanka which *“is stronger for communicable diseases and vaccination programmes”* (Participant 13) but also in place for NCDs, such as community-based cancer screening and surveillance, meant that some up-to-date and nationally representative epidemiological data were available for all to access for their *“analysis, predictions, resource planning, etc.”* (Participant 19). In the absence of local data or literature, researchers found *“comparable”* regional data and information to be useful for planning and justifying local projects. Interestingly, it was seen as more appropriate to do this for something like NCDs where *“all*

[across the region] are struggling [equally]” (Participant 8) than, for example, for Maternal and Child Health issues where Sri Lanka is seen as a *“regional success story” (Participant 14)* and is therefore in a noncomparable situation to neighbouring countries. Many Sri Lankan NCD and nutrition researchers also conducted their prevalence studies in and compared outcomes between urban and less urban areas (such as rural sectors, estate sectors, and suburban areas). The publication of these data in accessible reports and academic journals contributed to developing a body of literature on local urban-rural health disparities that set the foundation for further inquiry. One researcher pointed to a colleague’s studies on this topic as directly influential in the development of their community intervention research project whilst another credited this work for highlighting an area that requires more research attention and resulted in their team adding *“a whole urban component” (Participant 17)* to their food security survey.

Research requirements

Much of the public health research conducted in universities was done for degree fulfilment by Community Medicine¹ (MD and MSc) students in the form of assessed theses. In order to gain board certification as a specialist in Community Medicine, these students are then required to complete an additional year or two of overseas training attached to an international research institute, and to publish a first author peer-reviewed journal publication or present multiple oral research presentations. This research-heavy certification system along with other postgraduate research activities at universities was seen as a great stimulator of novel and important research: *“So my students, when they do*

¹ Community Medicine is a term that is used interchangeably with public health in Sri Lanka.

research, we always make sure when we approve the proposal, it's something novel...[they] do very interesting studies" (Participant 7).

International data collection and benchmarking initiatives, such as the STEPS (STEPwise approach to surveillance) survey and The Global School-Based Student Health Survey (GSHS), indicate where research attention should be focussed as well as how and how often globally comparable NCD and risk factor surveillance data should be collected. These initiatives were hugely influential in the Sri Lankan context; many of the researchers in this study were either involved in the STEPS survey effort or used the findings as the basis for programme development or further research. For some, all of their NCD and nutrition research efforts were almost exclusively guided by these *"globally accepted"* international initiatives that they not only felt were essential to quantifying the problems but that were important because they connected with a wider NCD community that *"we are also a part of"* (Participant 20).

Finally, funders' increasing focus on policy-relevant research outcomes and recommendations meant that researchers had to submit proposals with *"real world implications...relevant to national importance"* (Participant 11) to be eligible for competitive national funding (for example, National Science Foundation funding). No one indicated that this requirement changed the amount of research produced, but that it did influence the type of research that was proposed.

Training and capacity building opportunities

Research training and capacity building opportunities had a two-fold positive impact on evidence production by: 1) providing more personnel with the basic research skills necessary to conduct data collection and analysis (for example, research workshops for Ministry of Health Staff and epidemiological and statistical training for Community Medicine students); and 2) expanding students' and researchers' awareness of different public health topics and methodologies (for example, urban health and nutrient profiling) through compulsory overseas training, the inclusion of public health topics on the medical students' MSc curriculum, and various professional short courses. Although participants were keen to point out these opportunities, most indicated that more needed to be done to expand these opportunities both in terms of participant numbers and the content covered.

Individuals motivated to do research

For many individuals conducting research in Sri Lanka, research is not their primary priority or income generating activity *"so only the people that are really keen will do [it]" (Participant 6)*. For non-clinical academics, research often takes place alongside teaching responsibilities and for clinician-researchers, research is juggled around their clinical responsibilities. It therefore follows that a rather important facilitator of research evidence production in this context was one's individual motivation to conduct research, whether that be based on a *"passion for research"* (Participant 1) or the promise of academic accolades and promotions: *"We don't get any money, but probably I think one [of the personal motivations] is for the promotion"* (Participant 2). Passion for research was conveyed as being driven by one's inquisitive nature or a strong belief in and personal

commitment to the importance of evidence-based medicine, practice, and policy and its ability to create positive, meaningful change.

Research collaborations

Some researchers were part of local or international research collaborations that they felt greatly facilitated the production of high quality and representative evidence. Local collaborations between principal investigators (PIs) at different universities and medical facilities across the country, although rare, meant that study populations under investigation were larger and more diverse and that the data analysis burden, which no facility alone had the capacity for, could be shared. Collaborations with international universities, often at the individual (PI or graduate student) or research group level, were regarded as useful for upskilling, generating research publications, and establishing knowledge-exchange relationships with experts in the field, and the possibility of securing *“a lot of research funding” (Participant 6)*. Collaborations with international health and development agencies, at the university or institution-level, usually led to the production of funded, large-scale, and policy-relevant research.

Funding for locally important research

From the larger funding pots available from overseas universities and international health and development agencies that were particularly interested in certain NCDs and nutrition issues to the much *“small[er]...but encouraging” (Participant 19)* Ministry of Health research allowances intended to encourage research activity outside of the academy, most researchers agreed that funding, in varying forms and amounts, was available and ranged from relatively easy to obtain to highly competitive. Importantly, most researchers also felt

that, for the most part, international funders (and funder-collaborators) supported and respected their local research agendas, which facilitated the generation of locally important research evidence. Some attributed this to the strong representation of Sri Lankan community physicians now working in international organisations such as the WHO, UNICEF, and the World Bank *“who are well aware of local programmes and how things are”* (Participant 6). When asked about how one might find out about funding opportunities, the response was occasionally *“quite casually”* or *“informally”*, meaning that well-known, well-connected, or senior researchers were more likely to be informed about and obtain funding. As a by-product of obtaining funding, some researchers described the *“regular meetings, Skype discussions, and email discussions [with funders]...and reports [required by funders]”* (Participant 9) as helpful to ensure that problems were solved quickly, and research deadlines were met.

3.4.3.2 Barriers to evidence generation

The four key barriers to evidence generation: 1) Data collection, availability, and accessibility issues; 2) Not enough local research capacity; 3) Funding issues; and 4) Research is conducted in silos are discussed below. Many of these barriers highlight the limitations to or inequities in some of the facilitators discussed above.

Data collection, availability, and accessibility issues

Whilst all researchers felt that available and accessible context-specific research tools and data were key facilitators to the generation of high-quality, context-specific, mixed-methods, and innovative research, the reality of conducting NCD, nutrition, and urban

health research often posed myriad data collection, availability, and accessibility issues.

Data collection issues more generally experienced included:

1. Field research can be unpredictable and requires a high level of flexibility that may not be afforded by inflexible research timelines and allocated resources.
2. NCD research on lifestyle factors, specifically, can take a long time to conduct as the outcomes under investigation often take *“a long time to appear”* (Participant 6) – this requires additional resources and sustained support which is often at odds with researchers’, and policymakers’ desires for *“quick, quick, quick results”* (Participant 6).
3. A lack of available and accessible context-specific research tools and protocols that are sensitive to contextual differences and facilitate the production of locally relevant findings with relevant policy and practice implications.

“Sometimes we follow the international protocols, international guidelines, international tools developed for foreign communities...we should use local. For an example, if we use a questionnaire, we should first validate it, then use. There is no central agency or institute to evaluate those, validity.” (Participant 9)

“More accurate [diet assessment] tools would be good...that get correct data from men...sometime[s], if wife is there, he will not tell the truth.” (Participant 9)

The fact that urban health was a relatively new area of research meant that the tools and data available to conduct robust research were particularly limited.

“The problem is that for urbanisation for urbanicity there is no proper tool available. There is no tool to kind of assess the urbanisation and for that we kind of try and develop a tool that was actually done for the Tamil Nadu and it was a concept that has been given and it’s called the urbanicity index and so that is used to measure the relationship between urbanisation and NCDs but still it’s very difficult to capture everything, all the aspects of urbanisation, in that tool. So far, we haven’t come up with a good tool as yet.” (Participant 6)

Sensitivities around studying domestic war and conflict as determinants of health also meant that some researchers did not feel they there were able to explore this risk factor that *“continues to impact us” (Participant 13)*.

Some participants also felt that there was a lack of qualitative methods training opportunities available and as a result both an underutilisation and underappreciation of these methods. Even those who had qualitative research skills felt that ‘soft’ outcomes were more difficult to capture and more difficult to communicate and publish.

“If you look at the number of people that really lost weight, it would be only a small number, but if you look at people that have changed their attitude about life...you know, very soft outcomes, to look at those it is much higher than what you have for your objective outcomes. This is the problem with research though, we chase the objective outcomes, which you need to show to publish the paper. If these outcomes are not there, it’s not publishable. But really and truly from a programme point of view, the communities have gained a lot.” (Participant 6)

Qualitative research was also seen as more time-intensive and unpredictable and therefore less-favoured by medically trained graduate students who may lack the necessary skillset and/or have strict time and funding parameters to work within.

“Most of the research, particularly on diet, has [until recently] been coming from the stream of Community Medicine...[qualitative research] catches nuances, how something is shifting. It will involve a lot of hard work, a lot of qualitative interviews, a lot of listening, a lot of investment and they are not very tangible. They’re not easy to measure, so it demands a lot of investment. In these postgraduate studies, people have very limited funding, and you have a deadline hanging over you.” (Participant 13)

A few participants also indicated that rigid research environments that were quite hierarchical, were characterised by resource scarcity and competition, and allowed limited deviation from pre-agreed research protocols, restricted innovation and one’s ability to appropriately react and adapt to the research environment: *“I think Sri Lankan students are*

hardworking, meticulous, tolerant, and they [have] grit...[but] they are so bogged down by structures and formalities which really suppresses their imagination and their love for learning. By the end of it, you're so tired" (Participant 13).

Finally, the lack of 'data sharing and publishing culture' described by almost every participant meant that researchers were restricted in the data they could access and use and concerned that this might lead to unnecessary duplication of work. Many researchers spoke highly of the excellent work done by MD, MSc, and PhD students but lamented that most of this research was never published for widespread consumption – an issue that is discussed further in section 3.4.4 below.

Not enough local research capacity

NCDs, nutrition, and urban health are huge, complex topics that span disease prevention, treatment, and cure and therefore require the attention of a large and well-trained research workforce to produce up-to-date, high-quality, and context-specific evidence. It was conveyed that although the Sri Lankan academic community does conduct high-quality research in the areas of NCDs and nutrition, that more people investigating more diverse research questions were needed. Health economics, for example, was mentioned as an underserved area of research.

Various barriers, however, impacted both the current and desired number of local researchers as well as their capacity and expertise. Most of the public health researchers in Sri Lanka are medically trained, and this impacts the type of research conducted (often disease/patient/treatment focussed). One participant explained their experience of the

clinician mindset as: *“The population approach, they can't understand. They think only, anything, any decision for them is based on their individual patients, whom they see in the private sector. So that vision, that we must, as a country, as a population, take everybody, improve the whole status...doesn't get through”* (Participant 8). Some participants that had expertise teaching medical students believed that both research training and public health education for medical students is currently quite limited and too theoretical and that not all students were particularly interested in these subjects: *“Learning of epidemiology, or any of these things, by the clinicians is very weak in Sri Lanka. You know, actually to the extent of, this public health is looked down upon as not a technical, medical discipline. Even in medical schools, you'll see this. Students are not interested. I think this whole region of Southeast Asia, we have this problem. No one is interested in...It's not technical enough for them, you know”* (Participant 8).

Occupying a dual clinician-researcher role also often meant that researchers were time poor and for those who had specialised research skills or interests, demand often exceeded their capacity. Many participants therefore called for more local public health researchers. These human resource issues were further exacerbated by the occurrence of research students and professionals migrating for education, funding, or job opportunities at overseas universities and international organisations, as well as the limited incentives to do public health, as opposed to, clinical research in Sri Lanka: *“it's not a very popular or lucrative speciality [here]”* (Participant 13).

Funding issues

Despite the fact that participants viewed NCDs and nutrition as relatively well-funded topics, they had all experienced funding frustrations and barriers that impacted the type, quality, and quantity of research they were able to conduct. These funding barriers also frequently incurred personal financial burden. The limitations of available funding opportunities included: not always covering researcher salaries; a lack of dedicated funding for resource-intensive long-term and follow-up studies; a lack of funding opportunities for research collaborations; a lack of small project grants for individual researchers; limited urban health research funding; and the small-scale and unreliable nature of local funding. These limitations meant that:

- Researchers often had to *“spend from their own pocket” (Participant 13)*, meaning that wealthier students or researchers who could afford to take on more opportunities (including travelling to conferences) and greater risks (for example, piloting projects that may not be attached to sustained funding sources).
- Longitudinal and follow-up studies were not supported, which created gaps in the evidence.
- Research collaborations were less likely to occur or be successful and sustained.
- Individual researchers who wanted to pilot more innovative projects were less able to do so.
- Urban health research was underfunded.
- Researchers who applied for limited and sometimes unreliable local funds were restricted by the type of research they were able to conduct and were often unable to initiate, scale or finish projects *“that had been granted on paper”* but did not result *“in a smooth distribution of the funds” (Participant 14)*.

Indeed, the SLNCDS suffered from the latter. Funding opportunities were also not always advertised and so those ‘in the know’ had a competitive advantage. Once awards were granted, researchers spoke about additional barriers encountered – including the complex, and labour-intensive process of handling fees – that interfered with research time. Although a rare occurrence, certain funders imposed or recommended their own agendas or protocols, which were not always seen as the most appropriate or beneficial for the intended intervention recipients and required additional resources to rectify: *“This is research conducted by four other countries, a multi-national project. All those things mentioned in the global protocol are not compatible with our population...based on our experience, our past research findings...[so] we have changed some protocols, some research procedures” (Participant 9).*

Research is conducted in silos

Research was often described as being conducted within disciplinary, institutional, and sectoral silos. The implications of the latter are discussed further in section 3.4.5 below. *“There are different, different researchers. Different, different researcher communities. They do their research separately. There is no network of researchers established here. I do my research; I publish my data. Another person does their research and publishes their data” (Participant 9).* This meant that individuals working on the same topics were often doing *“small studies here and there”* instead of *“get[ting] together to design a well-designed, credible, large-sized study” (Participant 10).* The barriers that existed to forming research networks or collaborations across disciplines and institutions that many researchers indicated a need for or a desire to be a part of were threefold: 1) lack of centralised

information sharing makes it difficult to know who is working on what and where at any given time; 2) there is no coordination body or physical institute where *“people with diverse interests can pool their resources and skills”* (Participant 10) to work on shared problems; and 3) there is a lack of top-down agenda setting based on the research gaps and knowledge needs of the policy community that could act as a common research rallying point. Others felt that the lack of a unified research agenda was not necessarily due to limited top-down leadership but rather due to different researchers having different research priorities motivated by different factors – most often their personal interests and passion. Researchers within the academy were also viewed, by policymakers and ministry researchers, as having different research motivations and agendas to Ministry of Health researchers. Whereas academics were described as being concerned about what would get them promotions and publications, ministry researchers and some policymakers described the work of non-academic researchers as being focussed on implementable research that would benefit the community. These differences were implicated as a potential factor that might impact attempts to collaborate or to create and enforce a shared agenda that included researchers within and beyond the academic sector.

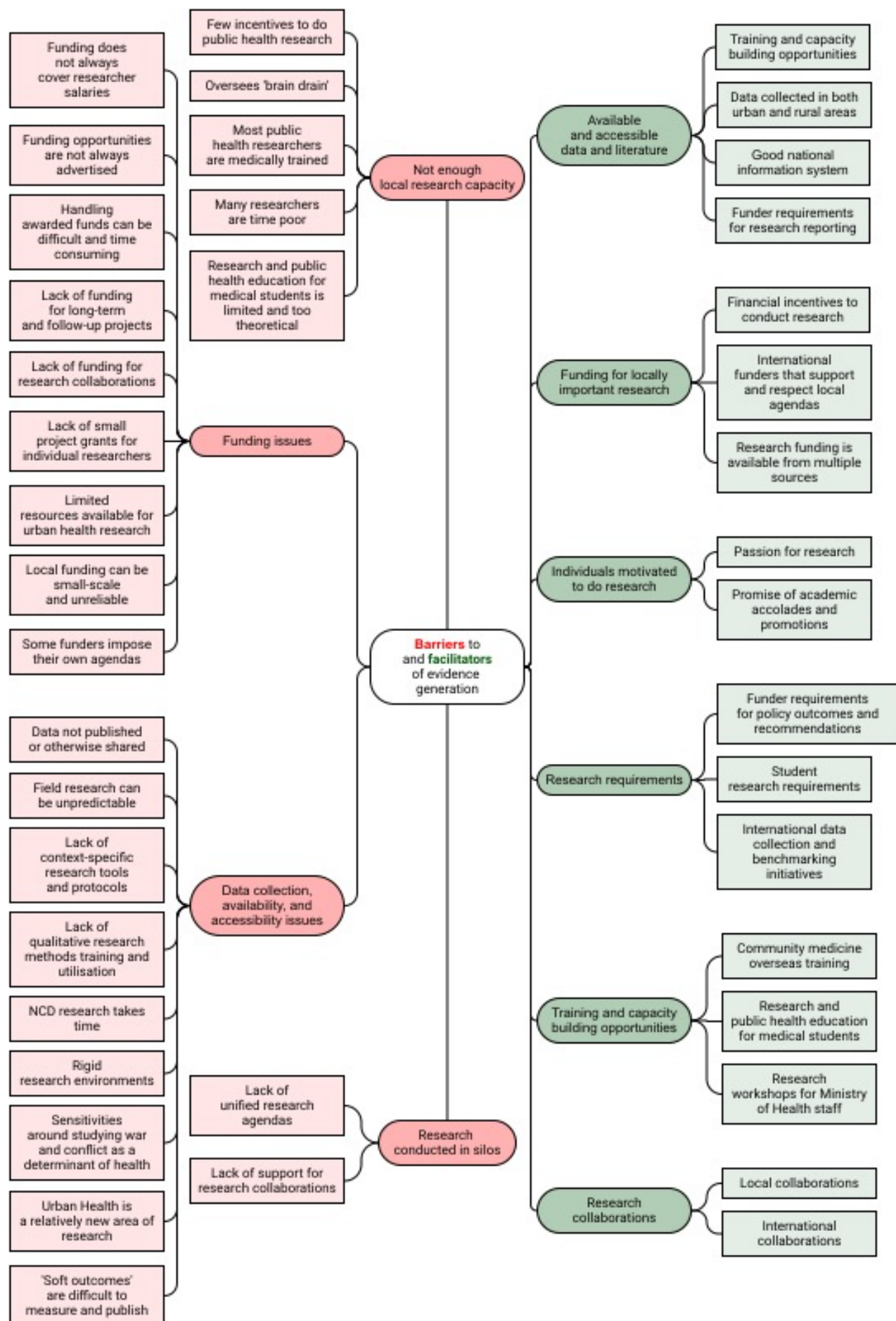


Figure 3.2. Thematic network for 'barriers to and facilitators of evidence generation'

3.4.4 Barriers to and facilitators of evidence communication

All participants mentioned the communication of evidence, information, and ideas (or lack thereof) as a key, distinct feature of the EBPM pipeline that they felt helped or hindered the consideration or uptake of evidence by policymakers (Figure 3.3). Researchers were well aware of policymakers' position that stressed that the evidence does not speak for itself nor does it make its way unassisted to the right person at the right time. Many had tried their best to engage actively in tailored evidence communication but were often unable, and sometimes unwilling, to overcome the multiple barriers that a lack of formal communication infrastructure imposed. For the most part, evidence communication was described as very important but effortful, time consuming, and beyond the remit of researchers' roles, responsibilities, and skillsets.

3.4.4.1 Facilitators of evidence communication

The four key facilitators of communication: 1) Appropriately targeted materials; 2) Incentives and opportunities to share research findings; 3) Relationships and affiliations that facilitate communication opportunities; and 4) Researchers who are personally motivated to engage in evidence communication are discussed below.

Appropriately targeted information

"If [evidence] is for politicians, you need to have it prepared in a completely different way" (Participant 19). Some researchers who had experienced evidence communication success credited, in part, the time, effort, and resources spent on appropriately targeting their policy-relevant research to the policymaking community as opposed to relying on traditional dissemination channels, such as peer-reviewed journals and report publications, alone.

Researchers translated and repackaged their evidence into *“very short, very catchy, crisp and clear” (Participant 19)* material by writing and disseminating a policy brief alongside their academic publications so that *“at a glance [policymakers] can understand what the problem is, and also in point form, what the necessary actions are” (Participant 8)*. One participant even suggested that *“because we [doctors and researchers] are very bad at simplifying...you have to have a communications person in the team...to put information into pictures and graphs for the fact sheets and policy briefs” (Participant 8)*. Policymakers added that these efforts are more effective if they are actively directed to or communicated with a specific, appropriate policymaker: *“[researchers] have to bring their materials to the ministry and address them to the correct person and even make some dialogue with them...for example, if it is something about noncommunicable diseases, the deputy director general of noncommunicable diseases is the key person there” (Participant 15)*.

Incentives and opportunities to share research findings

Whilst participants acknowledged the importance of communicating their research via highly engaging and digestible materials for a policy audience, many pointed out that this is not yet the norm and could be further facilitated by schemes to promote and incentivise the scaling of such practices. For example, by requiring the reporting of policy outcomes and recommendations, funding bodies help to make the process of identifying, articulating, and sharing policy recommendations common practice: *“usually funders are very keen on recommendations...they are really interested in policy recommendations...[these] are a major part of our obligation...and are part of reporting” (Participant 4)*. Health events and campaigns that spotlighted attention on specific health topics, for example, National Nutrition Month or World No Tobacco Day also created opportunities for information

sharing and awareness raising not only with a primed policy community but with the general public: *“on certain topics, they hold press conferences [during Nutrition Month]...I tend to attend them as a resource person so that gives the opportunity to provide [information] to the policymakers there as well as to the public through the media”* (Participant 10). Beyond the academy, promoting a publication and dissemination culture to support *“evidence-based improvements in health”* (Participant 17) had more recently been facilitated by providing financial incentives to Ministry of Health staff who publish/share their research findings: *“recently, [the Ministry] took a decision to encourage research by giving an additional allowance...and if you publish, you are given a little bit more. It may be small, but it is actually encouraging”* (Participant 19).

Relationships and affiliations that facilitate communication opportunities

Many participants noted that although the above-mentioned opportunities and incentives facilitated evidence communication, they did not necessarily get you in a room with policymakers or guarantee a receptive audience. For that type of direct, invited communication, there was no substitute for good personal relationships and prestigious affiliations. Participants categorised the former as either informal/passive or formal/active and the latter as arising from one's status as a medical doctor or association with a particular organisation or academic institution:

“Sri Lanka is a small country, so ministry colleagues, some time in our career, we have been together. Done our postgraduates together or are friends from a long time. So, it's easy. We can just call, meet, there is no problem.” (Participant 8)

“Actually, I think I have fostered a lot of good will with [policymakers] by helping them a lot... if they like you, they will then help you.” (Participant 13)

“These clinicians are something else in Sri Lanka. They are not just doctors or clinicians. They are real power brokers...[they] are very interested in diabetes and

obesity, this kind of research, and they're backed by the huge pharmaceutical [industry]...[anonymous clinician] can actually walk into [anonymous influential policymaker's] office any day and he will be listened to.” (Participant 13)

“I think definitely if you have international stature your data and what you say will be much more accepted than otherwise. Particularly, your chances of being invited for bigger meetings as a guest speaker and then sometimes invited orations and so on. So that gives opportunities without much effort to disseminate your data and findings.” (Participant 14)

In each case, one's special relationship or status meant that they were either able to reach out to policymakers with ease and/or be readily contactable and called upon by policymakers as a trusted or credible source. A few researchers, however, did caution that some people use their personal networks and relationships to further their own over an evidence-based agenda: *“if you really want something, you can pull the strings ...the negative thing is, the networks [can be] used for personal gain and privilege. So that's the disadvantage we have, because when that person goes to the minister and says something, he will make it appear that it is good for the system, but actually it might be a personal gain” (Participant 1).*

Researchers who are personally motivated to engage in evidence communication

With the exception of the mandatory reporting of policy recommendations to funders, communicating policy-relevant research beyond the academy is a voluntary activity and therefore relied on individual researchers' conviction that such communication is both important and a part of their role. Such researchers, who were often in more senior positions, made a habit of producing evidence dissemination plans for each of their projects and went out of their way to engage in *“other things [that] are more important than publications” (Participant 9)* for effective evidence communication such as *“policy*

briefs/summaries", "dissemination meetings", "public speaking engagements", "newspaper articles", "TV programs", and "social media".

3.4.4.2 Barriers to evidence communication

Whilst some participants described the various facilitators of their evidence communication success, many more shared the barriers they had encountered, which included: 1) Evidence consumers cannot access or understand communicated evidence; 2) Limited opportunities for bi-directional communication between researchers and policymakers; 3) Limited or restricted opportunities to publish in academic journals; 4) Researchers consider research and not dissemination to be their primary role and strength; and 5) Researchers lack the necessary communication skills. These five barriers are discussed below.

Evidence consumers cannot access or understand communicated evidence

Evidence consumers expressed difficulty finding and accessing available research as well as understanding the scientific jargon being communicated. This was exacerbated by a combination of: 1) many researchers exclusively disseminating their findings and recommendations via academic publications and reports written for an academic audience, and more often than not, in English; 2) low health and scientific literacy among policymakers; and 3) varying English-language proficiency among policymakers, especially at the sub-national level. The language barriers to communication experienced by intended evidence consumers, and indeed by evidence generators trying to appropriately translate their findings, were therefore twofold: scientific jargon and English-language.

"When I looked at the report, and we did have a lot of discussion on this, I mean, I said, "there's no point in giving this to any of our policymakers unless it's put into policy briefs." So, then I made some suggestions and I felt that...hmm...maybe the

language isn't right...because the political language is different. This writing part then is also a challenge because as you know we use English for official purposes, but English is not the mother tongue. And a lot [of policymakers] don't have the writing ability and the conversational ability in English...so if we are advocating to policymakers, we have to be really careful in the material that we use...and if this is going to be in Sinhala that's even more challenging for me because I studied in Sinhala like years ago and now if I'm to sit and write it'll take a long time for me. So, there are a lot of issues.” (Participant 19)

Limited or restricted opportunities to publish in academic journals

Some researchers, at various career stages, emphasised that they were not always able to publish their research in academic journals, and that this initial barrier limited further evidence communication with and beyond the policy community. Specific research publication barriers included: unaffordable publication fees; a lack of local indexed journals which instead encouraged publication in international English-language journals that may not be open access; bias against low- and middle-income researchers in international journals; and difficulty publishing soft outcomes (such as qualitative programme evaluations) compared to more highly valued “hard-core” quantitative research.

“Another big problem is publishing data. Whenever a paper is sent to an international journal, especially from this part of the world, it's very difficult to get a publication, even if it's good work...It's publication bias. What I feel is that they don't trust our data. They don't trust it because when you compare with other papers that are published in the same journal, the methods they are not super fantastic. Sometimes the methods are even better and very extensive here when research is done. But with all that, if there are no big names and its coming from a developing country then it is not [trusted]...and it can be very disheartening...And also, the other thing is that the open access, the subscription, we can't afford publication fees. So, because of that we have to drop a lot of journals from consideration for publication. That's a huge, huge problem and so you really get discouraged by that. And it's like a catch-22 situation. We can't publish because there is a big stumbling block here and then they say there is no evidence from developing countries. And a problem is that local journals are not indexed so people would publish in local journals only if they can't get it into an index journal...And so sometimes the good work isn't published even in local journals. Even I wouldn't think of publishing in local journals.” (Participant 6)

Researchers consider research and not dissemination to be their primary role and interest

Not all researchers wanted to engage in evidence communication beyond the usual peer-reviewed requirements. For many, dissemination was not a role or responsibility required of them and was therefore seen as a distraction from the work that they were paid to do and that contributes to their career progression. Others were simply “*not interested*” because it was “*not [their] passion*” (Participant 2). Graduate research students, particularly, were described as “*doing very good research*” but “*lacking a publishing attitude....as going through the hassle of publishing has no advantage for their degree fulfilment*” (Participant 7).

Researchers lack the necessary communication skills

For those who were keen and willing to engage in effective and appropriate evidence communication with policy groups or the media, not all felt they had the necessary training and support to do so. Lacking these skills also contributed to low communication confidence that some participants believed accounted for their hesitation to engage.

“I have appeared [at meetings with policymakers] but I didn't feel that it's a very comfortable place because you need very different skills. I don't have the full skills for that at the moment...what my main core skills are is being a researcher and teaching students. So probably [communicating with policymakers] won't be very successful.”
(Participant 2)

Researchers who were involved in university lecturing also noted that whilst certain Community Medicine students (masters and doctorate) received basic, theory-based teaching about the policymaking process, including evidence synthesis and communication, the type of important learning that comes from experience or “*getting your hands dirty*”

and relies on *“interactive teaching and [requires] a lot of group work”* (Participant 6) was lacking if not absent from the curriculum.

Limited opportunities for bi-directional communication between researchers and policymakers

All researchers and most policymakers spoke about the lack of forums and platforms that explicitly facilitate the sharing of relevant information between research and policymaking communities as the greatest barrier to systematic and accessible bi-directional evidence communication: *“There is no forum for us to discuss the evidence with the stakeholders in Sri Lanka. There is no review or formal focal or forum to discuss evidence in one place, to coordinate everything in one place. What usually happens is that whenever they want...they call us as resource persons or experts and invite us”* (Participant 6). Many felt that the resulting informal and more exclusive channels disadvantaged people who did not have personal relationships with policymakers and therefore found it very difficult to organise a meeting or get a document onto their desk. These barriers were described as being particularly acute for early career researchers with less expansive networks. It was also pointed out, by both researchers and policymakers, that the barriers to achieving evidence communication success within the existing informal structures were compounded by the fact that health researchers and health policymakers were under different ministries and therefore had limited opportunities, obligations, and incentives to work together: *“The ministries work very individually”* (Participant 6). The fact that policymakers are chronically time poor further restricted the quality and quantity of bi-directional communication. As one researcher exclaimed whilst recounting a public speaking engagement that doubled up as a dissemination opportunity, *“That [policymaker] got up and left!”* (Participant 13) whilst

the presentation was in progress. It was believed that the policymaker's busy schedule was the reason for the sudden, premature exit.

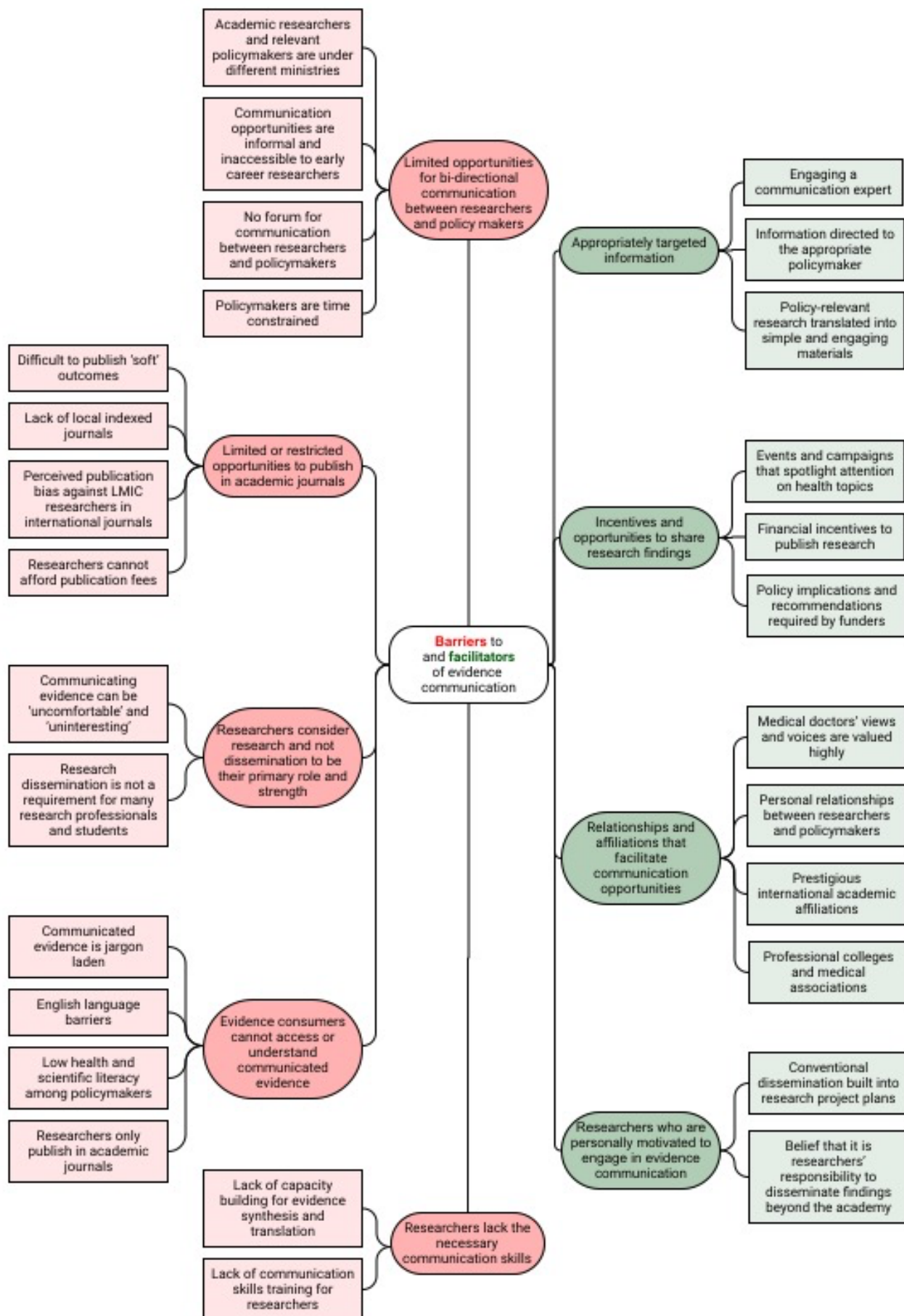


Figure 3.3. Thematic network for 'barriers to and facilitators of evidence communication'

3.4.5 Barriers to and facilitators of evidence uptake

Participants outlined various barriers to and facilitators of evidence uptake (Figure 3.4). The inability to transfer research knowledge successfully and routinely into policy was, for the most part, described as a problem that required resolution. Evidence uptake was determined as much by the quality and quantity of available research evidence as it was by people's perception of what constitutes 'evidence', the decision-making context, and the people involved in decision-making. The six facilitators and eight barriers of evidence uptake are outlined, in that order, below.

3.4.5.1 Facilitators of evidence uptake

The six facilitators of evidence uptake discussed below are: 1) Windows of opportunity; 2) Advocacy; 3) Relevant and reliable research; 4) Appropriate and effective evidence communication; 5) Health and research literate policymakers; and 6) Technical support.

Windows of opportunity

Participants believed that windows of opportunity could increase the likelihood of knowledge uptake. Specifically, when policies were reviewed or updated, both expert opinion and research evidence were explicitly called upon: *"In 2010, we developed a nutrition policy...[in] 2013 they want[ed] to revise and update. Now they have done that based on the experiences and data that we have gathered"* (Participant 20). Plan prioritisation and costing exercises also invited evidence use, as was the case for the National Multisectoral Action Plan for the Prevention and Control of Noncommunicable Diseases 2016-2020 which initially included over 400 actions that were not costed nor prioritised, *"so we helped them to make a prioritised action plan for two of the first*

years...we selected a handful of actions directly connected to the lagging-behind areas in the progress report” (Participant 8). Research evidence that aligned with the political priorities of the day, sometimes sparked by a change in government or another event that changed the political mood, also made evidence uptake more likely. A primed audience, through advocacy efforts, were seen as more prone to request or accept evidence within this window.

Advocacy

Many participants had directly experienced or witnessed the success of advocacy efforts. Advocacy directed toward those who made and influenced policy by members of the general public, research community, the WHO, and public officials, was intended to convince policymakers of the importance of particular issues or spotlight attention on potential solutions – the WHO was particularly involved in guiding the agenda through advocacy “*behind the scenes*” and at “*high levels*”. As key policy influencers, the general public were also an important target audience of the research community’s awareness raising or knowledge empowerment efforts: “*I have written a fair amount in normal, daily [newspapers] where the public tends to read...I’ve written more than a hundred articles, perhaps*” (Participant 10). Some researchers also supported citizen activists by providing evidence to support and strengthen their causes.

Relevant and reliable research

The availability of relevant and reliable research evidence was a key facilitator of evidence uptake. Research that was policy-relevant and ready (i.e., that moved beyond defining a problem into solution proposition and implementation territory) was viewed as more useful

and workable by policymakers. Research co-developed with policymakers was also often more policy-relevant and timely and therefore more likely to be adopted. The co-development process further facilitated trust-building and a feeling of project inclusion and ownership on behalf of the policymakers who, as a result, were more likely to deem the evidence as robust and reliable.

“When I formulate a research question or research idea, I usually get people from the government sector who are involved in decision-making, because I don't conduct research in isolation. So, my research team, we usually have members from the Ministry of Health also. What has happened is like when we conduct research in isolation and then we try to disseminate the finding, sometimes the policymakers or even the program people may not be happy with the research or they say, “This part is not addressed or there is some deficiency in your research”...But if they are on board from the beginning, so then they are aware of it, they may give you useful comments to modify your data collection tools or to include certain variables, etc...And also to tailor-make to their [research] needs too.” (Participant 4)

Research that was commissioned by the Ministry of Health and led by government research agencies, such as the Medical Research Institute (MRI), also had high policy-relevance as it directly met the ministry's evidence requirements. This ‘inside’ research evidence was also given priority over ‘outside’ research.

“The thing is now for the Ministry of Health, they give the priority for us because we are part of their arm. And most of the time they know academics are mainly for the publications and they are not for the implementations as well as they are not much towards recommendation level. Therefore, the ministry is always giving priority to our research than the academic research.” (Participant 17)

Appropriate and effective evidence communication

The appropriate and effective communication of evidence for a policy audience described in section 3.4.4 above was considered an important facilitator of evidence use. Although researchers acknowledged that good communication was not sufficient to guarantee evidence uptake, all who had successfully influenced policy had invested significant time

and effort into evidence communication and/or building a public 'expert' profile and/or relationships with policymakers. The results of these efforts often manifested in particular researchers becoming the 'go-to' experts on certain topics. When evidence was communicated by these individuals, it was more likely to travel further along the EBPM pipeline. Policymaker participants pointed to the strength of these relationships with go-to experts as a key facilitator of not only evidence communication, but more specifically, the likelihood of uptake.

Health and research literate policymakers

Policymakers with a scientific background expressed a preference for evidence-informed governance: *"There are three ways of government: the scientific way, the democratic way, and the popular way. We simply adopted the scientific way of doing things...the scientific way of governance. Not the popular things"* (Participant 3). These policymakers conveyed that they understood and engaged with the evidence as well as commissioned and used research evidence to help *"pick the best solution"* (Participant 3). Technical training opportunities implemented for Ministry of Health staff, such as research methodology courses and policy development skills training, also contributed to policymakers' ability to engage with and utilise global, regional, and local research findings in a more rigorous and systematic way.

Technical support

One way that policymakers overcame evidence availability and accessibility barriers was to directly invite expert opinion to the decision-making table. This was achieved by setting up technical advisory committees or working groups which generally included one to two

academics and non-academic public health specialists. Although there was no guarantee that the latest findings shared by researchers would be adopted, these gatherings allowed policymakers to seek highly specific technical support and guidance for policy and programme development and implementation. The National Advisory Committee on the Prevention and Control of Cancers under the chairmanship of the Secretary of Health was one such example shared.

Support from global, regional, and national WHO personnel and resources which carried a *“high-level seal of approval”* (Participant 12) was also an integral component of many of the NCD and nutrition EBPM success stories shared by participants. Upon the request of government officials, the WHO assisted with generating or directing policymakers toward research evidence and best practice, coordinating evidence synthesis activities, and guiding plan development and prioritisation.

3.4.5.2 Barriers to evidence uptake

Although many participants identified or experienced evidence uptake facilitators, the barriers to evidence uptake were both greater in number and detail. These eight barriers included: 1) Evidence gaps; 2) Irrelevant, low quality, and conflicting evidence; 3) Ineffective and inappropriate evidence communication; 4) Lack of collaboration with and cooperation by researchers; 5) Noncommunicable disease prevention is not a top political priority; 6) Political and staffing instabilities; 7) Political influences and conflicts of interest; and 8) The nature of policymaking and the people involved in it.

Evidence gaps

The absence or perceived absence of evidence was a primary barrier to its uptake. Common complaints pertained to the lack of context-specific, island-wide, solutions-oriented, population-based, implementation, evaluation, policy-relevant, and up-to-date research evidence that was required by the policy community to make evidence-based decisions.

Some researchers, however, pointed out that not all of these evidence gaps were real but rather perceived due to the poor publication and dissemination of research discussed in section 3.4.4, as well as policymakers' selective research seeking strategy based largely on experts. Both researchers and policymakers agreed that much of the evidence base focussed on measuring problems – *“a lot of people are doing research but it's mostly on prevalence” (Participant 6)* – rather than developing, implementing, and evaluating solutions. This meant that although individuals were aware of the burden of different NCDs, nutritional insufficiencies, and urban-rural health disparities, the question of how best to tackle these issues effectively and appropriately remained just that: a question. Even in cases where intervention evidence was available, some policymakers wanted qualitative data that might help to explain why some nutrition indicators, for example, were not improving in the country and how they could implement interventions better based on this information. Beyond the various gaps in the type of research evidence available, there were also areas of research that many participants felt were neglected, such as urban health: *“urban [health] is the one that is a little bit neglected...I think [it] is high time for us to really focus and identify some relevant targeted interventions for them” (Participant 17).*

Irrelevant, low quality, and conflicting evidence

Not all evidence is equal or equally policy-relevant and ready. Research evidence based on pilot projects that had not been scaled was seen as less appealing and less relevant to policymaking. Conflicting research evidence and expert opinion also made it difficult to decide which evidence to trust and use, an issue that was further exacerbated by a lack of evidence synthesis initiatives that allow for direct comparison and critical appraisal of evidence: *“it's hard for decision-makers to make those decisions if there's so many voices, and you know, the data is everywhere” (Participant 9)* and *“such systematic and methodological analysis and coming to a decision [based on that] is not happening...there is a weakness there” (Participant 15)*. Invited expert opinion and advice was also described by policymakers as sometimes being too theoretical: *“We have advisory committees, and we have other things...but our problem is that our universities and academia and other people are bit of a theoretical people. They are not practical enough to give proper advice” (Participant 3)*. Some researchers were also concerned that the dissemination of low-quality and non-generalisable research evidence combined with the practice of simply taking up any evidence without proper quality appraisal might lead to *“false decisions...based on those low-quality research projects, especially the community work” (Participant 9)*. They viewed this as a barrier to the uptake of high-quality research evidence to support EBPM.

Ineffective and inappropriate evidence communication

In addition to the communication barriers that impacted the effective and appropriate communication of evidence outlined in section 3.4.4, some participants also suggested that evidence or advice from *“foreign experts coming in” (Participant 6)* might influence how much policymakers trust or are willing to act on communicated evidence. Participants did

not point to any one person or organisation deemed to be a particularly untrustworthy or unacceptable source of information, but rather indicated that these judgments are based on political context and the specific people involved in the knowledge exchange process. As a general rule, however, participants suggested that working with a Sri Lankan or someone who knew the local system within one of the big international organisations was preferable to working with an outsider.

Lack of collaboration with and cooperation by researchers

To create both proactive and reactive policy, the collaboration and cooperation of the research community was seen as key. Many, however, felt that this 'ideal' was not achieved due to various barriers. According to researchers, policymakers did not express their evidence needs or engage the research community in relevant consultations. Inversely, policymakers felt that they were not included enough in the research generation process, with some expressing frustration and offense when asked to consider evidence after it had been generated without their prior knowledge or direct consultation, which they believed would have helped to create more policy-relevant and ready research evidence to support EBPM. Of course, not all researchers wanted to engage or be engaged in the policymaking process. Whilst some found the policy environment to be unfamiliar and therefore uncomfortable, others felt that the effort involved in being forthcoming and fighting for the inclusion of their research evidence in policy decisions was simply not worth their unrewarded time and effort. Some researchers also believed that it was the responsibility of policymakers to initiate collaborations with researchers: *"what we feel, probably it is slightly arrogant, since we are academic researchers, they should outsource us, get our opinion... We don't have to fight with their opinion"* (Participant 2).

According to participants, at the end of the day, policy engagement did not necessarily translate into outputs valued within the academic sphere, and the absence of a formal or systematic process for incorporating research into policy also meant that researchers and policymakers alike did not always know how to become involved with research or EBPM activities. Some felt that designating a WHO Collaborating Centre that focussed on NCDs, for example, as has been done for blood transfusions and occupational health in Sri Lanka, could “*help a lot*” to bring both parties together and produce mutually beneficial outcomes: research publications and policy-relevant information.

Noncommunicable disease prevention is not a top political priority

Some participants believed that the long-term nature of NCD prevention made it a less attractive cause for politicians who were seeking quick policy wins. This often meant that undernutrition or communicable disease agendas that could turn around quicker success stories were prioritised. NCDs were also described as being “*complex issues*” that necessitated equally complex or highly involved political solutions, for example, multisectoral prevention strategies that require novel skills and infrastructure, coordinated action across sectors, and the sharing of intervention ownership and therefore power.

Others suggested that NCDs were only a political priority when politicians had a personal connection to them or had identified their importance to their electorates, for example, in the case of chronic kidney disease (CKD) which was prevalent in the home province of the current president. This, however, was not overly common because “*what is most difficult to change is the NCDs because it's a relatively new thing...It's a new thing and it's not a priority for anybody's electorate*” (Participant 13). The lack of charismatic NCD champions within

and outside of government to relentlessly push the agenda and advocate for the prioritisation of NCD prevention was also identified as a key barrier to NCDs not receiving the sustained political attention they deserve. This barrier was contrasted with the many maternal and child health and communicable disease champions that participants could name, recall having memorable encounters with, and point to their various success stories.

“In Sri Lanka what I feel is that all the successful public health campaigns or spheres have been spearheaded by a very charismatic person or a group of people who have owned that problem, who have invested a large part of their career into that...My personal belief is that in spite of the largest allocation of funding for NCDs, one of the main reasons that it has not worked so far is because there is no good leadership for that, the cause of NCDs. For example, if you ask me for immunization or maternal health or HIV or health education, I can name like five, five legends who have made these institutions uncontested bastions of you know...you wouldn't dare tell them breastfeeding is not important.” (Participant 13)

Political influences and conflicts of interest

NCDs and nutrition are linked to the commercial determinants of health,² which makes them vulnerable to industry interference. Policymakers may therefore face strong opposition to the uptake of certain evidence by powerful interest groups. Urbanisation is also often guided by economic growth considerations and supported, in Sri Lanka, by various foreign investors and interests. As a result, participants believed that research evidence might therefore conflict with or come secondary to influential voices and agendas, or interfere with “*making the business people happy*” (Participant 14). Some participants also pointed to the high level of political reciprocity that saw certain health agendas prioritised over others, for example, previous politicians had championed the causes of those that supported their ascension – a strategy that may or may not align with EBPM.

² Commercial determinants of health are the factors that influence health which stem from a profit motive. For example, corporations marketing unhealthy foods.

Political and staffing instabilities

Political and staffing instabilities contributed to projects being delayed, abandoned, or replaced based on new priorities. Participants suggested that political instability in the country was not conducive to the type of long-term attention, investment, and accountability that NCDs, nutrition, and urban health require. Each time a government was dissolved or disbanded participants witnessed:

- Priorities change, or policies repealed overnight, for example, *“When the new guy came, I think without any consultation he [was] suddenly...thinking about economic revamping and making the business people happy. He reduced sugar tax”* (Participant 14).
- Changes to the local research funding environment.
- Impacts on people’s mindsets. For example, they might be less able to focus on their work/projects.
- *“Opportunities for industry and business people to influence the politicians”* (Participant 14).

Short political cycles, often leading to short-term thinking, also saw politicians prioritise *“wonder projects”* that overpromised, under-delivered, and most importantly, *“exhaust[ed] the financial resources”* (Participant 13) that might otherwise be allocated to NCD prevention. Even in cases where evidence uptake intention was strong, the strength or longevity of this intention could be diminished by high staff turnover and staffing difficulties within the Ministry of Health, which led to capacity gaps and individuals being overburdened or unable to staff the implementation of evidence.

“Usually, the policy is generated over some time period. By the time it is implemented, usually who initiated the policy was not there. Usually, retired or something...people are also getting transfers [within the ministry] every four years. There is no permanent person in that area to look after that matter, so I think that I found some weakness in the system.” (Participant 16)

“In terms of capacity in the Ministry of Health, it remains very low unfortunately. There was one person in charge of NCDs and she's now working in the [WHO] country office, but she has a huge amount of work. Being in charge of all the institute agenda, for one person is not enough. So that's also something that we've seen. That they were full of good intentions, but unfortunately, the way the ministry was organised was not that efficient [for NCDs].” (Participant 12)

The nature of policymaking and the people involved in it

Policy-making was described as being slow, messy, and overly bureaucratic: *“it takes such a long time in Sri Lanka. If something needs cabinet approval, some policies have gone on for five, six years... [and] some stay as a draft forever” (Participant 8)*. These delays impacted evidence relevancy and deterred some participants from actively engaging in the process. Although many participants spoke about EBPM as the ‘ideal’, they contrasted this with the reality of policy generation, which was not necessarily research evidence-driven and was instead based on other considerations, such as the expert opinion of senior trusted officials – *“mainly the expert opinion is what matters”; “I think it’s quite traditional...[that] we listen to the senior people” (Participant 2)* – or on what might look impressive. Among those most often invited to give their expert opinion, they were said to hold and peddle particular views and ideologies which dominated the policy agenda. These included prioritising wisdom over emerging research evidence, a belief that public health is a lesser science (compared to medicine), and their long-term commitment to certain health issues that they felt might be diluted by increasing investment in NCDs and emerging nutrition issues: *“the public health specialists themselves are a bit reluctant for a paradigm shift” (Participant 7)*. Many of the vocal or go-to clinicians that some described as having a medical mindset to public health

could act as amplifiers or dampeners of certain information and agendas. For example, evidence that supported *“low-cost secondary prevention strategies”* (Participant 14) over primary prevention interventions might be more valued and promoted by these individuals to politicians.

There were varying responses among participants over whether best-practice EBPM necessitated research evidence alone or whether expert opinion was an equally valid form of evidence. Some thought this distinction was context or policy question dependent, whereas the majority of researchers believed that research evidence or evidence-informed (rather than opinion-based) expert advice were more systematic, less biased, and therefore preferable information sources. The lack of independent science advisors in government coupled with low research experience and training among policymakers were additional barriers to the uptake of evidence based on the characteristics of the people involved, or not, in the policymaking process. Both of these barriers, some thought, added additional weight to the argument that policymakers may not receive or know if they are receiving representative evidence-based advice if their ‘evidence’ seeking strategy was based on invited expert opinion alone – particularly if that advice was coming exclusively from one individual.

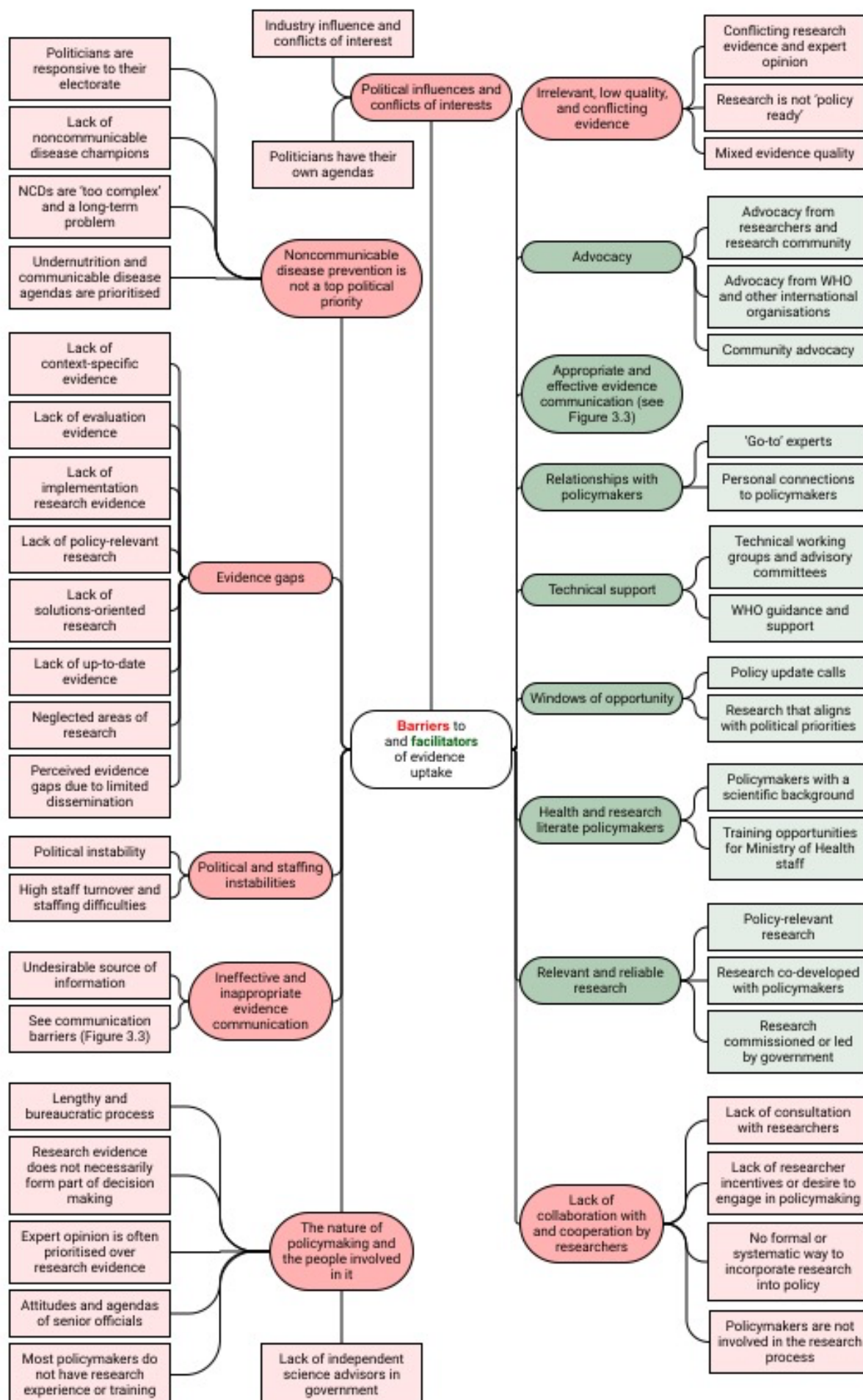


Figure 3.4. Thematic network for 'barriers to and facilitators of evidence uptake'

3.5 Discussion

3.5.1 Summary of key findings

Although other studies have also investigated the various barriers to and facilitators of public health EBPM, this is the first to focus on noncommunicable diseases, nutrition, and urban health in the Sri Lankan context. This study identifies and describes six facilitators and four barriers to evidence generation, four facilitators and five barriers to evidence communication, and six facilitators and eight barriers to evidence uptake based on 23 semi-structured interviews conducted with 11 policymakers, 11 researchers, and one research funder. Study findings were also visually presented as non-hierarchical thematic networks to illustrate the multistage data analysis process that included the identification of the most self-evident themes that emerged from the textual data through to the summation and interpretation of these themes.

3.5.2 Comparison with existing literature and strengths of this study

This study confirms that much of what is known about the barriers to and facilitators of EBPM from the 'global' literature (based predominantly on high-income, English-speaking experiences) also applies to the Sri Lankan context. For example, there is no shortage of analysis that highlights the need to equip researchers with more effective communication skills (76, 108); the fact that the dissemination of policy-oriented work goes largely unrewarded (108, 109); the impact of vested interests and conflicts of interest on the uptake of research evidence (110); and the difficulties inherent in meeting long-term public health objectives within short-termist and unstable political environments (78, 111).

Context-specific differences, however, were also uncovered. A first set of these differences related to evidence communication. English language barriers that existed between evidence generators and consumers hindered the effective communication of evidence. Bilingual researchers who worked and communicated in English found it difficult to communicate, especially via written formats, with policymakers who had low or no English language proficiency. This is a topic that is only partially touched upon in global best practice guidelines for communicating evidence to policymakers. Whilst these documents remind researchers of the importance of translating information into the correct language for the target audience, taking into account people's varying knowledge of English, they do not address the difficulties faced by researchers in doing this, especially in resource-constrained settings (112, 113). The near exclusive reliance on expert opinion shared through personal contact between researchers and policymakers as a source of evidence, which some participants believed to be rooted in a tradition of seeking the wisdom of senior officials rather than consulting new knowledge (i.e., research evidence), raised concern about the quality of communicated information. This interpretation of information sharing through personal contacts as a potential barrier to achieving systematic and rigorous EBPM is at odds with studies that encourage the scaling of this type of two-way communication to facilitate evidence use (76, 78). The limited opportunities to publish in academic journals due to perceived bias against low- and middle-income country researchers further reduced the dissemination of research and its subsequent consideration in policymaking. These concerns are supported by a systematic review conducted in 2020 on the role of geographic bias in knowledge diffusion, which concluded that both author and institutional characteristics might interfere with reviewers' judgement of research, although further

robust evidence is required to explain fully the geographic skew toward high-income research in academic journals (114).

A second set of context-specific differences related to evidence uptake barriers. These included the strong involvement of clinicians in public health policymaking as well as the relatively recent arrival of NCDs and their associated risk factors on the political agenda. Together, these barriers put the primary prevention of these 'new' health issues in direct competition with the prevention and management of communicable diseases, maternal and child health, and secondary and tertiary disease prevention agendas. This issue of competing priorities in low- and middle-income countries, which often results in NCDs and their associated risk factors receiving less political attention and resources than they deserve, is well-documented and requires both a mindset shift and an injection of human and financial resources based on local capacity gaps to be overcome (115).

By providing a holistic assessment of the EBPM environment, this study further breaks from much of the EBPM literature that pays great attention to the demand side of EBPM (which includes evidence uptake and communication) and far less to the factors that impact evidence production (76, 110, 116). The barriers to and facilitators of evidence generation identified in this study provide valuable information for appropriately and effectively addressing some of the root causes of evidence uptake barriers, such as 'evidence gaps', 'low quality evidence', 'limited relevance of research', and 'research capacity gaps' (80, 116, 117).

3.5.3 Limitations of this study

The qualitative approach used here is appropriate given the exploratory nature of this study and the lack of previous research conducted on the barriers to and facilitators of NCD, nutrition, and urban health EBPM in Sri Lanka. However, a more systematic and structured approach to data collection, for example surveys, would be needed to assess comprehensively the magnitude and frequency of barriers and facilitators and how these might differ by participant sociodemographic characteristics. This exercise would also be necessary to scale this cross-sectional investigation and perform it on a repeat basis.

A combination of the purposive sampling strategy used as well as my inability to speak Sinhala or Tamil may have limited the diversity of the study sample. Key informants were well-connected in health circles but less so in urban development and planning. These initial contacts may have further limited snowballing, which resulted in predominantly health sector contacts being reached. Participants believed that there were not many people in the country working on urban health issues, within or outside of health – another factor that could have contributed to the low urban health representation among participants.

Research funders and civil society members were also fewer in number (participants highlighted the *“lack of structured civil society”* for NCDs in Sri Lanka), more difficult to contact, and less likely to agree to participate in the study. This further restricted the sample to researchers, policymakers, and one research funder. Although I was assured that researchers and influential policymakers were proficient in conversational English, one of the barriers to evidence communication highlighted in this study identified a subset of policymakers who face additional barriers to engaging with EBPM due to English language barriers. These policymakers were not included in this study. A more diverse sample of

participants may have highlighted additional barriers to and facilitators of EBPM, contributing to a richer depiction of the EBPM environment.

3.5.4 Reflections on researcher positionality

Reflecting on researcher positionality, which involves consideration of one's positions, identities, and worldviews as they pertain to the research question, methods, and context, is critical to assess ethical practice and the validity of research findings (118). Although my identity as a young, white, female, English-speaking student from the University of Oxford most certainly impacted how I conducted interviews and how interviewees responded, on the whole, I felt that these aspects of my positionality positively impacted data collection. Most participants seemed to share honest accounts of their experiences and appeared quite comfortable disclosing information to me that they would otherwise not share with colleagues and, at times, wanted to keep *"off the record"*. This may have been a reflection of my position as an outsider or my young age and student status that rendered me non-threatening. I also used my positionality differently in different spaces and interactions. For example, some interviewees requested my 'expert opinion' on certain matters, treating me as an intellectual equal, whilst others established a position of authority that called for me to be more passive and lean into a naïve student persona. Compared to my other visible or ascribed characteristics, my affiliation with the University of Oxford sometimes had a palpable impact on research interactions: some participants were keen to speak with me because of this affiliation, whilst others said it made them feel nervous – a feeling that subsided once they met me face-to-face. One participant, who started the interview quite closed, opened up considerably once I communicated that I was Australian and not British – for this participant, Britishness was associated with Sri Lanka's colonial past.

3.5.5 Implications of this research

3.5.5.1 Recommendations for policy and practice

The findings from this study can support an evidence-based approach to EBPM. For each barrier and facilitator identified by participants, policy and practice recommendations and responses can be formulated. The timing of this research, which coincides with the expiration of the National Multisectoral Action Plan for the Prevention and Control of NCDs 2016-2020 (32) and the National Nutrition Policy of Sri Lanka 2010-2018 (87) as well as the development of a new urban health policy, aligns with a window of opportunity to inform the development or next iterations of these plans and policies. Although this study does not quantify issues to guide prioritised action, a few strategies can be suggested:

1. *Focus on cross-cutting issues.* Some barriers and facilitators identified in this study impacted all three EBPM themes: evidence generation, communication, and uptake. For example, the lack of incentives for researchers to conduct and disseminate policy-relevant research, as well as actively engage in the policymaking process.
2. *Focus on barriers with matched facilitators i.e., ready-made solutions.* Some barriers, for example, ‘most policymakers do not have research experience or training’ had matched facilitators: ‘health and research literate policymakers’. In these cases, barriers could be reduced by scaling existing facilitators/solutions, for example, ‘training opportunities for Ministry of Health staff’.
3. *Focus on downstream barriers with identifiable upstream causes.* Some of the downstream barriers to evidence uptake, for example ‘evidence gaps’, had clear upstream causes in the area of evidence production. Focussing on the root causes of these downstream issues, for example ‘lack of funding for long-term and follow-up projects’, could help to create appropriate, effective, and sustainable solutions.

4. *Focus on tailoring solutions to barriers and facilitators that are well covered in the literature.* As mentioned above, many of the barriers and facilitators to public health EBPM well-documented in the literature also apply to the Sri Lanka context. In cases where EBPM approaches that tackle these barriers and utilise these facilitators have been implemented and evaluated, for example using knowledge brokering to promote EBPM (119, 120), these approaches could be tailored to a middle-income setting following contextualisation guidelines (86) without having to reinvent the wheel.
5. *Focus on overarching barriers.* The informal nature of the knowledge exchange process was viewed as a key overarching barrier to the systematic and rigorous use of evidence in decision-making. Focussing efforts on interventions that address such 'global' barriers could have positive implications for the overall EBPM environment. For example, supporting structural and personal interactions between researchers and policymakers throughout the policymaking process – including agenda setting, policy formulation, implementation, and evaluation – could improve the generation, dissemination, interpretation, and utilisation of evidence in public health policy (83).
6. *Assign appropriate responsibility for actions.* The National Multisectoral Action Plan for the Prevention and Control of NCDs 2016-2020 (32) assigned responsibility for different proposed actions for achieving the desired outcome of 'Evidence generated and used for national policy and programme development' to different actors. Based on the findings from this study, these responsibilities could be reviewed and more appropriately assigned. For example, proposed action 4.3.3.g 'Identify research questions to support the implementation, monitoring and evaluation of the NCD action plan' which was assigned to the Post Graduate Institute of Medicine and

academia might include policy stakeholders in the next iteration of the plan to ensure that research projects are co-designed and co-owned by researchers and policymakers – a strategy that has proven successful in increasing the use of research evidence by policymakers (38).

This study demonstrates the utility of conducting a qualitative investigation of the barriers to and facilitators of EBPM as experienced by those involved in the process before developing strategies to improve EBPM or applying ‘off the shelf’ EBPM approaches based on high-income country experiences.

3.5.5.2 Avenues for further investigation

Going forward, ongoing commitment is required to strengthen both the demand for and supply of policy-oriented research evidence to support EBPM. To support these efforts, further research should focus on expanding and scaling this investigation to assess the experiences of more and diverse stakeholders and monitor changes to barriers and facilitators over time. A less time and analysis intensive quantitative research method could facilitate this endeavour (for example, surveys). The potential impacts of the COVID-19 pandemic on research agendas, funding priorities, and political attention (121) highlight the importance of monitoring the barriers to and facilitators of NCD, nutrition, and urban health EBPM over time.

Developing, implementing, and evaluating appropriate and effective approaches to support EBPM – from developing context-appropriate research tools to support the generation of policy-relevant evidence, to evaluating the effectiveness of research training for Ministry of

Health staff – are necessary next steps that should be supported by further research. Given Sri Lanka's success in the areas of vaccine-preventable diseases and maternal and child health, a comparative study of the similarities and differences between the barriers to and facilitators of EBPM in these areas compared with those studied in this chapter, could provide further insight into tailoring contextually-appropriate and effective approaches.

3.6 Conclusion

This chapter has described and discussed the various barriers to and facilitators of evidence generation, communication, and uptake in public health policymaking in Sri Lanka experienced by researchers, policymakers, and research funders. Drawing on the finding in section 3.4.3 that there are *'a lack of available and accessible context-specific research tools and protocols that are sensitive to contextual differences and that facilitate the production of locally relevant findings with relevant policy and practice implications'*, as well as the expressed needs of SLNCDS collaborators described in Chapter 1, the next chapter develops and validates a context-appropriate brief dietary survey for Sri Lankan adults to support research outcomes with clear policy and practice implications.

Chapter 4. Relative validity of a brief dietary survey to assess food intake and adherence to national dietary guidelines among Sri Lankan adults

The study presented in this chapter has also been published as a peer-reviewed paper with the following citation: Renzella J, Fernando S, Kalupahana B, Townsend N, Rayner M, Wickramasinghe K, Katulanda P, Scarborough P. Relative validity of a brief dietary survey to assess food intake and adherence to national dietary guidelines among Sri Lankan adults. *BMC Nutrition*. 2020;26;6(1):68.

4.1 Chapter summary

Both SLNCDS staff and Chapter 3 interviewees cited the absence of a dietary survey developed for and validated with the Sri Lankan adult population, for use in NCD risk factor research, as a key barrier to the development and evaluation of effective dietary interventions. Within Chapter 4 I respond to this barrier by developing and relatively validating a context-specific dietary survey, the Sri Lankan Brief Dietary Survey (SLBDS), with 94 Sri Lankan adults living in Colombo (Western Province), Kalutara (Western Province), and Trincomalee (Eastern Province). The relative validity of the SLBDS, which estimates food intake and adherence to the Food Based Dietary Guidelines for Sri Lankans, was assessed against a 24-hour Dietary Recall (reference method). The findings from this study show that the SLBDS demonstrates promise as a fit for purpose research tool, but additional research

is needed to assess its test-retest reliability and to validate further the reporting of salt, oil, and coconut intake.

4.2 Introduction

As discussed in Chapter 1, unhealthy diet is the leading modifiable risk factor for the development of NCDs (6). Despite the promising global progress made in preventing and controlling NCDs in the last decades, they remain the world's leading causes of death. This is in part due to a combination of unsustained and ineffective action mounted against key modifiable risk factors and the many 'data blind spots' that result from inadequate and infrequent data collection (1). Substantial reductions in NCD morbidity and mortality therefore require increased investment in evidence-informed healthy diet promotion (122). This necessitates accurate and timely dietary data collection to identify trends, develop appropriate solutions, prioritise resource allocation, and evaluate intervention effectiveness. Dietary intake, however, is notoriously difficult to capture accurately in population-based studies, and the complex and burdensome nature of 'gold standards' can limit their context suitability and sustainability (123, 124) – as was highlighted by the case of the SLNCDS.

While diet may be the single most important risk factor for NCDs, it is by no means the only one. Embedding dietary intake measurements within multi-topic, multi-component national NCD risk factor surveys that collect behavioural, physical, and biochemical measurements in an attempt to avoid survey fatigue is therefore a popular surveillance approach (5). The WHO STEPwise Surveillance (STEPS) methodology, for example, recommends WHO Member

States undertake multi-topic, multi-component STEPS surveys every 3-5 years – a schedule that has proved challenging in resource-constrained settings (5). Supplementing these hugely important surveillance systems with short and easy to administer surveys that facilitate the periodic collection of good-quality data therefore has appeal – especially in resource-constrained settings where data collectors may receive minimal training (125). The availability of validated brief dietary assessment tools, however, is limited, with many focussing on few, select food groups (for example, fruit and vegetable intake) (126).

Where data are being collected, linking these data to action – the ultimate goal of dietary surveillance – is not always realised (127). Context-specific research tools designed to inform context-appropriate interventions may help to close this knowledge to action gap. This, of course, must include an understanding of contextual gender differences in dietary intake informed by self-report methods that are equally valid for collecting dietary intake data from women and men – an area of research that is currently underserved (128).

Country-specific and evidence-informed national dietary guidelines provide a convenient and logical structure to inform the development of a short dietary assessment tool; measuring recommendation compliance generates research outcomes that can be used to assess diet-disease associations and inform and evaluate national nutrition policy and public health interventions (129). Often developed and endorsed by multiple government sectors (for example, the Ministry of Health, the Ministry of Education, and the Ministry of Agriculture in the Sri Lankan context) these documents and the activities born from them also provide a ready-made rallying point for the multisectoral action required to effectively tackle NCDs (122).

4.2.1 Brief dietary survey for Sri Lankan adults

The rise in diet-related NCDs in Sri Lanka increases attention and importance on nutritional surveillance research (25, 26, 130); the seven-year gap between the most recent Sri Lankan STEPS surveys (conducted in 2008 and 2015) highlights the need for contextually-validated, efficient, and easy to use dietary surveillance supplements (131). Other methods currently used in the Sri Lankan NCD research context make important contributions but have practical constraints. The contextually-validated Food Frequency Questionnaire for Sri Lankan Adults (SLFFQ) incurs both high memory and analysis burden (132) and the ‘international’ 24-hour Dietary Recall (24DR) requires up to one hour to complete and a highly trained interviewer to administer (133, 134). The Sri Lankan Brief Dietary Survey (SLBDS) (Appendix V) was therefore developed with the following considerations in mind: 1) context suitability; 2) low administration burden for participants and researchers; 3) rapid and straightforward analysis; 4) suitability for repeat assessments in large-scale follow-up studies; 5) low respondent fatigue in a multi-risk factor survey; and 6) ability to provide useful health-related information to inform population-level policy and interventions.

The objective of this chapter is therefore to assess the relative validity of a newly developed brief dietary survey to estimate food intake and adherence to the Food Based Dietary Guidelines for Sri Lankans (SLFBDGs), using a 24DR (133) as reference. SLBDS content and structure are based on the SLFBDGs (135). The core food groups outlined in the SLFBDGs and used in the SLBDS are (1) ‘Rice, bread, other cereals and yams’; (2) ‘Fruit’; (3) ‘Vegetables’; (4) ‘Fish, pulses, meat and eggs’; (5) ‘Milk or milk products’; and (6) ‘Nuts and oil seeds’. NCD-relevant food/beverage categories and items addressed in the wider SLFBDG document are also included in the survey: (7) ‘Sweetened drinks, sweets and desserts’; (8)

'Fast food'; (9) 'Salt'; and (10) 'Tea and coffee'. Within each of these categories, commonly consumed foods and beverages were defined by consulting the SLFBDGs, SLFFQ, and local nutrition researchers. The SLFBDGs provide numerical daily recommendations in the form of serving sizes for food groups 1 to 6 and salt intake (< 5g (1 tsp)/day) and general intake advice (non-numerical) for food and beverage categories 7, 8, and 10. This makes it possible for the SLBDS to assess adherence to dietary guideline recommendations. The SLBDS, available in English, Sinhala, and Tamil, is one A4 sheet in size. It asks 37 questions about the amount of food and beverages consumed in prescribed quantities (for example, number of whole eggs); 17 yes/no diet-related questions (for example, "did you eat Western fast food yesterday?"); and two open-ended questions that probe for information on special diets (for example, vegetarian diet) and atypical intake pertaining to participant consumption over the past 24-hour period. The survey also records respondent age, ethnicity, sex, and place of residence.

4.3 Methods

Figure 4.1 provides an overview of the SLBDS relative validation process, from face validation and pre-testing to survey administration and statistical analyses. These steps are outlined in further detail below.

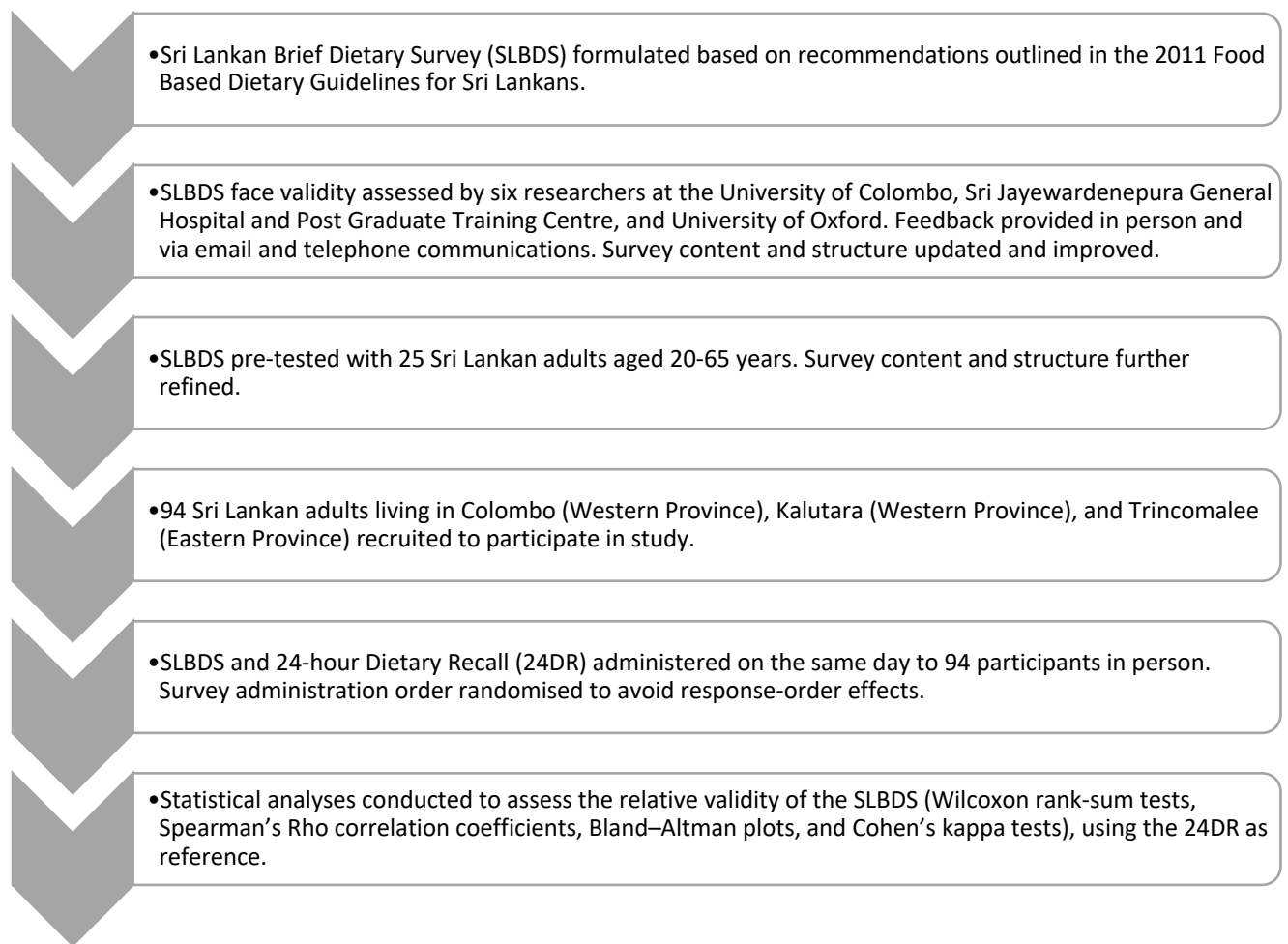


Figure 4.1. Relative validation process

4.3.1 Face validity and pre-testing

Face validity, a process whereby the SLBDS was subjectively viewed as covering what it purported to measure, was assessed by six researchers at the University of Colombo, Sri Jayewardenepura General Hospital and Post Graduate Training Centre, and University of Oxford. This process was conducted in person and via email and telephone interviews. The feedback and discussion generated through this process focussed on prescribed SLBDS intake units (for example, coconut spoons versus cups versus tablespoons) and how best to measure notoriously difficult to capture oil, salt, and coconut intake, with researchers divided on whether to measure intake frequency (i.e., number of times item consumed in a

24-hour period) or intake amount. In the latter case, the decision was taken to record both. Clarity of survey wording and format was further refined through pre-testing with 25 Sri Lankan adults aged 20 to 65 known to our research network.

4.3.2 Criterion validity testing (relative validation)

The face validated and pre-tested version of the SLBDS was subsequently tested against the 24DR to determine criterion-related validity – i.e., how well the new SLBDS estimated 24-hour food intake and adherence to the SLFBDGs compared to the reference method (24DR). This reference method was selected because of its use in prior brief instrument validation studies and its statistically significant comparability to the ‘gold standard’ self-report 7-day weighed-intake dietary record (7DWR) in the target population (134). The 24DR has a similar objective to the SLBDS and measures intake over the same time frame (24 hours) whilst differing in its reliance on memory and portion size reporting format. These similarities and differences make the 24DR an appropriate reference method for this study (125, 136).

4.3.2.1 Study sample

Between December 2018 and February 2019, both the SLBDS and the 24DR were administered to a sample of 94 Sri Lankan adults living in urban Colombo, and urban and rural sectors in Kalutara and Trincomalee. The Trincomalee district is located in the majority Moor and Muslim Eastern Province, whereas both Colombo and Kalutara are majority Sinhalese and Buddhist Western provinces. A sample size calculation was conducted to determine the sample size required to detect a low correlation between results from the test and reference surveys ($r = 0.3$) with alpha and beta set to 95% and 80% respectively, and accounting for a 10% participant dropout rate. Divisional Secretaries of Colombo,

Kalutara, and Trincomalee were contacted to obtain electoral lists for each Grama Niladhari Division (GND) within the district and gain permission to visit individual households for data collection. Adults aged 18 years or older who were willing and able to provide informed consent were eligible for inclusion. Data collection started at a randomly selected location within the district. From that starting point, the nearest house appearing in the relevant electoral list was approached. If a consenting adult was present, the third house to the left was approached for the next interview, and so on. If more than one eligible adult was present in the household, the interviewee was selected by drawing lots. If an eligible adult was not present or did not consent, the house next door was approached. This recruitment method was followed until 56, 29, and nine participants in Colombo, Kalutara, and Trincomalee, respectively, were recruited.

4.3.2.2 Dietary assessment

Each participant completed two consecutive face-to-face interviewer-administered dietary surveys, the SLBDS (new tool) and a 24DR (reference method), in the participant's preferred language: Sinhala (n = 85) or English (n = 9). As the surveys were administered one after the other during the same visit, administration order was randomised to avoid response-order effects. Data collection was undertaken in participants' homes by two experienced female Sri Lankan researchers (BK and SF), with 50% of the study sample randomly allocated to each interviewer (i.e., the same interviewer applied both dietary surveys). Data collectors were consulted during the survey development phase and trained through role play and practice interviews with members of the research team to deliver the surveys uniformly, closely following the provided templates and corresponding instructions.

Both surveys are structured dietary assessment tools that ask participants to recall their food and beverage consumption during the previous 24 hours – a short recall period that has proven useful for minimising recall bias (137). The two surveys differ in length, degree of survey structure, memory requirements, recall process, detail captured, and analysis burden (Table 4.1). The same standard household utensils were referenced to obtain information on portion sizes in both surveys and each queried whether or not the day being recalled was typical of participants' usual food intake, with interviewers prompting atypical responses for further explanation. Vegetarian status and special diets were also recorded on the paper-based templates provided.

Table 4.1. Comparison of Sri Lankan Brief Dietary Survey and 24-hour Dietary Recall characteristics

Dietary assessment characteristics	Sri Lankan Brief Dietary Survey (SLBDS)	24-hour Dietary Recall (24DR)
Study design	Cross-sectional	Cross-sectional
Time period of interest	Previous 24 hours	Previous 24 hours
Information queried	Specific components of diet (excluding contextual details)	Total diet (including contextual details)
Survey structure and length	Structured 1 A4 page Reporting units prescribed	Structured Variable length Reporting units not prescribed
Time required to complete	5 – 15 minutes	30 minutes – >1 hour

Recall requirements	Total consumption by food group in prescribed units	Consumption as recalled
Data coding and analysis	Data coding and unit conversion not required	Data coding and unit conversion required

4.3.2.2.1 Administration of the Sri Lankan Brief Dietary Survey

Using the SLBDS, interviewers asked participants if they had consumed each of the following food groups: (1) ‘Rice, bread, other cereals and yams’; (2) ‘Fruit’; (3) ‘Vegetables’; (4) ‘Fish, pulses, meat and eggs’; (5) ‘Milk or milk products’; (6) ‘Nuts and oil seeds’; as well as (7) ‘Sweetened drinks, sweets and desserts’; (8) ‘Fast food’; (9) ‘Salt’; and (10) ‘Tea and coffee’ in the past 24 hours, and if ‘yes’, what portions (in prescribed units) of specific foods (also prescribed) within each group they consumed. After a first pass of the survey, the interviewer revisited unanswered questions.

4.3.2.2.2 Administration of the 24-hour Dietary Recall

Detailed food and beverage consumption information was collected from participants using the 24DR method. Uninterrupted and in their own words, participants were asked to list everything they had consumed, including food and drink items and their corresponding quantities, the previous day (from waking to evening). The interviewer then probed this list for additional information: consumption time and location; item brand; further item description; and leftovers. To conclude the interview, respondents were given a further opportunity to provide additional information/detail on their 24-hour intake.

4.3.3 Statistical analyses

All 188 surveys were first verbatim transcribed and translated into English by one Sri Lankan researcher (SF) and then entered into Excel with 24DR data hand coded and summed to reflect SLBDS food groups/categories (1 to 10 listed above) (JR). Coding was blinded to the results of the SLBDS to avoid bias. This was achieved by coding the 24DR survey results before access was gained to SLBDS data. A chi-square test was used to determine whether participant characteristics differed by participant sex. As most of the dietary data were not normally distributed, the median and interquartile range (IQR) for intake of each food group and food/beverage item (based on serving size where specified in the SLFBDGs and portion size where unspecified) reported in the SLBDS and 24DR were calculated. Wilcoxon rank-sum tests were used to assess the statistical differences between medians. Correlation (r) between individual intakes collected by each measure was determined using Spearman's Rho tests. The use of these non-parametric tests ensures that spikes at 'zero consumption' do not invalidate statistical assumptions. To detect differences and bias between the two methods, differences were plotted against means in Bland-Altman plots. Cohen's kappa (k) with 95% confidence intervals were estimated to measure the inter-rater reliability for comparing achievement of recommended food group intake (where 0 = not achieved and 1 = achieved) based on the SLFBDGs between the new and reference method. For yes/no SLBDS questions: "Did you consume Western or local fast food yesterday?" and "Did you add salt, sauce/ketchup or chutney/chilli paste to your breakfast/lunch/dinner/snack?", 'yes' responses were assigned a score of 1 and 'no' a zero. 24-hour Dietary Recall data were coded similarly by assigning the reporting of fast food (Western and local) and salt intake at specified meal times (breakfast, lunch, dinner, and snack) a score of 1 (if intake was reported) and zero (if no intake was reported). The unweighted kappa statistic describes the

level of agreement over and above chance agreement between the two measures as slight (0-0.20), fair (0.21-0.40), moderate (0.41-0.60), substantial (0.61-0.80), and almost perfect (> 0.81) (138). To assess whether the SLBDS was an equally valid measure of dietary intake for both female and male participants, the results for each of these agreement analyses were calculated separately in females and males as a secondary analysis. A p value < 0.05 was considered as evidence against the null hypothesis. All statistical analyses were conducted in R version 4.0.1.

4.3.4 Ethical approval

Ethics approval for this study, which also covers the data collection and analysis in Chapters 5 and 6, was received from the ethical review committee of the Faculty of Medicine, University of Colombo (Ref: EC-18-111) and the Oxford Tropical Research Ethics Committee (OxTREC), University of Oxford (Ref: 561–18). Written informed consent was obtained from each participant prior to data collection. Compensation for participation was not provided.

4.4 Results

Ninety-four Sri Lankan adults, including 62 females and 32 males aged 18 to 65 (mean = 40.7, SD = 12.6), agreed to participate in the study. Compared to female participants, male participants were more likely to report their dietary intake over the previous 24 hours as atypical. There were no statistically significant differences between females and males with respect to age, ethnicity, place of residence, vegetarian status, and adherence to special diets. All 94 participants completed the two dietary surveys, in varying degrees of detail, and were included in analyses. SLBDS and 24DR administration time ranged from five to 15

minutes and 30 minutes to over an hour, respectively. Participant characteristics are described in Table 4.2.

Table 4.2. Participant characteristics (n = 94)

Characteristic	Females (n=62)	Males (n=32)	p value
	n		
Age group (in years)			0.39
18-29	16	6	
30-44	21	10	
45-59	18	13	
60+	5	2	
Information not provided	2	1	
Ethnicity (self-defined)			0.29
Muslim	5	2	
Sinhala	54	26	
Tamil	3	4	
District			0.33
Colombo	39	17	
Kalutara	19	10	
Trincomalee	4	5	
Sector			0.70
Urban	45	22	
Rural	17	10	
Estate	0	0	
Vegetarian			0.63
Yes	1	1	

No	61	31	
Adheres to special diet			0.21
Yes	2	3	
No	60	29	
Recall period reported as 'typical'			0.01
Yes	56	24	
No	3	7	
Information not provided	3	1	

Table 4.3 presents the median and interquartile range (IQR) for the number of servings consumed for each of the six main food groups of the SLFBDGs as recorded by the SLBDS and 24DR. Median (IQR) 'Fish, pulses, meat and eggs' intake from the SLBDS (3.3 (2.0-5.0) daily servings) was the only food group that was significantly underestimated ($p < 0.05$) when compared to corresponding values recorded by the 24DR (4.0 (3.0-5.6) daily servings). For all other SLFBDG food groups (Table 4.3) and food/beverage items that do not carry a numerical daily intake recommendation in the guidelines (Table 4.4), there was no evidence of difference between data collected by the SLBDS and 24DR methods.

Table 4.3. Median (IQR) for the number of servings consumed for six food groups as recorded by the SLBDS and 24DR

Food group	Recommended daily servings	Daily servings (SLBDS)	Daily servings (24DR)	p value
		Median (IQR)	Median (IQR)	
Rice, bread, other cereals and yams	6 - 11	6.0 (4.0-8.0)	6.3 (4.3-8.9)	0.38

Fruit	2 - 3	1.0 (0.0-1.2)	0.0 (0.0-1.0)	0.17
Vegetables	3 - 5	1.0 (0.3-1.7)	1.7 (0.7-1.8)	0.09
Fish, pulses, meat and eggs	3 - 4	3.3 (2.0-5.0)	4.0 (3.0-5.6)	0.03
Milk and dairy products	1 - 2	1.0 (0.3-1.5)	1.0 (0.3-1.4)	0.46
Nuts*	2 - 4	0.0 (0.0-0.0)	0.0 (0.0-0.0)	1.00

*The unstructured 24DR was ill-equipped to collect information on the *amount* of oil intake and none of the participants volunteered this information. Median (IQR) oil consumption could therefore not be compared between the two tools.

Table 4.4. Median (IQR) for the number of portions consumed for six food and beverage items as recorded by the SLBDS and 24DR

Food / beverage	Guideline recommendation	Daily servings (SLBDS)	Daily servings (24DR)	p value
		Median (IQR)	Median (IQR)	
Desserts	“Take less sugar, sweets or sweetened drinks.”	0.0 (0.0-0.0)	0.0 (0.0-0.0)	1.00
Sweets		0.0 (0.0-1.0)	0.0 (0.0-1.0)	0.88
Sweet fizzy drinks		0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.24
Jaggery		0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.69
Sugar		2.0 (0.0-4.0)	2.0 (0.0-4.0)	0.82
Tea/coffee	“Tea without milk and sugar has certain advantages. It is advisable to avoid tea/coffee closer to a main meal, as it will reduce iron absorption.”	2.0 (1.0-2.8)	2.0 (1.0-2.0)	0.76

The open-response format of the 24DR meant that participants were able to report the consumption of items that were not included in the SLBDS. These items included buns and bakery products; butter; Milo milk packets; Nestomalt/Viva/Sustagen; savoury biscuits; soya meat; and alcohol. Alcohol was the only example of an item not queried in the SLBDS for which two participants offered consumption data because they thought *“it was important for researchers to know this information in the context of health-related research”* (Male participant, Colombo).

Correlation between individual intakes collected by each measure was determined using Spearman’s Rho tests. Spearman’s Rho scores ranged at the food group level from 0.73 (‘Vegetables’) to 0.84 (‘Milk and dairy products’) and from 0.40 (‘curd’) to 1.00 (‘dosa’, ‘hoppers’, ‘milk rice’, ‘dried fish’) for specific food and beverages (Table 4.5). Eighty-five percent of surveyed food items showed correlations > 0.70 , with three of the 34 items showing correlations between 0.56 and 0.69 (‘pasta/noodles’, ‘cooked vegetables’, and ‘cheese’) and two having correlations of 0.40 (‘curd’) and 0.43 (‘yoghurt’), both of which were underreported in the 24DR. These results indicate strong validity at the food group level for the SLBDS and for 85% of individual items, and moderate and low validity for 9% and 6% of items, respectively. Sex-disaggregated results show that correlations for ‘pasta/noodles’ (female: $r=0.38$, male: $r=1.00$), ‘pieces of large fruit’ (0.68, 0.85), ‘medium size sweets’ (0.60, 0.95), and ‘sweet fizzy drinks’ (0.67, 0.93) were weak or moderate in females compared to strong for males in those same categories. Correlations for ‘cooked vegetables’ (0.74, 0.65), ‘raw vegetables’ (0.83, 0.50), and ‘whole eggs’ (0.97, 0.68) were moderate in males compared to strong correlations reported for females. Only one food

group, 'Vegetables' (0.82, 0.56), showed a comparatively weaker correlation for male than female participants.

Table 4.5. Spearman's Rho between mean daily servings of food groups and specified foods recorded by the SLBDS and 24DR

Food groups and specified food and beverages	Total (N=94)		Females (n=62)		Males (n=32)	
	Spearman's r value	p value	Spearman's r value	p value	Spearman's r value	p value
Rice, bread, other cereals and yams	0.82	< 0.001	0.81	< 0.001	0.79	< 0.001
Bread	0.82	< 0.001	0.87	< 0.001	0.73	< 0.001
Dosa	1.00	< 0.001	1.00	< 0.001	1.00	< 0.001
Hoppers	1.00	< 0.001	1.00	< 0.001	1.00	< 0.001
Milk rice*	1.00	< 0.001	1.00	< 0.001	-	-
Pasta/noodles	0.56	< 0.001	0.38	0.003	1.00	< 0.001
Pittu	0.82	< 0.001	0.71	< 0.001	1.00	< 0.001
Rice	0.93	< 0.001	0.93	< 0.001	0.86	< 0.001
Roti	0.93	< 0.001	0.95	< 0.001	0.90	< 0.001
String hoppers	0.87	< 0.001	0.86	< 0.001	0.89	< 0.001
Yam/potato/jackfruit/breadfruit	0.82	< 0.001	0.80	< 0.001	0.83	< 0.001
Fruit	0.81	< 0.001	0.81	< 0.001	0.79	< 0.001
Fruit juice	0.94	< 0.001	0.93	< 0.001	1.00	< 0.001
Fruit salad*	0.70	< 0.001	0.70	< 0.001	-	-
Medium size fruit	0.87	< 0.001	0.90	< 0.001	0.79	< 0.001

Pieces large fruit	0.75	< 0.001	0.68	< 0.001	0.85	< 0.001
Vegetables	0.73	< 0.001	0.82	< 0.001	0.56	< 0.001
Cooked vegetables	0.69	< 0.001	0.74	< 0.001	0.65	< 0.001
Raw vegetables	0.74	< 0.001	0.83	< 0.001	0.50	0.003
Fish, pulses, meat and eggs	0.83	< 0.001	0.83	< 0.001	0.77	< 0.001
Cooked pulses	0.73	< 0.001	0.71	< 0.001	0.75	< 0.001
Dried fish	1.00	< 0.001	1.00	< 0.001	1.00	< 0.001
Dry sprat	0.75	< 0.001	0.77	< 0.001	0.79	< 0.001
Meat/poultry/fresh fish	0.86	< 0.001	0.85	< 0.001	0.85	< 0.001
Whole eggs	0.86	< 0.001	0.97	< 0.001	0.68	< 0.001
Milk and dairy products	0.84	< 0.001	0.86	< 0.001	0.82	< 0.001
Cheese	0.66	< 0.001	0.70	< 0.001	0.72	< 0.001
Curd*	0.40	< 0.001	0.39	0.002	-	-
Fresh milk	0.86	< 0.001	0.77	< 0.001	1.00	< 0.001
Milk powder	0.91	< 0.001	0.93	< 0.001	0.88	< 0.001
Yoghurt*	0.43	< 0.001	0.51	< 0.001	-	-
Nuts and oil seeds						
Nuts	0.83	< 0.001	0.83	< 0.001	0.82	< 0.001
Other						
Medium size desserts	0.85	< 0.001	0.80	< 0.001	1.00	< 0.001
Medium size sweets	0.73	< 0.001	0.60	< 0.001	0.95	< 0.001
Sweet fizzy drinks	0.78	< 0.001	0.67	< 0.001	0.93	< 0.001
Jaggery*	0.85	< 0.001	0.84	< 0.001	-	-

Sugar	0.88	< 0.001	0.86	< 0.001	0.94	< 0.001
Tea/coffee	0.86	< 0.001	0.83	< 0.001	0.91	< 0.001

*Correlation estimates for 'milk rice', 'fruit salad', 'curd', 'yoghurt', and 'jaggery' intake in males could not be calculated because there was no variance in the sample.

Visual exploration of agreement between the SLBDS and 24DR using Bland-Altman plots (Figure 4.2) showed that for 'Rice, bread, other cereals and yams', there is minimal difference between the intake recorded on the tested method compared to the reference method between 0-10 servings. At > 10 servings, the SLBDS tended to overestimate recorded intake compared with the reference method. 'Vegetable' intake was similarly measured by the two methods, with the SLBDS tending to slightly overestimate intake as the number of servings consumed increased. There was relatively little variation across all levels of intake for 'Fruit', showing acceptable agreement between the two methods. 'Fish, pulses, meat and eggs', 'Milk and dairy products', and 'Nuts' all tended to be slightly underestimated by the SLBDS compared to the 24DR as the number of servings consumed increased. For each category, less than 6% of participants fell outside of the limits of agreement (LA).

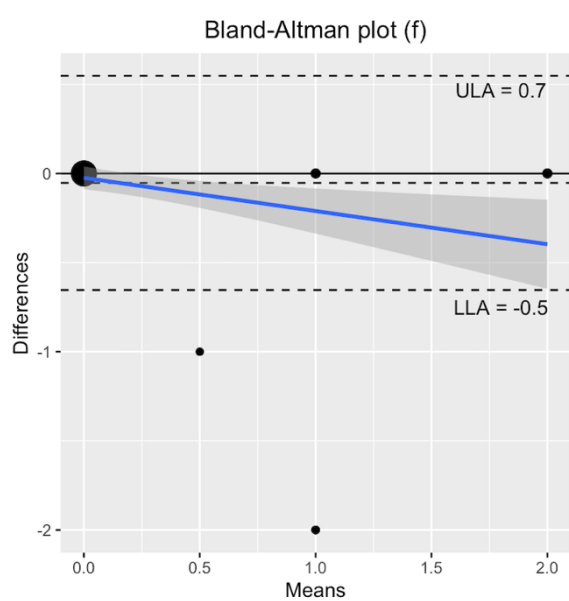
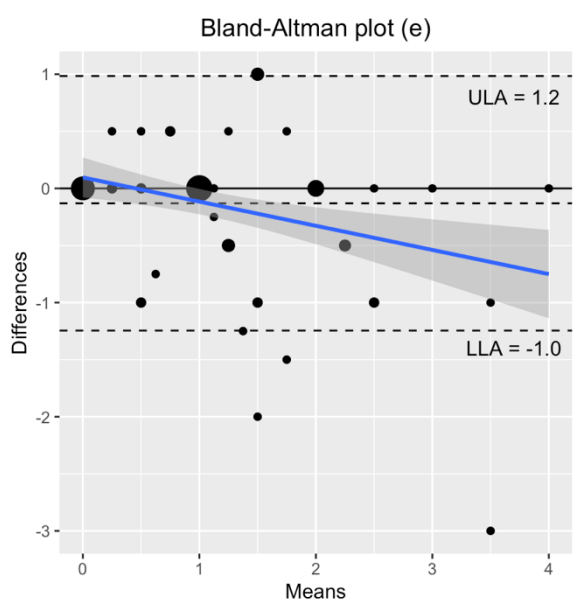
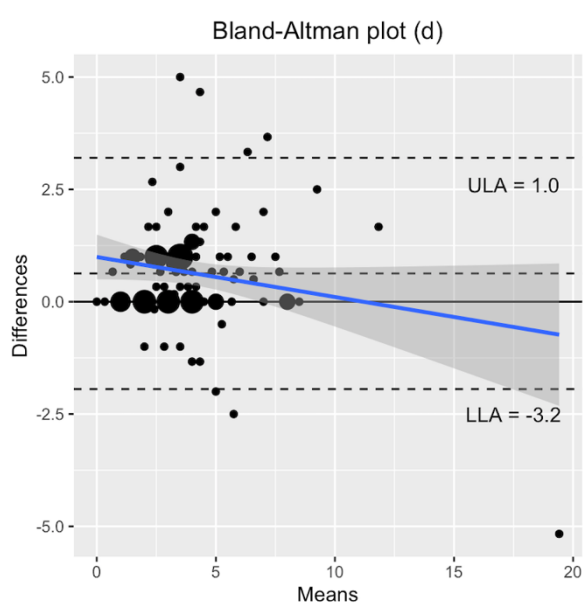
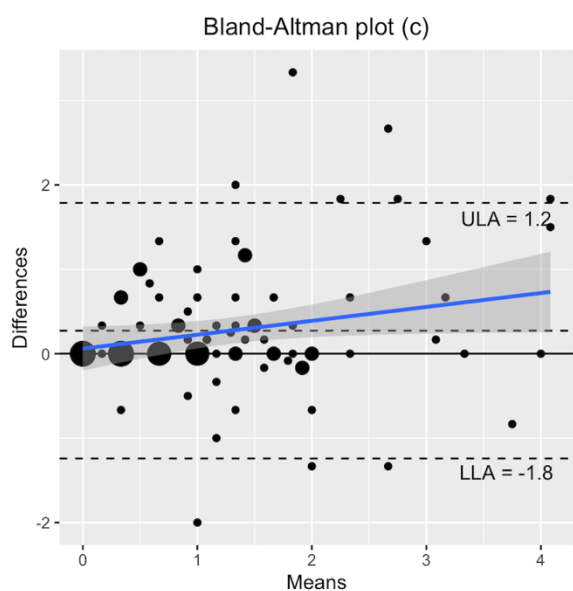
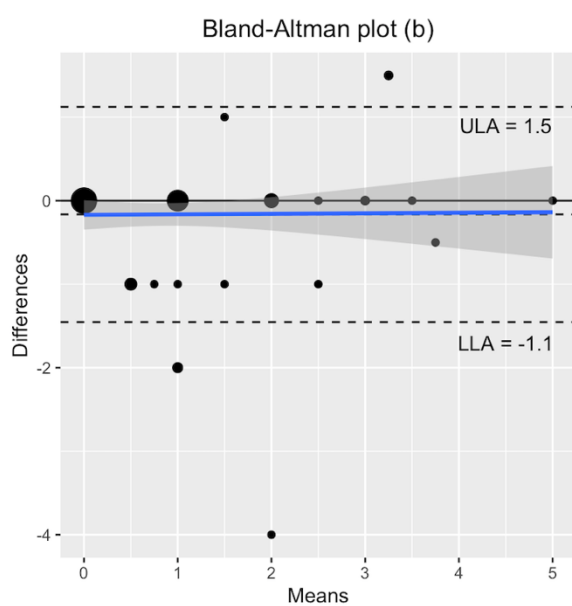
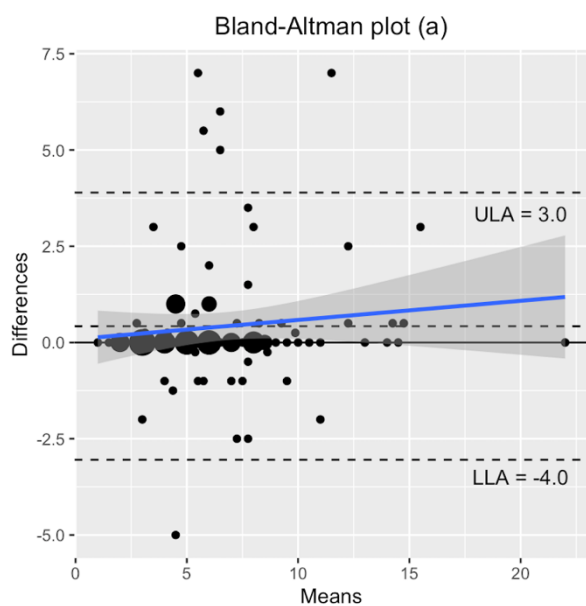


Figure 4.2. Bland-Altman plots for **(a)** Rice, bread, other cereals and yams; **(b)** Fruit; **(c)** Vegetables; **(d)** Fish, pulses, meat and eggs; **(e)** Milk and dairy products; **(f)** Nuts. The size of data points is proportional to the number of observations at each value. ULA = upper limit of agreement; LLA = lower limit of agreement.

Table 4.6 presents kappa (κ) statistics and 95% confidence intervals for agreement between participant achievement of the SLFBDG recommendations calculated from the SLBDS and 24DR. K values range from 0.59 (95% CI: 0.32-0.86) for ‘Vegetables’ to 0.81 (95% CI: 0.66-0.96) for ‘Fruit’ indicating a moderate to strong level of agreement. Sex disaggregated kappa statistics (Table A4) do not indicate statistically significant sex-based differences.

Table 4.6. Cohen's kappa for agreement between achievement of the Sri Lankan Food Based Dietary Guideline recommendations calculated from the SLBDS and 24DR

Food groups	Total (N=94)		
	% participants who achieved SLFBDG recommendation (95% CI)		κ value (95% CI)
	SLBDS	24DR	
Rice, bread, other cereals and yams	52.1 (42.0, 62.2)	57.5 (47.5, 67.4)	0.76 (0.63, 0.89)
Fruit	23.40 (14.9, 32.0)	19.2 (11.2, 27.1)	0.81 (0.66, 0.96)
Vegetables	7.5 (2.3, 12.8)	12.8 (6.0, 19.5)	0.59 (0.32, 0.86)
Fish, pulses, meat and eggs	64.9 (55.3, 74.6)	78.7 (70.5, 87.0)	0.61 (0.45, 0.78)
Milk and dairy products	34.0 (24.5, 43.7)	30.9 (21.5, 40.2)	0.64 (0.47, 0.80)

Table 4.7 presents kappa (k) statistics and 95% confidence intervals for food and beverage items ('medium size desserts'; 'medium size sweets'; 'sweet fizzy drinks'; 'sugar'; 'jaggery'; 'tea/coffee') surveyed in the SLBDS for which numerical intake recommendations are not outlined in the SLFBDGs. Consumption data in both the SLBDS and 24DR was assigned a score of 0 (if an intake of zero portions was reported) or 1 (if reported intake was > 0 portions) and the kappa statistic was calculated for each. The calculated k values range from 0.71 (95% CI: 0.56-0.86) for 'medium size sweets' to 0.85 for both 'medium size desserts' (95% CI: 0.71-0.99) and 'jaggery' (95% CI: 0.65-0.92) indicating a strong level of agreement between the number of participants reporting consumption > 0 for the six food items listed above in both the SLBDS and 24DR. Sex-disaggregated kappa statistics (Table A5) show no evidence for sex-based differences in agreement.

Table 4.7. Cohen's kappa for agreement between number of participants reporting consumption > 0 in both the SLBDS and 24DR

Food and beverage item	Total (N=94)		
	% participants that reported consumption > 0		κ value (95% CI)
	servings (95% CI)		
	SLBDS	24DR	
Medium size desserts	17.0 (9.4, 24.6)	17.0 (9.4, 24.6)	0.85 (0.71, 0.99)
Medium size sweets	34.4 (24.5, 43.6)	31.9 (22.5, 41.3)	0.71 (0.56, 0.86)
Sweet fizzy drinks	18.1 (10.3, 25.9)	11.7 (5.2, 18.2)	0.75 (0.56, 0.94)
Jaggery	4.3 (0.2, 8.3)	3.2 (0.0, 6.7)	0.85 (0.57, 1.00)
Sugar	66.0 (56.4, 75.5)	69.2 (59.8, 78.5)	0.78 (0.65, 0.92)
Tea/coffee	82.0 (74.2, 89.8)	83.0 (75.4, 90.6)	0.74 (0.56, 0.92)

Table 4.8 presents kappa (k) statistics and 95% confidence intervals for yes/no SLBDS questions: “Did you consume Western or local fast food yesterday?” and “Did you add salt, sauce/ketchup or chutney/chilli paste to your breakfast/lunch/dinner/snack?”. A strong level of agreement between fast food reporting in the SLBDS and 24DR is indicated by high k values: 0.80 (95% CI: 0.68-0.93) for ‘Fast food’ (any type); 0.81 (95% CI: 0.68-0.95) for ‘local’; and 0.79 (95% CI: 0.64-0.94) for ‘Western’. Sex-disaggregated k values do not suggest statistically significant differences in fast food reporting on the two surveys between females and males (Table A6). K values for reporting of salt intake at different meal times are low, ranging from 0.03 to 0.09, indicating slight agreement between the number of participants reporting their salt consumption on the SLBDS and the 24DR. There is no evidence for sex-based differences in agreement for the reporting of salt intake (Table A6).

Table 4.8. Cohen's kappa for agreement between number of participants reporting consumption of fast food and salt intake in both the SLBDS and 24DR

Food and beverage item	Total (N=94)		
	% participants that reported consumption > 0 servings (95% CI)		κ value (95% CI)
	SLBDS	24DR	
Fast food	43.6 (33.6, 53.6)	42.6 (32.6, 52.6)	0.80 (0.68, 0.93)
Western	26.6 (17.7, 35.4)	19.2 (11.2, 27.1)	0.79 (0.64, 0.94)
Local	25.5 (16.7, 34.4)	28.7 (19.6, 37.9)	0.81 (0.68, 0.95)
Added salt			
Breakfast	95.7 (91.7, 99.8)	52.1 (42.0, 62.2)	0.09 (0.01, 0.18)
Lunch	95.7 (91.7, 99.8)	42.6 (32.6, 52.6)	0.06 (0.00, 0.13)
Dinner	95.7 (91.7, 99.8)	43.6 (33.6, 53.6)	0.03 (-0.04, 0.10)

Snack	96.8 (93.3, 100.0)	27.7 (18.6, 36.7)	0.03 (0.00, 0.05)
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The SLBDS specifically queried oil (method, reheating, and amount) and coconut (fresh and powder) consumption. For both oil and coconut, no intake information was reported in the 24DR for either amount consumed or whether oil used in cooking was reheated. Conversely, a greater proportion of participants specified method of cooking with oil (for example, fried, deep fried, and tempered) in the 24DR (97%) compared with the SLBDS (71%). All k values for oil and coconut reporting were low, ranging from 0.00 to 0.15 (Table A7). Sex-disaggregated k values do not indicate significant differences in oil and coconut reporting between female and male participants (Table A8).

4.5 Discussion

The SLBDS was developed for and relatively validated with the study population in question to assess food intake and adherence to the SLFBDG recommendations for potential use as a dietary surveillance supplement and in multiple risk factor NCD studies (such as the SLNCDS). In this chapter, the SLBDS's relative validity has been demonstrated in comparison to a 24DR that has been previously validated against a 7DWR in the target population (134). At the food group level, the SLBDS performed well. Correlations between intake recorded on the new and reference tool were strong ($r > 0.73$) and agreement between recommendation adherence calculated by the two tools was moderate to strong. At the food and beverage item level, 85% of surveyed items showed correlations > 0.7 , with five of the 34 items showing correlations between 0.40 and 0.69. There was no evidence of difference in agreement between female and male participants.

It was not possible to compare salt and cooking oil intake as well as fresh and powdered coconut consumption between the two methods that were primarily intended to investigate food, and not nutrient, intake. The 24DR failed to capture any data on the amount of coconut, cooking oil, and salt consumed by participants. Difficulties and inconsistencies in measuring self-reported added salt and oil intake are not unique to this study and are well-documented in the literature (28, 139, 140). This is in part due to the fact that salt and fats are often 'hidden' in foods; salt, oil, and coconut are not always added in exact amounts during cooking; and participants who are not involved in food preparation cannot be expected to recall accurately meal ingredients in dietary surveys. In the Sri Lankan context, capturing intake is further hindered by the absence of an updated, consensus nutritional composition database for Sri Lankan foods (141, 142). Given nonoptimal intake of dietary fat and salt are established dietary risk factors for the development of NCDs and self-report measures are widely utilised in diet-disease research, accurate and appropriate measurement of these commonly consumed yet underreported nutrients remains a challenge (143-145). Context-specific qualitative studies that explore how people use and consume coconut, oil, and salt, and importantly, how they report use and consumption in their own words are necessary for tool revision and improvement. Over 95% of participants recorded whether they added salt or salty sauce to meals (breakfast, lunch, dinner, and snack) when prompted by the SLBDS, as compared to 28% (snack) to 52% (breakfast) on the 24DR when asked about meal ingredients. This demonstrates the utility of the SLBDS in prompting reporting of salt intake data akin to that collected by the WHO STEPS instrument which asks participants 'how often' salt is added to food and cooking (with possible answers ranging from 'Never' to 'Always') (131). However, in the absence of objective (for example,

a 24-hour urinary assessment) or repeat self-report measurements, it is difficult to conclude which survey – the SLBDS or 24DR – reported ‘true’ intake. Multiple administrations of the SLBDS at non-consecutive time points would be required to capture daily variability and average consumption patterns – for salt and all other dietary components queried – over time. Prompting participants for information on oil reheating on the SLBDS was another feature of the SLBDS not present in the 24DR.

4.5.1 Study limitations

A key limitation of this study is that it only included participants from three of 25 districts in Sri Lanka, which limits the generalisability of findings. Collecting additional demographic data, including employment status, education, income, and whether or not survey participants are involved in food preparation would provide additional information to support SLBDS validity and subsequent context-specific improvements for different subsets of the population. This study assessed the relative validity of the SLBDS but did not investigate test-retest reliability – a key performance characteristic for the selection of dietary surveillance measures that capture ‘usual intake’. Further research with a larger and more diverse study sample that tests the validity and reliability of the SLBDS against an unbiased measure of true intake or multiple ‘error-prone’ reference measures (convergent validity) is therefore required before the SLBDS can be utilised widely to measure the dietary intake of the Sri Lankan adult population (146, 147). In the context of nutrition intervention research, it is also prudent to measure a tool’s sensitivity or responsiveness to change – i.e., a measurement method’s ability to detect dietary intake changes under intervention conditions. Further research that tests the SLBDS’s sensitivity to change is therefore also recommended (148, 149). Study districts were selected to represent a range

of Sri Lankan demographics. Participants in this study, however, were low consumers of certain food items. It is therefore also recommended that the SLBDS be tested in populations with different patterns of consumption (Table A9).

4.5.2 Implications of this research

Food consumption surveys provide vital information for the formulation, implementation, and evaluation of appropriate and effective diet-related policies and targeted programmes. A validated research tool that is able to measure population diets and adherence to the SLFBDGs is therefore necessary to track progress towards national health and nutrition goals (32). The SLBDS responds to this need, providing a contextually-appropriate dietary surveillance measure that has clear public health relevance. Depending on the specific research question of interest, single food groups that demonstrated strong correlation and agreement in the SLBDS can be queried in lieu of administering the SLBDS in its entirety or the more time and resource intensive 24DR, FFQ, and STEPS survey.

The more detailed 24DR captured intake of food/beverages not included on the SLBDS or in the SLFBDGs. Notably, this study did not assess the appropriateness or comprehensiveness of the current SLFBDGs that were last updated in 2011 or the health benefits of complying with guideline recommendations. Future research should focus on updating the SLFBDGs to continue to reflect population diets under conditions of nutrition transition and to integrate contextually-appropriate environmental sustainability considerations that contribute to the achievement of global environmental targets (150). The health and environmental implications of adopting current and updated guideline recommendations should also be

assessed – projects that might be assisted by or contribute to the continual improvement of the SLBDS.

This study supports a shift toward focussing attention on comparable surveillance outcomes (i.e., achievement of recommended daily intake for different food groups) over prioritising the consistent use of ‘off the shelf’ tools – a shift that may have implications for reducing errors associated with self-report dietary measurement methods (151). The development of consensus portion size conversion guidelines for the Sri Lankan population would further facilitate the ability to compare study outcomes and make the survey innovation process and subsequent validation against existing tools easier for researchers.

Future research might also explore online delivery of the SLBDS to further reduce administration and analysis burden; potential interviewer and social desirability bias; the time and cost associated with administering repeat surveys; and to support real-time translation of data for evidence-based decision-making. Other dimensions of tool validation, including social validity – i.e., whether participants feel the SLBDS is an acceptable and important research tool – are also important to explore and feed back into future survey development efforts.

4.6 Conclusion

Addressing the problem of suboptimal diet requires context-specific solutions informed by context-specific data collected by context-specific tools. The findings from this chapter demonstrate that the SLBDS shows promise as a fit for purpose research tool to supplement

and support dietary surveillance activities in Sri Lanka – meeting the needs of SLNCDS researchers and Chapter 3 interviewees. The next steps are to assess SLBDS test-retest reliability, as well as other qualitative dimensions of tool validation that may increase the accuracy and representativeness of data collected. The next chapter addresses the latter.

Chapter 5. Factors that impact Sri Lankan Brief Dietary Survey participation, engagement, and social validity among Sri Lankan adults, with a focus on gender

At the time of thesis submission, a paper based on the study presented in this chapter is under review for publication at *BMC Nutrition*. Submitted manuscript authors include: Renzella J, Fernando S, Kalupahana B, Rayner M, Scarborough P, and Townsend N.

5.1 Chapter summary

Whilst Chapter 4 presented the results from a quantitative validation exercise to assess Sri Lankan diets, it did not explore other dimensions of tool validation that may increase the accuracy and representativeness of data collected. This chapter therefore employs semi-structured interviews conducted with Chapter 4 participants to identify the various factors that might impact SLBDS participation, engagement, and social validity. Interview data were analysed thematically and are presented as non-hierarchical thematic networks. Study participants identified a number of factors that influenced their survey participation and engagement. These included the time of day interviews occur, recall ease, level of commitment required, perceived survey value, emotional response to surveys, and interviewer positionality. Many of these factors were gendered, but both female and male participants expressed a preference for engaging with socially valid research that they felt justified their personal investment in data collection. When explicitly asked to share ideas about how to improve the surveys, many participants opted not to provide suggestions as they felt they lacked the appropriate expertise. The findings presented in this chapter have

implications for the accuracy and equity of data collected by the SLBDS, as well as dietary surveillance activities more generally, and ultimately the appropriateness and effectiveness of programmes and policies informed by these data.

5.2 Introduction

As discussed in Chapters 3 and 4, while there are various dietary survey tools available, many of these may overlook contextual detail necessary for informing national and sub-national dietary intervention development, implementation, and evaluation. Innovation is therefore required to create research tools that are optimal to answer outstanding research questions, especially in contexts with a dearth of setting-specific information. When developing a new tool, a quantitative assessment of whether or not said tool is able to measure what it purports to measure is essential. Demonstrating quantitative validity (for example, criterion-related validity), however, does not guarantee that a method is contextually-appropriate or user-friendly (125, 152). Tool validation efforts should therefore also consider the target population and their milieu to avoid encountering situations where groups of people and their dietary risks go unaccounted for in data collection and use (153). Validating our work with society – by inviting participant opinions on the acceptability of and satisfaction with different research methods (also known as social validity) (154) – is one way of illuminating where expert opinion might be at variance with user experience to the detriment of data accuracy and representativeness.

Gender differences in dietary survey participation in Sri Lanka nicely illustrate the need for tool innovation and social validation. The well-documented underrepresentation of male

study participation and the extrapolation of results based on female-dominated studies calls into question the appropriateness and effectiveness of interventions informed by these data as well as the equity implications of conventional self-report data collection methods (130-132, 134, 155, 156). Previously reported barriers to inclusive data collection – including male participant access and availability (134) – appear symptomatic of limited resources whereby female participants represent the path of least resistance to data collection. As many LMICs, such as Sri Lanka, are encouraged to expand their national surveillance activities to capture setting-specific information (41), such efforts may unintentionally exacerbate gender-based inequalities.

5.2.1 Chapter objective

As discussed in Chapter 4, the SLBDS was developed to reduce both participant and researcher burden and collect context-specific and intervention-relevant data. Whilst other tools are widely (24DR) and increasingly (FFQ) used in Sri Lanka, data collection and analysis burdens remain barriers to their inclusion in already cumbersome multiple NCD risk factor studies. Additionally, available evidence does not indicate that social validity or gender responsiveness considerations have informed the development or use of these surveys (130, 155, 157). The objective of this chapter is therefore to explore the factors that impact SLBDS participation, engagement, and social validity, with a focus on gender. Participant survey improvement suggestions are also explored.

5.3 Methods

5.3.1 Study design

Given the nature of this exploratory study that intended to understand participant views and experiences, qualitative research methods were deemed appropriate. Of the various qualitative research techniques available, semi-structured interviews were selected as the most desirable data collection method due to their ability to facilitate the exploration of underexplored topics, directed probing, and follow-up questioning (93-95).

5.3.2 Data collection

Semi-structured face-to-face interviews took place with Chapter 4 study participants in their home after the SLBDS (the newly developed tool) and 24DR (the reference method) had been administered. Although participants were not required to participate in or complete both dietary surveys to be included in follow-up interviews, the survey response rate among interviewees was 100 percent. As with the dietary survey data collection, interviews were conducted in the participant's preferred language: Sinhala or English. Functional equivalence of these data was achieved through verbatim transcription into the language used by the participant and free translation into English by SF. Section 4.3.4 provides details of the ethical approval received for this study.

Interviewees were asked the following five questions:

1. Which survey did you prefer?
2. Why did you prefer that survey?
3. Do you have any suggestions for improving the surveys?

4. Looking at previous research, we have found that more Sri Lankan women participate in dietary surveys than men. What do you think might be the reasons for this difference?
5. Is there anything you would like to tell me that I have not asked you about?

This succinct and semi-structured question guide was developed to 1) accommodate participant and interviewer fatigue following the administration of two dietary surveys and 2) facilitate participant-directed discussion. Participants were not restricted by answer length or detail, and question five provided participants with an opportunity to introduce views that may not have been considered during interview guide development.

5.3.3 Data analysis

Translated transcripts were coded by question on the basis of salient issues and themes that arose from the text. Informed by Attride-Stirling's thematic analysis methodology, codes were classified and consolidated into three classes of themes – basic, organising, and global – differentiated by the level of interpretation required for identification (107). This coding hierarchy is described in detail in section 3.3.6. Following the transcription and translation of interview data by SF, ten randomly selected transcripts covering the three districts were read twice and then manually coded to identify basic, organising, and global themes. The thematic groupings generated from this subset were then discussed and revised with SF and NT before coding the remaining transcripts. Once all transcripts had been analysed, thematic groupings were again discussed and revised with the wider research team. This resulted in an iterative coding and re-coding process that informed study findings and their illustration as non-hierarchical thematic network maps (see Figure 3.1).

5.4 Results

5.4.1 Participant profile and survey preference

Of the 94 participants who completed the two dietary surveys, 93 provided informed consent to participate in a follow-up interview. One of the Chapter 4 participants did not have time to participate in further data collection. These participants ranged in age from 18 to 65 years old (mean = 40.7, SD = 12.6) and resided in urban (72%) or rural (28%) sectors in Colombo, Kalutara, and Trincomalee districts. Sixty-six percent identified as female and 34% as male. Participants self-defined their ethnicity as either Muslim (6%), Tamil (8%), or Sinhalese (86%). Participant characteristics are presented in detail in Table 4.2. When asked which of the two surveys (SLBDS or 24DR) they preferred, 37% of participants indicated a preference for the SLBDS whereas the majority (58%) preferred the 24DR. Five people (5%) *“liked both equally”* and reported no survey preference. Interviews ranged from approximately 5 to 15 minutes in duration.

5.4.2 Presentation of interview findings

Results of the semi-structured interviews are presented by global themes: 1) Participant experience determines survey preference; 2) Facilitators of and barriers to survey co-creation; and 3) Dietary data collection is gendered. Each section includes a summary discussion of key findings, a diagrammatic overview (thematic network) of findings, and a discussion of the associated organising and basic themes supported by representative interview quotations. Each quotation is ascribed to a participant in the following format – *(Participant sex, Participant district of residence)* – to protect their anonymity. At times, single words or short quotations (two to three words) from transcripts are used that are not ascribed to a single participant. The purpose of using these words, that are commonly used

by participants, is to use their rather than my wording as much as possible when reporting and interpreting findings. An example of this can be found in the last sentence of the section above: five people *“liked both equally”* and reported no survey preference.

5.4.3 Participant experience determines survey preference

Participant experience was the overarching determinant of survey preference (Figure 5.1).

The most salient themes that contributed to this finding were recall ease; participant commitment to data collection; perceptions of survey value; and emotional responses to reporting food intake.

Recall ease

Recall ease, a combination of the cognitive effort and memory requirements participants felt were necessary to complete the survey, was the most commonly mentioned factor that contributed to survey preference for both female and male respondents. The majority of participants preferred the 24DR as they found it was easier to recall food consumed as meals: *“It was easier for me to recall meal by meal. When I answered the short questionnaire I totally forgot the herbal drinks that I consumed”* (Male, Colombo); portions consumed in their own words: *“It is hard to recall in those quantities - cups, fist fulls etc.”* (Female, Colombo); and 24-hour intake chronologically: *“It is easier to recall the food in the order in which it was eaten throughout the day”* (Female, Kalutara). A minority, however, welcomed the prescriptive reporting measurements and structured inquiry employed by the SLBDS as it prompted them to recall both what and how much they had eaten with minimal effort on their part. A few participants also felt that the prescriptive nature of the SLBDS assisted their recall of often forgotten food and beverage items (for example, condiments,

snacks, and drinks): *“It prompted me to remember some of the food items I may have otherwise forgotten to recall” (Male, Colombo)*. The level of difficulty experienced by participants in calculating, converting, and reporting their food consumption factored into survey preference decisions for both the SLBDS, *“I didn’t have to think too much” (Female, Colombo)*, and the 24DR, *“The 24-hour Dietary Recall was much easier because it was difficult for me to convert the amounts eaten to portions in my mind” (Female, Kalutara)*.

Participant commitment

The amount of participant commitment required by each survey was a common survey preference factor for both female and male participants. Some participants preferred the *“less time consuming”* survey because they *“didn’t have to give more information than necessary” (Female, Colombo)* whereas others *“appreciate[d] the opportunity to give descriptive details” (Female, Colombo)* about their cooking methods and food intake. The SLBDS’s shorter administration duration, which *“saved”* or *“wasted less”* time, was the most commonly cited reason for preferring the SLBDS.

Perceptions of survey value

For some participants, the survey experience was valuable and worth their time and efforts if they perceived the data collected to be useful for diet-disease research. Seemingly contradictory statements made by the same individuals, *“I like the short survey”* and *“I think the descriptive details that can be collected [with the 24DR] will be more useful for the researchers” (Female, Colombo)*, nicely illustrate the survey preference thought process that resulted in them favouring the tool with ‘greater common good’.

For some respondents, survey value was based on whether or not they felt that they, through their diet, were accurately represented and therefore valued in data collection:

“The short questionnaire was not representative of the way and what I eat” (Male, Colombo). Others were concerned about the appropriateness of the SLBDS in different socioeconomic contexts and how this might impact data collection and representativeness: *“The short dietary questionnaire requires you to recall the food consumption of the previous day, do the mental calculation of portions and report it. That may not be practical for less educated people” (Male, Trincomalee).* The former value judgment was a feature of male participant responses whereas the latter was important to male and female participants alike. In both cases, participants preferred the more inclusive 24DR.

Emotional responses

Only a few female participants reflected on their preferred survey experience as being relatively *“more enjoyable”* or *“less stressful”* to the alternative. For those who associated cooking with feelings of joy or pride, the open-ended 24DR was more enjoyable as it offered an opportunity to discuss subject matter they understood and valued in detail: *“I liked that questionnaire because it asks about the dishes and what was contained in each food in detail. All this is information about the food that I myself cook. Therefore, it was more enjoyable to answer the 24-hour dietary recall” (Female, Kalutara).* The converse was true for participants who specified not being intimately involved with household cooking: *“The 24-hour Dietary Recall is asking for lengthy details that I don’t know how to answer as I don’t cook!” (Female, Trincomalee).* For these respondents, being asked to provide information beyond the scope of their knowledge was a more stressful experience.

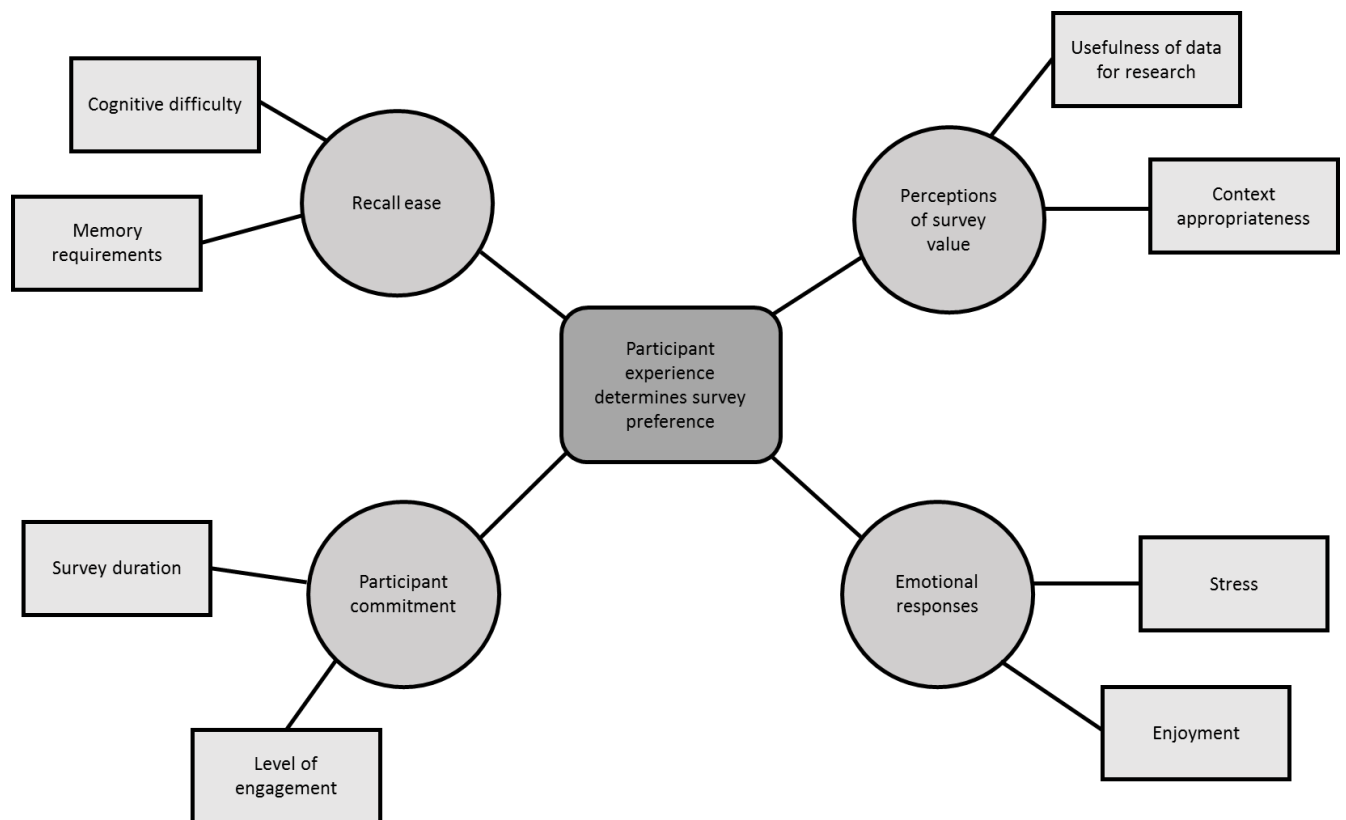


Figure 5.1. Thematic network for ‘participant experience determines survey preference’

5.4.4 Facilitators of and barriers to co-creating dietary survey research methods

To involve end-users in the development of the SLBDS, participants were invited to suggest survey amendments and improvements. Some participants were forthcoming with actionable suggestions whereas many more expressed feelings of disempowerment that prevented them from sharing their ideas: *“I don’t think I have enough knowledge to suggest changes” (Female, Kalutara)*. Interestingly, prior demonstration of a participant’s ability to identify and articulate a need for survey improvements, either by expressing a clear survey preference (in response to interview question 1) or citing a survey’s inadequacies and less desirable features as determinants of their preference (in response to interview question 2),

were not predictors of a participants' willingness or perceived ability to suggest improvements to researchers when explicitly invited to do so.

Interview question 3, "Do you have any suggestions for improving the surveys?", had the highest non-response rate of the four questions asked. In addition to participants who expressed feelings of disempowerment, half of the study sample declined the opportunity to share improvement suggestions. Figure 5.2 below illustrates the various barriers to and facilitators of co-creating dietary survey tools with study participants.

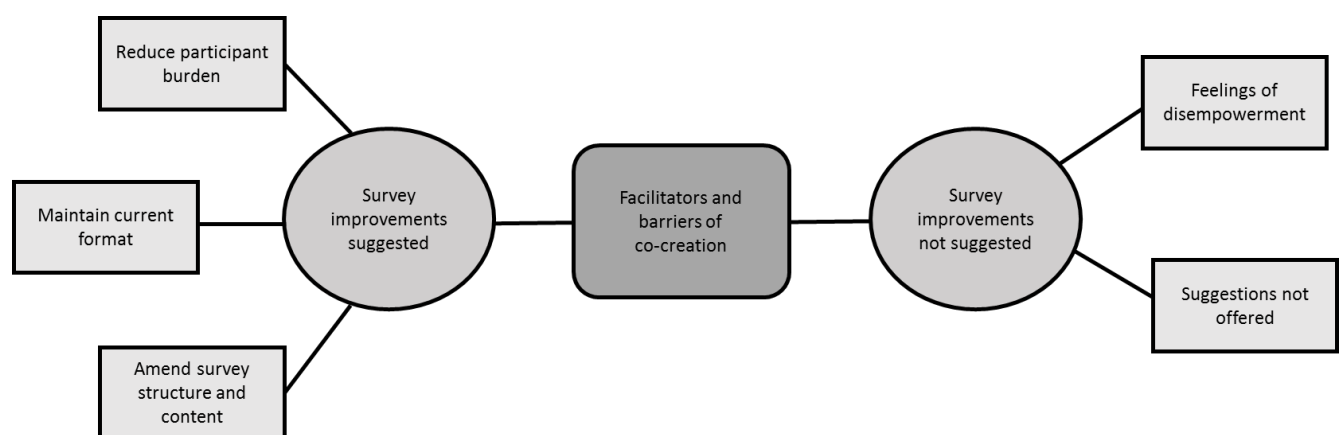


Figure 5.2. Thematic network for 'facilitators of and barriers to co-creating dietary survey research methods'

Participants who did suggest survey improvements either expressed their satisfaction with the surveys in their current form, suggested structural and content amendments, and/or recommended strategies for reducing participation burden (Table 5.1). Only male participants spoke to the latter. Many of the participants who offered suggestions transformed their previously expressed 24DR and SLBDS likes and dislikes into improvement

suggestions, whereas others used this explicit opportunity to engage in survey development to share insights not previously expressed in response to other interview questions.

Table 5.1. Survey improvement suggestions and representative quotations

Survey improvement suggestions	Representative quotations
Revise survey structure	<i>"I think dietary questionnaires should have less 'yes'/'no' questions. They should be more open ended so that you can obtain richer data" (Female, Colombo).</i> <i>"The short questionnaire can ask the same thing meal by meal" (Female, Colombo).</i>
Expand survey content	<i>"There should be more detailed questions on oil consumption" (Female, Colombo)</i> <i>"If you asked about alcohol consumption you may be able to get a better idea of the calorie intake" (Female, Colombo).</i>
Reduce participation burden	<i>"[Researchers] must categorise the data into food groups after obtaining the food data as meals. When you ask a participant to recall what he ate as a food group you are trying to get him to do your job" (Male, Colombo).</i> <i>"Better to make these questionnaires self-administered and let the participant fill" (Male, Trincomalee).</i> <i>"It is very important to develop questionnaires that will not consume so much time. If not, people do not have the time to waste on things like this" (Male, Colombo).</i>
Maintain current format	<i>"I don't think they need improvement. Especially the short diet questionnaire [which] adequately captures the Sri Lankan ways of eating" (Male, Colombo).</i>

5.4.5 Dietary data collection is gendered

Overwhelmingly, participants felt that both diet as a research topic and the methods used to investigate it favour the inclusion of Sri Lankan women, with implications for survey participation, level of participant engagement, and data collection burden. The thematic network for 'dietary data collection is gendered' illustrates the multiple themes that support and explain this claim (Figure 5.3).

Food related activities are the role and responsibility of women

Female and male participants suggested that Sri Lankan women are both more willing to participate in dietary research than men and have a greater amount of necessary survey knowledge to engage. High food and cooking literacy, however, were not always spoken about as something to be revered, but rather part and parcel of being a woman in Sri Lankan society: *"There is this thing that is said here. It is not very nice. A woman's knowledge or wisdom is the length of a kitchen spoon handle"* (Female, Colombo). Some female participants spoke of possessing this type of knowledge as a burden in the context of dietary research, as it further extended the already expansive remit of women's food-related roles and responsibilities: *"In the male dominant Sri Lankan culture everything related to food is viewed as the sole responsibility of the woman"* (Female, Colombo).

Despite agreeing on the existence of a clear gender-based knowledge divide, female and male participants offered varying perspectives as to how the type of food-related knowledge queried by dietary surveys is predominantly acquired by women. According to most female participants, their knowledge develops through daily exposure to *"all matters related to food, cooking, and preparation"* (Female, Kalutara) because *"it is the women in Sri*

Lanka who do most of the cooking. The men usually just eat whatever is cooked. Here, the women know the recipes [and] know how to cook so they are more knowledgeable” (Female, Colombo). Male participants who shared a view on the subject believed that a woman’s intimate relationship with food and nutrition through the life-course – *“[Women] go through pregnancy, childbirth, breastfeeding. Their nutritional requirements change in the life-cycle so they think more about food” (Male, Colombo)* – and relationship with body ideals and weight – *“Women are much more body conscious and think about weight and food a lot” (Male, Kalutara)* – were unique gendered experiences and sources of surveyed knowledge.

Female and male participants also offered differing insights as to why women might be more willing and men less so to participate in dietary research. Some female participants felt that they placed a greater value on the outcomes of diet-disease research and were therefore more willing to invest their time and effort in data collection: *“Women are more health conscious and wouldn’t mind spending time on taking part in a survey that may ultimately contribute to society” (Female, Colombo).* Other female respondents also described feeling valued by and enjoying research interested in a core component of their identity: *“For Sri Lankan women, food is a part of our lives (Female, Colombo)* so *“women like to be involved in things related to food and food research and like participating in the interviews” (Female, Colombo).* Female participants generally believed that men felt quite the opposite: *“They think that answering questions about food, kitchen, etc. are beneath them” (Female, Colombo)* and *“also probably think that surveys such as these are not important or serious” (Female, Colombo).* Some female participants suggested that men’s less open and expressive social conditioning is a primary deterrent to their participation in

face-to-face and/or interview-based research that investigates personal matters, food-related or otherwise: *“I think men in our society are not very expressive” (Female, Colombo)* and *“They are not encouraged to engage with others about food or anything too personal about themselves. They are uncomfortable sharing things that are personal details” (Female, Colombo)*. According to some male participants, Sri Lankan men might be less willing to participate because the data collection process involves disclosing personal and sometimes embarrassing information about the consumption of unhealthy diets: *“Men are out and about more than women in Sri Lanka, and they may consume more junk food. Therefore, they may be reluctant to report such eating patterns” (Male, Colombo)*. The perceived incompatibility of long survey duration and men’s busier lifestyles was also described by some male participants as a barrier to participation: *“I think the men are generally busier than women. They don’t have the time to commit to answering long questionnaires” (Male, Kalutara)*.

Data collection methods favour the participation of women

Female and male respondents alike suggested that the administration of home-based surveys during business hours meant that women were more likely than men to be accessible to researchers: *“These surveys happen during the day. The men are out working during the day. So, women are available for answering” (Male, Kalutara)*. Despite consensus acknowledgement of this dual female participation facilitator and male participation barrier, some participants did not feel that this was a simple problem with a simple solution. One participant explained that it was in fact men’s mindset towards participation – *“men just think they have more important things to do like earning a living rather than taking part in*

such surveys” (Female, Colombo) – that may pose the greatest barrier to their accessibility and availability, even if survey time and location were to change.

Participants also suggested that researcher-respondent dynamics within specific information sharing dyads (for example, same or mixed gender) may foster or hinder levels of survey participation and engagement. Male participants responding to female data collectors was described as being less conducive to male participation and engagement whereas a data collector who is also a doctor, irrespective of their gender, might encourage male and female participation alike: *“They don’t like to answer to females, who typically collect data” (Female, Colombo)* but *“if it is a medical person, anyone would be very cooperative” (Female, Colombo)*. Some female participants described feeling more empathetic toward female data collectors and wanting to assist them in doing a good job: *“we are more sociable and enterprising...keen to help a researcher trying to do her job. Men are less sympathetic and would not waste their time on others” (Female, Colombo)*. Male participants suggested that women may experience and react to researcher-researched relationship dynamics differently to men – *“I think it is easier to convince women to take part in surveys. Women are more compliant” (Male, Colombo)* – contributing to their expressed willingness to participate.

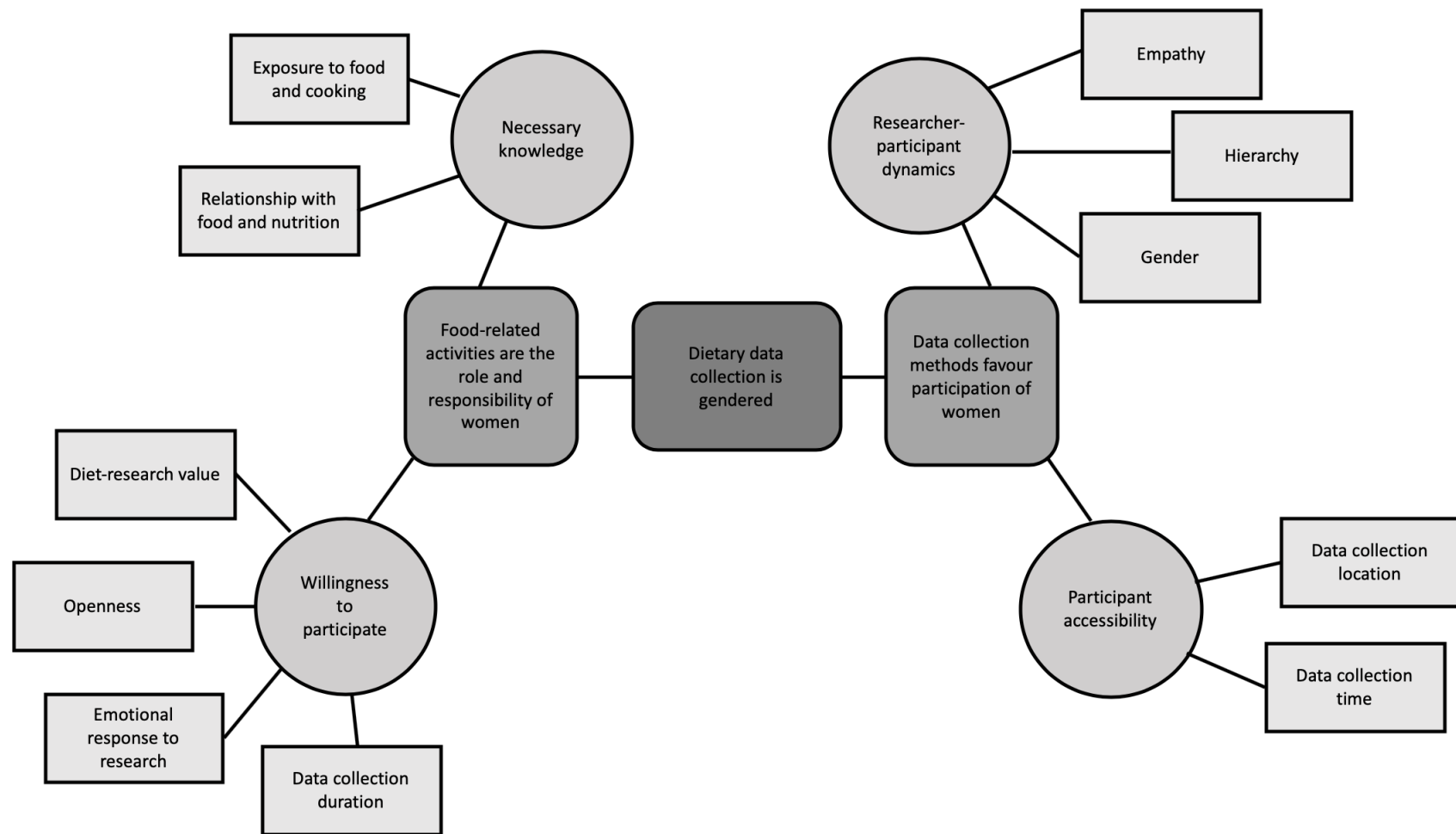


Figure 5.3. Thematic network for ‘dietary data collection is gendered’

5.5 Discussion

5.5.1 Summary of key findings

The findings from this chapter reveal that the majority (58%) of study participants preferred the 24DR when compared with the SLBDS. Acting on some of the survey improvement suggestions put forward by participants might therefore help to improve the SLBDS and make it an easier, more enjoyable, and valuable experience for participants. The chapter's findings also suggest that the methods most commonly used to investigate diets in the Sri Lankan context – home-based face-to-face interviews conducted during business hours – are gendered, with implications for survey participation, level of participant engagement, the social validity of methods, and the data collection burden experienced by participants. The chapter's findings therefore support the observation that recruitment of female participants represents the path of least resistance for data collection because face-to-face surveys that query diet detail simultaneously accommodate and benefit from women's knowledge, accessibility, style of communication, and desire to 'help out'.

5.5.2 Implications of this research for future survey development

Consideration of the following set of questions through a gender-sensitive lens during the survey and study development/improvement/adaptation process might therefore help to increase the representativeness of data collected (by the SLBDS and other surveys that employ similar methods), and reduce the potential negative implications of gender-based participation burden:

- **Survey content:** Do participants have the necessary survey-relevant knowledge to participate? Are questions asked in a way that allows participants to share this knowledge?
- **Data collection methods:** How, where, and by whom are data collected? Are these methods conducive to accurate information sharing?
- **Social validity:** Do participants consider survey content, methods, and use to be socially valid?

5.5.2.1 Survey content

Survey content is a combination of the information questioned and the way it is queried – both of which impact a respondent’s ability to answer survey questions accurately. In this study, participants suggested that women have a greater amount of food knowledge that would favour the reporting of detailed responses. Both female and male participants found it easier to report intake as consumed throughout the day as opposed to calculating aggregate intake of specific food and beverages in prescribed quantities. Male participants more often commented on the length or time-consuming nature of the survey but both female and male participants agreed that time-efficient methods were more desirable. This conflicted with requests for the inclusion of additional questions to make surveys more representative and useful for diet-disease research. The observation that commonly used dietary surveys do not cater for diverse dietary knowledge and reporting style preferences has implications for excluding people less intimately engaged with food preparation and cooking who might therefore consume less healthy diets (158). The SLBDS addresses participant concerns about time-efficiency but does so by collecting a focussed amount of

dietary detail in a way that was not deemed socially valid by many participants. Born from a desire to reduce analysis burden, the prescribed reporting units made it more difficult for participants to share their knowledge. This aspect of the survey might need to be revisited to include multiple reporting options. The development of a comprehensive, standardised conversion guide for researchers analysing the dietary intake of Sri Lankan adults would make inclusion of this feature feasible.

5.5.2.2 Data collection methods

How are data collected?

Interviews are unnatural social situations (159). Face-to-face data collection can force a level of intimacy that study participants believed was less appealing to Sri Lankan men who may not be as comfortable sharing personal details and/or unhealthy eating habits. The increased anonymity of telephone interviews or self-administered (paper-based or online) surveys could help foster disclosure of personal or “*embarrassing*”, as one participant described unhealthy dietary habits, information. Virtual methods can also be more time efficient, produce comparable quality data to face-to-face interviews, and allow for greater data collection coverage over a wider geographical area (160). They may, however, present a barrier to helpful and dynamic dialogue between researchers and participants (for example, tailored explanations of specific instructions) particularly useful for participants with lower diet/research literacy and experience.

When/where are data collected?

The time and location of data collection has implications for gendered participation. There was overwhelming agreement among participants that home-based surveys conducted

during business hours favour the participation of women and reduce men's ability to participate. Inclusive strategies to minimise the impact of these barriers might include the collection of data outside of business hours, during weekends, or in workplaces. If, however, research activities are in competition with leisure time or work commitments, they will require a high level of social validity or strategic buy-in from participants and employers. The implications for research resources to support novel data collection approaches will also need to be considered.

Who is collecting data?

Chapter findings implicate diet as a research topic that is sensitive to 'sex of interviewer effects' (161), which in the Sri Lankan context, can be moderated by other dimensions of a researcher's positionality. Interviews are the generation of data between two people; different dyads produce different data. Certain elements of the data collection process (for example, standardised survey tools) can be controlled, within reason, to reduce researcher influence on data production (162). The findings from this study suggest that with a contextually-grounded, gender-sensitive understanding of the research environment, the impact of researcher-researched gender and power dynamics can also be managed to support accurate data sharing. Many researchers who match the gender of the interviewer to the gender of the interviewee (i.e., conduct 'same-gender' interviews) base this decision on the presupposition that rapport is more easily achieved under these conditions (163).

The reality, however, is not that simple. Participants in this study identified women interviewing women and doctors (irrespective of gender) interviewing both women and men as conducive for sharing reliable data. This study did not, however, investigate the vulnerability of different participants to various power imbalances and the associated

ethical implications of this. Comments offered by few male participants that *“women are more compliant”* and *“easier to convince”* indicate that further research is needed to understand whether certain participants feel pressured to participate in dietary research activities in the Sri Lankan context.

5.5.2.3 Social validity

Both female and male participants expressed a preference for engaging with socially valid research that they felt justified their personal investment in data collection. Study participants tended to appraise social validity by asking *‘Am I valued in this research?’* or *‘Is this research valuable for society?’*. If the answer was ‘yes’ to either, then the participant associated the survey with a useful expenditure of their time and effort. The prescriptive SLBDS was deemed more exclusive with respect to what it included and therefore who it included. Survey content amendments and better communication with participants about the research purpose and participant value may ameliorate some of these exclusive/exclusion concerns. Ideally, more effective communication and tailored study information would be informed by a more detailed understanding of the different value-based motivations for participation and engagement.

Co-creation

Under the presupposition that co-creating research methods with end-users improves method acceptability and satisfaction (164, 165), participant feedback and survey improvement suggestions were invited and analysed. From the responses and reactions of participants, many of whom expressed feelings of disempowerment that prevented them from sharing their ideas with an ‘expert’, it is clear that a greater level of context-

appropriate attention and planning needs to be invested in creating conducive conditions for participant engagement in the co-creation process. Further research is therefore required to understand what successful co-creation with research participants in Sri Lanka might look like.

5.5.3 Comparison with other literature

Gendered physical survey participation barriers (for example, access and availability during business hours) are well-documented in the Sri Lankan dietary assessment literature (132, 134). Other explanatory factors have not been explored. The findings from this study support the known barriers and illuminate additional features of conventional data collection methods that favour the participation of women. The finding that people, irrespective of gender, prefer shorter and easier surveys is not a revelation, and reflects the trend of converting dietary assessment tools into brief versions (157). This does, however, conflict with participant desires for more expansive surveys that represent diverse populations and diets.

Neither the Sri Lankan literature nor this study explore conflict resolution strategies that weigh different aspects of participant preference that may impact survey social validity. Previous studies have suggested that different research topics and contexts favour different combinations of same- and cross-gender interview pairings (161). For example, in contexts where men more often discuss intimate topics with women, cross-gender dyads have been preferred (163, 166). In the Sri Lankan context where men are described as generally “*less expressive*”, it is difficult to know which pairing(s) would generate greater rapport. This study does not provide detailed insight on this topic; participants did not discuss whether

male participants would be more comfortable being interviewed by male researchers and no comparison data are available as female researchers conducted interviews.

To the best of my knowledge, this is the first study to explore the social validity of dietary data collection tools for Sri Lankan adults. The global dietary assessment literature is also thin when it comes to discussing social validation, although various ‘acceptability’ assessments (both quantitative (167) and qualitative (168)) do form part of some survey development and validation studies. Comparatively, the social acceptability and importance of health interventions (goals, procedures, and outcomes) are an established and expanding area of research (165). Increasingly, NCD researchers are being encouraged to assess the social validity of health interventions, programmes, and policies – as a moderator of effectiveness – but do not appear to be extending a similar level of inquiry to the data collection tools used to inform such activities (169). This highlights an important inconsistency and begs the question: can a programme, policy or intervention achieve social validity if it is not informed by tools subject to the same assessment criteria?

5.5.4 Strengths and limitations of this study

The main strengths of this study are the large sample size and the use of semi-structured qualitative research methods that allowed participants to direct discussions and share emic perspectives. As mentioned in Chapter 4, a key limitation of this study is that it only involved three districts in Sri Lanka, which limits the generalisability of findings. This research also suffers from the very phenomenon it is trying to explore – low male participation in dietary research. This implicates findings in a cycle whereby female experiences and preferences shape the data collection process and potential propagation of its gendered nature and

burden. The self-selecting women and men who participated in this study may also not be representative of the wider population, necessitating further research with those who would ordinarily not engage with dietary data collection. As indicated by participant experiences and the interviewer effects literature (161), the gender of the data collectors in this study may have impacted how questions were asked and answered. Without a comparison, it was not possible to assess these impacts. Additionally, systematic member checking was not undertaken with participants, which would have strengthened further the credibility of results.

5.6 Conclusion

Dietary research is vulnerable to trading on gender stereotypes. This has implications for surveillance activities, and ultimately the appropriateness and effectiveness of programmes and policies informed by these data. Many of the barriers to general and male-specific participation and engagement uncovered in this study are not insurmountable. Overcoming them, however, requires both contextually-grounded and gender-sensitive investment in data collection focussed on currently underrepresented individuals and groups. In the context of expanding dietary surveillance in Sri Lanka and LMICs more generally, the relationship between data quantity, quality, and equity requires further setting-specific consideration. Exploring the social validity of new and existing measurement methods will assist this effort. Crucially, the findings from this study should inform the next iteration of the SLBDS.

Chapter 6. Food labour, consumption hierarchies, and diet decision-making in Sri Lankan households

The study presented in this chapter has also been published as a peer-reviewed paper with the following citation Renzella J, Fernando S, Kalupahana B, Scarborough P, Rayner M, Townsend N. Food labour, consumption hierarchies, and diet decision-making in Sri Lankan households: a qualitative study. *BMC Nutrition*. 2020;6(1):64.

6.1 Chapter summary

Chapter 3 interviewees identified a skew towards ‘what’s the problem’ research over ‘what should we do about it and how’ evidence, as a barrier to the successful promotion of healthy diets. While Chapters 4 and 5 in this thesis develop, validate, and seek to improve measures of dietary intake to inform and evaluate interventions, this chapter explores the context-specific factors that might impact the success of such interventions – specifically, who is responsible for, who is able to perform, and who influences targeted dietary behaviours at a household level. These factors are explored through semi-structured interviews with 93 Sri Lankan adults. Chapter findings suggest that women in Sri Lanka continue to shoulder the burden of food-related labour disproportionately to men but that this responsibility is not always a proxy for dietary decision-making power. While men are often absent from the kitchen, their role in food purchasing and payment is prominent in many households. Despite these observed gender differences in food labour and provisioning, “traditional” age- and gender-based consumption hierarchies with negative

nutrition consequences for women and children are not common, indicating that Sri Lankan 'table culture' may be changing. The results from this chapter provide key learnings for dietary interventions with the aim of influencing day-to-day practice.

6.2 Introduction

With a substantial portion of the Sri Lankan adult population failing to consume a balanced and varied diet, interventions that improve the quality of the Sri Lankan diet in line with national dietary guidelines have been suggested (28). The Sri Lankan Food-Based Dietary Guidelines (SLFBDG) aim to provide healthy diet guidance for the general public that can be 'practically translated into day-to-day practice' (135). To support this translation, the Sri Lankan government aims to increase guideline dissemination; conduct awareness campaigns to promote guideline adherence; and train health workers on the SLFBDG recommendations (32). The success of such high-agency interventions that provide people with healthy diet advice, guidance, and encouragement is heavily mediated, however, by the targeted individuals' personal resources: time, knowledge, skills, autonomy, and material means (170). Successful implementation of the SLFBDG recommendations therefore depends on a clearer understanding of who is responsible for, who is able to perform, and who influences 'day-to-day practice'. In terms of food preparation, for example, it is well-documented that Sri Lankan women, be they Sinhalese, Tamil or Moor, disproportionately shoulder the burden of domestic chores and that men do not share the responsibility for cooking in equal measure (171, 172). Less is known, however, about household responsibility for other food-related chores such as purchasing, payment, and preparation and how the food preferences of family members influence diet decisions.

When it comes to consumption, we know that intervention benefits may not be equally distributed within households if intra-household food distribution subscribes to gender and age biases (hereinafter referred to as consumption hierarchies) (173). Unequal food distribution, where patriarchal consumption hierarchies manifest in inadequate nutrient consumption in women compared to men, has been well-documented in many South Asian countries (174). There is also some evidence of consumption biases that preference adult men over women and children in the allocation of calories among poor urban families in Sri Lanka (175). However, variations in cultural norms and food practices make it difficult to generalise the findings from these other South Asian countries for Sri Lanka as a whole.

6.2.1 Chapter objectives

By investigating food skills, knowledge, decisions, and consumption biases in Sri Lankan households, we gain a contextual understanding of how and for whom interventions aimed at promoting healthy eating might work. With the aim of informing the development and successful implementation of such interventions, this chapter has the following objectives:

- explore the heterogeneous nature of household food-roles and responsibilities;
- understand food decision-making influences; and
- investigate the presence and potential impact of consumption hierarchies.

6.3 Methods

6.3.1 Data collection

All 94 participants who were invited to take part in the previous two components of this study (outlined in Chapters 4 and 5) were also invited to participate in this third and final

study component. After participants reviewed the study information sheet and provided written informed consent for a recorded interview to take place, semi-structured face-to-face interviews were conducted with each participant in their home. Section 5.3.1 outlines the reasons for using semi-structured interviews in this study. As per the previous two study components, interviews were conducted in the participants' preferred language: Sinhalese or English and functional equivalence of these data was achieved through verbatim transcription into the language used by the participant and free translation into English (n = 84) by SF. Section 4.3.4 provides details of the ethical approval received for this study.

No time limit was set for interviews, which ranged from approximately 10 to 30 minutes in duration. Participants were asked the following questions about responsibility for household food labour and differences in food choices and consumption patterns between household members:

1. How do food **purchasing** responsibilities differ between household members?
2. How do food **payment** responsibilities differ between household members?
3. How do food **preparation** responsibilities differ between household members?
4. How do **cooking** responsibilities differ between household members?
5. How do food **choices** differ between household members?
6. How does food **consumption** differ between household members?
7. Is there anything you would like to tell me that I have not asked you about?

6.3.2 Data analysis

Transcribed and translated interview data were manually analysed in Microsoft Excel following Braun and Clarke's (2006) multiple step thematic analysis strategy (176). This analysis method is similar to Attride-Stirling's (2001) analysis approach used in Chapters 3 and 5 but does not specifically facilitate the illustration of results as non-hierarchical thematic networks. For the study presented in this chapter, the identification of themes and subthemes facilitated by Braun and Clarke's (2006) strategy was deemed more suitable for analysing responses to the types of questions asked of study participants. Transcripts were first coded by question and then by participant. This allowed for the comparison of experiences between and within households. To begin the coding process, ten randomly selected transcripts covering the three districts were read twice and then manually coded on the basis of salient experiences that arose from the text. The codes and thematic groupings generated from this subset were discussed and revised with SF and NT before coding the remaining transcripts. Once all transcripts were coded, thematic groupings (themes and subthemes) were discussed and revised with the wider research team. Despite being interested in all patterns and differences reported by participants, most differences in food labour roles and responsibilities were expected to be gender-based (171, 172). Gender differences were therefore coded for deductively in anticipation of confirming or challenging Sri Lankan gender norms. All other codes were generated inductively. To improve the internal generalisability of findings in this large sample size (177), quasi-statistics (percentage of participants who spoke to each theme or subtheme) were used to give non-precise counts ("*some*", "*few*", "*many*") an element of precision (178).

6.4 Results

6.4.1 Participant characteristics

Of the 94 people invited to participate in interviews, 93 agreed to participate and were included in analysis. The reason provided for non-participation is described in section 5.4.1. Four of these individuals (one female participant and three male participants) reported living alone. All other participants lived in mixed-gender households. The demographic characteristics of study participants – including age, sex, place of residence, and ethnicity – are described in detail in section 5.4.1.

6.4.2 Presentation of interview findings

Results of the semi-structured interviews are presented by theme and associated subthemes. Each section includes a summary discussion of key findings supported by representative interview quotations, which are ascribed to participants in the following format – (*Participant sex, Participant district of residence*) – to protect their anonymity. At times, single words or short quotations (two to three words) from transcripts are used that are not ascribed to a single participant. The purpose of using these words is described in section 5.4.2. As discussed above, quasi-statistics (the percentage of participants who spoke to each theme or subtheme) are also presented.

6.4.3 Interview findings

Three key themes emerged from analysis of the interview transcripts. These themes and their associated subthemes (Table 6.1) are discussed in detail below.

Table 6.1. Interview findings: themes and subthemes (N = 93)

Themes	Subthemes
1. Rigid gender differences exist in household food labour responsibilities	<i>Women do most of the food-related work</i>
	<i>When labour is shared, roles are often gendered</i>
	<i>The “breadwinner(s)” pay for household food</i>
2. There is some overlap between responsibility for food labour and influence over household diet	<i>In many households, food decisions are driven by children, elderly family members, and individuals with medical conditions</i>
	<i>Influence over household diet is often gendered</i>
	<i>In households where all food preferences are catered for, women prepare multiple meals</i>
3. The presence of intra-household consumption differences based on age and gender is uncommon, and its impact unclear	<i>Traditional age and gender consumption hierarchies are not a feature of most households</i>
	<i>Where present, consumption hierarchies do not always result in unequal intra-household food distribution</i>
	<i>Women express a preference for ‘healthy eating’</i>

6.4.3.1 Rigid gender differences exist in household food labour responsibilities

All respondents spoke to the topic of responsibility for household food purchasing, payment, preparation, and cooking through a gender lens. Where gender-based differences

were reported, they appeared both clear-cut and set in stone. For example, with the exception of flexibility under extenuating circumstances such as illness, travel, or pregnancy, daily food roles and responsibilities were often categorised as belonging solely to the realm of women or men. The rigidity of these gendered roles and responsibilities is evidenced through reference to their repetitive (for example, *"I always"*) and axiomatic nature: *"My wife and three daughters do all the cooking. Males don't participate at all. It is not our tradition"* (Male, Colombo). With few exceptions, even in cases where responsibilities were shared between women and men, rigidity was a feature of these arrangements. For example, couples *always* shopped together or were responsible for each purchasing *specific* groceries.

Women do most of the food-related work

The responsibility for day-to-day food-related household labour is not shared equally between female and male household members. Cooking for the family, and particularly for children and the elderly, tends to be exclusively the responsibility of women. Compared with food preparation, where men assisted *"sometimes"*, *"very rarely"*, *"when my wife is indisposed"* or with *"specific tasks"*, cooking was most often described as being done *"mostly"*, *"exclusively"*, *"all"*, or *"100 percent"* by women.

"I have never cooked in my life. My wife and my sister who is living with us do one hundred percent of the cooking." (Male, Trincomalee)

"I do all of the food preparation. Actually, it doesn't take me much time to cook. I like to manage the cooking and preparation of food without help or interference." (Female, Colombo)

"I would say that 98% of the cooking is done by my wife. I have only cooked whilst I was in university. That too just rice, dhal curry and pol sambol." (Male, Trincomalee)

In two cases, cooking was a shared responsibility between a female and male family member.

“My husband and I share this workload. My husband is the one who cooks the rice every day. He helps in scraping coconut, peeling onion, cleaning and cutting vegetables daily.” (Female, Colombo)

Whereas food preparation and cooking were described as *“the type of work done by women”* (Female, Colombo), responsibility for food purchasing was more equally shared between women and men both across and within households. The majority of participants (67%) reported a gender difference in food purchasing responsibility, which was considered the sole responsibility of women in 48% and men in 44% of these households.

“My husband is practically ignorant about food, food quality, what is needed or not needed. He has no interest or knowledge about how the rest of the family eats or about their food preferences. So, I am aware of everybody’s needs and I go out and do the purchases.” (Female, Trincomalee)

“My husband does the food purchasing. I rarely buy food items. If I do buy my husband will certainly find fault with what I buy.” (Female, Colombo)

Shared responsibility for food purchasing reflected the experience of 25% of participants where women and men shopped for food together (during the same outing).

“My husband and I both go together to shop for the food for the whole month. The vegetables of course are bought from time to time throughout the month.” (Female, Colombo)

Some adults living with older family members reported that responsibility for food purchasing, whether shared between genders or assumed by one individual, fell to older family members.

“My mother and father do this as a shared responsibility. In my house, I live with my mother and father.” (Male, Colombo)

"It is my elder sister or my brother-in-law who go and purchase the food." (Male, Kalutara)

When labour is shared, roles are often gendered

In households where purchasing and preparation responsibilities were shared between women and men, roles were often gendered based on their labour-intensiveness or the category of food (for example, fresh versus packaged) being purchased. Male assistance with food preparation was commonly described as *"rare"* or *"specific"*. In these cases, male family members were typically assigned more physically demanding tasks such as dehusking coconuts or cleaning and cutting fish and meat.

"Usually, it is my mother or my aunt that does the food preparation. But if there is a need to dehusk a coconut, clean a fish or cut a chicken, my father or I might help." (Male, Kalutara)

Gendered roles also extended to couples that grocery shopped together. When reported, differences were based on the type of food being purchased; women were responsible for purchasing fresh fruit and vegetables whereas men's roles differed between households but often involved the purchasing of pre-prepared or 'Western-style' foodstuffs.

"The cooked food or takeaway food is purchased by myself. My wife purchases the raw foods, rations etc." (Male, Colombo)

The "breadwinner(s)" pay for household food

It was rare that household food payments were exclusively the responsibility of women (5%). In some households, the responsibility was shared between women and men, but the most common response was that food payment was exclusively men's responsibility (76%).

"My husband is the only breadwinner. He pays for everything." (Female, Colombo)

"The payment is done by my daughter as she is the only person who is earning sufficiently to buy food." (Female, Colombo)

Nineteen percent of respondents lived in households where payment responsibility was shared between women and men who all earned sufficiently to contribute. How much each person contributed (as a total amount or percentage contribution) was not disclosed by any of the study participants.

“The responsibility is shared between men and women. My sister who lives in the household also earns. We share the responsibility. There is no clear demarcation about how much a man would spend or a woman would spend.” (Male, Colombo)

6.4.3.2 There is some overlap between responsibility for food labour and influence over household diet

The answer to ‘*Who cooks?*’ – women – was near ubiquitous across households, whereas responses to ‘*What to cook and whose preferences to prioritise?*’ varied from household to household. These decisions were less often influenced by the preferences of the individuals responsible for cooking and more often determined by the age, gender, health status, and preferences of household members.

In many households, food decisions are driven by children, elderly family members, and individuals with medical conditions

In 30% of households, the fussiness, appetites or vulnerable state of children and older family members – factors that have “*nothing to do with their gender*” (Female, Kalutara) – were described as being highly influential in determining what meals were consumed by the entire family.

“The food choices we make are largely decided by what my son wants to eat. Almost all of the meals are planned and cooked according to his wish.” (Female, Kalutara)

“Predominantly my father’s choices are taken into account. That is not so much because he is a man. He is very old and he has low appetite. Therefore, we cook the foods that he would like to eat because he is old and feeble.” (Female, Colombo)

Where one family member had a food allergy or was following a health-promoting/disease-preventing diet, the household menu was tailored accordingly, and all members would “eat as they do”.

“The bulk of the food choices are tailored to suit my mother’s high cholesterol and diabetes. We all eat the food that suits her disease.” (Female, Colombo)

“As my husband is allergic to egg, we are very careful when using egg for cooking.” (Female, Trincomalee)

Influence over household diet is often gendered

Twenty-five percent of respondents said that food choices were “completely dominated” by a male family member, whereas twenty-one reported that the female family member responsible for cooking made all of the food-related decisions. In both cases, the preferences of these individuals impacted the food intake of all other family members to varying degrees of contentment and implications for health.

“It is always what my husband likes that gets cooked. There are many food items that he prefers that my daughter does not eat. But still the preference is given to what my husband likes.” (Female, Kalutara)

“My wife decides the food choices, what is bought and what is cooked. I never interfere in those choices. I eat to live, not live to eat. I’m very easy going about what is cooked and given to me.” (Male, Colombo)

“The women in my family want to eat healthy. The men in my family prefer more unhealthy food. But invariably it is the decision of the men that will prevail. In Sri Lanka, typically men make decisions about everything. They are the head of the family. They also decide what and what not to cook.” (Male, Trincomalee)

In households where all food preferences are catered for, women prepare multiple meals

Some women tried to meet everyone's food preferences simultaneously – whether based on individual tastes or dietary requirements – by cooking multiple dishes each meal. In every case, the additional effort required to satisfy and “respect” all preferences was conveyed. One respondent described this situation as the “*very hard daily balancing act*” that his mother has to perform because there is “*a huge issue of food choices in our house*” (Male, Trincomalee).

“Well, my wife makes all the food choices and meal planning by herself. But the preferences of each person are taken into account. She will make many different dishes to cater to the different preferences. We have different preferences in the curries we like to eat. We don't repeat the same dishes in the main meals.” (Male, Trincomalee)

“My husband is a vegetarian, so I have to ensure that not even a cooking spoon is mixed with meat dishes when cooking his food. A lot of thought and energy goes into cooking his vegetarian dishes which are not shared by the other members of the family. I have to cook two sets of meals because my husband's requirement is very specific.” (Female, Trincomalee)

6.4.3.3 The presence of intra-household consumption differences based on age and gender is uncommon, and its impact unclear

When asked how food consumption differs between household members, participants focussed on differences in the type, amount, and mode of food consumed between adult women, men, and children. The majority of households reported no age- or gender-based consumption differences or “*disparities*” in how food was distributed. Among those who reported consumption differences, no clear pattern emerged as to how these differences influenced or impacted the nutrition status of different household members.

Traditional age and gender consumption hierarchies are not a feature of most households

Seventy-two percent of participants did not indicate the presence of consumption hierarchies based on age or gender in their home: *“There is no gender discrimination in how the food is distributed”* (Female, Kalutara). One participant who distanced herself from the “tradition” of “serving men first and most” supplemented her answer with an explanation that consumption hierarchies of any kind are a tradition followed in “poorer families” where *“there is [not] enough food to go around”* (Female, Colombo). Other respondents conveyed scenes of communal and egalitarian eating: *“We eat together. We eat as each of us please”* (Female, Colombo).

Where present, consumption hierarchies do not always result in unequal intra-household food distribution

Consumption hierarchies that saw men served first and more and/or women and men eating at different times were present in 28% of respondent households: *“First the food is served for my father. Then my mother serves the food to us, the children. My mother eats what is left after we all eat”* (Female, Kalutara). Notably, serving order did not always affect the amount of food available to others: *“My husband’s father is served first, but I would not say his gender affects the amounts eaten by anyone or the way it is eaten in my household”* (Female, Kalutara).

Women express a preference for ‘healthy eating’

Some participants (10%) noted gender-based differences between the types of food that women (“healthy” and “fresh”) and men (“unhealthy” and “processed”) prefer. When making these comparisons, participants described “traditional foods”, “natural foods”, and

“vegetables and fruit” as healthy and “fatty and processed food”, “junk food”, “cheese”, “sweets”, “carbohydrates” and “meat” as unhealthy.

“If my husband is making the food choices, he buys all the fatty and processed foods and sugary foods without even reading the labels. If I make the choices I focus more on dark green vegetables, leaves and fresh food.” (Female, Colombo)

Gender differences in attitudes to healthy eating were less evident in children. Some parents said that their daughters took to their mother’s healthier preferences whereas others said they preferred *“much more meat like their father”*. Children, irrespective of gender, were generally described as having an appetite for *“oily and fried foods”, “short eats”, and “sweets”*.

“My husband eats more carbohydrates and meats. My youngest daughter and I eat more vegetables and fruits.” (Female, Colombo)

“My husband prefers more of processed food, cheese, and meats and so do my daughters. I prefer natural and traditional foods.” (Female, Colombo)

6.5 Discussion

6.5.1 Summary of key findings in relation to other studies

In recent decades, Sri Lanka has experienced rapid demographic, economic, nutrition, and social transitions (23, 24). The chapter’s findings show that despite this dynamism, rigid gender differences in household food labour roles and responsibilities remain present. More in tune with this prevailing trend of change, however, is the finding that *“traditional”* consumption hierarchies with negative nutrition consequences are not a common feature of households in Colombo, Kalutara, and Trincomalee.

Among study participants, women do most of the food related work, and are almost exclusively responsible for cooking. This supports the literature that examines the role of women in Sri Lankan society and the labour force participation and success barriers they continue to face (171, 172, 179). These studies, however, often aggregate domestic duties and childcare as a homogenous entity.

Moving beyond the question of '*who cooks?*', the findings from this study add nuance to the narrative that all domestic chores are 'women's work' by highlighting the role that men play. For example, whereas women are primarily responsible for food preparation and cooking, men are more involved in food purchasing and payment – the latter almost exclusively so. However, in almost all households, responsibility for food-related roles was inflexible. Without hesitation, participants were able to report who does what task and detail extenuating circumstances that might disrupt this arrangement. Even when responsibilities were shared, women and men assumed specific roles. For example, when food purchasing tasks were shared, women assumed responsibility for purchasing fresh and 'healthy' food whilst men shopped for pre-prepared or 'unhealthy' foods. An ethnographic study of 'cooking life' in Sri Lanka similarly discerns clear gendered trends in food procurement roles, which the author terms 'structures of repetition' (180). In line with the findings in this study, these structures are described as being sometimes flexible but not often broken.

For many families, food decisions were driven by children, elderly family members, and individuals with medical conditions. Where this was not the case, influence over household diet was often gendered: either the women responsible for cooking made all of the food-

related decisions or men's preferences were prioritised. In almost all cases, the dietary requirements or preferences of these 'food influencers' impacted the diet of all household members. The exception to this trend was found in households where women catered for the conflicting preferences of all family members. Importantly, participant experiences confirm that responsibility for food labour is not always a proxy for diet decision-making power. Where gendered preferences for healthy eating were expressed, women tended to prefer *"healthy"*, *"fresh"*, and *"traditional"* foods whereas men were described as preferring *"unhealthy"*, *"processed"* products and *"more meat"*. Women's higher awareness and knowledge of nutrition compared to men, who through their own admission had much less to do with food and in particular cooking, may in part explain this variation. Preference differences along health lines were often resolved by designing the household food menu around men's 'unhealthier choices' or by cooking various meals to satisfy everyone. At a household level, the literature paints a mixed picture of the role of Sri Lankan women in decision-making (172, 181). The findings presented in this chapter give a similarly heterogeneous account. Specifically, the role that children's fussiness and appetites play in influencing food decisions was a key and unexpected finding of this study in a context where obedience towards parents is considered a core virtue (172). Recent research in Taiwan and Singapore has also found that children exert considerable influence over their own and their family's meal choices (182, 183). In the latter study, Singaporean women noted that serving children foods that they liked was more practical and less wasteful. The accessibility and affordability of cooked meals purchased from food stalls made it relatively easy to satisfy children's tastes, especially for working mothers (183). To the best of my knowledge, no Sri Lankan study has explored the role that either children or elderly family members and their associated health conditions play in family food choices and dietary health outcomes.

The presence of consumption hierarchies with associated negative nutrition consequences for women and children was not a feature of most study households, with some participants describing scenes of egalitarian and communal eating. Where present, many participants insisted that upholding this tradition of serving older males first did not impact other family members' access to adequate nutrition. These findings are at odds with previous research. For example, the ethnographic study mentioned above identifies the presence of 'homogeneous consumption groups' that contribute to a lack of 'table culture' (i.e., where family members sit at the same table and share a meal together) (180). Additionally, research conducted in urban Kandy reports the presence of both age- and gender-based intra-household calorie allocation biases (175). The contrast between these findings and those presented in this chapter demonstrates the need for longitudinal mixed methods investigation into the context-specific presence, determinants, and outcomes of consumption hierarchies and intra-household food distribution both within and across South Asian countries.

6.5.2 Strengths and limitations of this study

The strengths and limitations of this study are similar to those described in the previous chapter. The main strengths of this study are twofold: the large sample size; and the qualitative and semi-structured method it followed, whereby participants were encouraged to share their experiences in their own time and words. This study has some limitations. Rich study findings may not be generalisable to the wider population due to the limited geographic area from which participants were recruited. Systematic member checking (or any other triangulation method) did not form part of this study. Doing so, however, would

have provided further confidence in the study results. Interviews were conducted, translated, transcribed, and coded by female researchers. The gender of the data collection team may have impacted how questions were asked and the types of responses received. Without a comparison, however, it is difficult to gauge how data collection was impacted. A key limitation of this study is the absence of participant socioeconomic and household composition data.

6.5.3 Implications for policy and practice

This study adds to the growing body of literature that demonstrates the value of qualitative evidence for our understanding of the multiple factors that influence the appropriate and effective implementation of health policies and interventions (184). Specifically, study findings have implications for the improvement of efforts to promote healthy eating through the provision of healthy diet advice, guidance, and encouragement in Sri Lanka. The SLFBDGs are one such example. Among study participants, women were more likely to have the necessary knowledge and skills required to implement healthy diet guidance, but they did not necessarily have the decision-making power to change household dietary behaviours. Health promotion interventions that are blind to this disparity risk overemphasising the role of women in effective behaviour change and may inadvertently reinforce gender stereotypes (185, 186). Diet improvement efforts should therefore be directed to all family members – especially men and children whose attitudes and preferences are a crucial determinant of what and how family members eat. Given men are more involved in food payment and purchasing than any other aspect of food labour, practical healthy purchasing advice to support various point-of-sale nutrition interventions

could be included in dietary guideline documents that aim to ‘provide the general public with solutions that they can easily follow’ (135).

Equally, all family members are involved in the consumption of food. Information to support the creation of healthy consumption environments, for example the promotion of family meals or inclusive ‘table culture’, could improve healthy eating behaviours in children, adolescents, and adults (187-189). Precedent for this can be found in the Brazilian, Korean, and Mediterranean diet guidelines, to name a few, where convivial consumption environments and the practice of enjoying meals in the company of others are core recommendations (190-192). For many female participants in this study, balancing the food choices of family members was a difficult task and it was often people’s tastes rather than health considerations that determined meals served. Dietary guidance that accounts for taste alongside health considerations may therefore be more useful to women who find themselves in this difficult decision-making role (193-195).

6.6 Conclusion

The chapter’s findings show that household gender and age dynamics in Colombo, Kalutara, and Trincomalee influence what and how people eat. Whilst confirming that women are disproportionately involved in food preparation and cooking, this study also contributes new and important findings about diet decision-making and the presence and potential impacts of intra-household consumption differences. Sri Lankan dietary interventions that aim to effectively and appropriately influence day-to-day practice should therefore be developed with a contextualised awareness of who is responsible for, who is able to

perform, and who influences targeted behaviours. The use of qualitative research can help generate such information.

Chapter 7. Discussion

7.1 Chapter summary

This final chapter reviews the aim and objectives of this thesis, summarises the main thesis findings, identifies and reflects on the key strengths and limitations of the thesis as a whole, and suggests avenues for further research.

7.2 Review of thesis aim and objectives

As discussed in Chapter 1, accelerating progress toward achieving global nutrition and NCD targets requires the development and implementation of setting-specific strategies based on local evidence. The generation of this evidence, however, requires context-appropriate research tools and a supportive research environment. Then, once generated, research evidence cannot be expected to speak for itself; the gap between knowledge and action needs to be bridged, and this process needs to involve the consideration of various contextual factors. Responding to the WHO's call to action to promote the contextualisation of global, regional, and national recommended interventions and policies (41-43) is therefore a multifaceted process with multiple entry points. One might start, however, by supporting what has been termed the 'cornerstone of public health practice': strong and connected national risk factor surveillance activities (196).

This thesis therefore aimed to improve the assessment of nutrition-related behaviours so as to target interventions better and inform policy in Sri Lanka. The achievement of this aim was supported by fulfilling the following five objectives:

1. **To conduct** a systematic review of the association between urbanicity and dietary intake and **describe** the urbanicity measurement methods used to investigate this association.
2. **To explore** the facilitators of and barriers to evidence-based public health policymaking in Sri Lanka, with a focus on nutrition, noncommunicable diseases, and urban health.
3. **To validate** a newly developed brief dietary survey to estimate food intake and adherence to the Food Based Dietary Guidelines for Sri Lankans, using a 24-hour Dietary Recall as reference.
4. **To explore** the factors that might impact Sri Lankan Brief Dietary Survey participation, engagement, and social validity among study participants.
5. **To investigate** how food labour, consumption hierarchies, and diet decision-making dynamics in Sri Lankan households might influence how and for whom interventions aimed at promoting healthy eating might work.

7.3 Main findings of this thesis

Chapter 3 identified and described the barriers to and facilitators of evidence generation, communication, and uptake in the areas of NCDs, nutrition, and urban health in the Sri Lankan context. Whilst many of the study findings confirmed that much of what is known about the barriers to and facilitators of EBPM from the 'global' literature (based predominantly on high-income, English-speaking experiences) also applies to the Sri Lankan context, important context-specific differences were also revealed. Some of the context-specific barriers identified included: English language communication barriers that existed

between evidence generators and users; perceived publication bias against LMIC researchers in international journals; the extensive involvement of clinicians and ‘medical mindsets’ in public health research and policymaking; and the relatively recent arrival of NCDs and their associated risk factors on the political agenda. The identification of these particular barriers and facilitators to EBPM highlights the value of undertaking such a study before embarking on research, evidence translation, and policymaking activities in the areas of NCDs, nutrition, and urban health in different country contexts. Chapters 4, 5, and 6 further demonstrate how the learnings from this qualitative inquiry can help to inform a setting-specific research agenda that is responsive and relevant to the needs of local stakeholders and whose results are therefore more likely to be utilised (73).

Chapter 3 interviewees, along with SLNCDS staff, also identified the absence of a low burden dietary survey developed for and validated with the Sri Lankan adult population as a key barrier to the development and evaluation of effective dietary interventions. Chapter 4 responded to this barrier by developing and relatively validating a context-specific dietary survey with clear public health relevance, the Sri Lankan Brief Dietary Survey (SLBDS), with 94 Sri Lankan adults. Specifically, this tool estimated food intake and adherence to the multi-ministry endorsed Food Based Dietary Guidelines for Sri Lankans (135). The findings from this study showed that the SLBDS demonstrates promise as a fit for purpose research tool – an outcome that supports a shift toward focussing attention on comparable surveillance outcomes (i.e., achievement of recommended daily intake for different food groups) over prioritising the consistent use of ‘off the shelf’ tools. The chapter’s findings also reinforce the need to further improve the measurement of salt, oil, and coconut intake

within the Sri Lankan population – key factors affecting dietary risk for the development of NCDs in Sri Lanka (130, 131).

Chapter 5 extended upon the validation exercise undertaken in Chapter 4 by exploring other dimensions of tool validation that may increase the accuracy and representativeness of data collected. Specifically, this chapter investigated factors that might impact SLBDS participation, engagement, and social validity. These factors included the time of day interviews occur, ease of recall, level of commitment required, perceived survey value, emotional response to surveys, and interviewer positionality. Many of these factors were gendered, but both female and male participants expressed a preference for engaging with socially valid research that they felt justified their personal investment in data collection. This particular finding highlights the need not only to develop research that is socially valid, but also more meaningfully to engage with participants when describing the purpose of a study, the value of their participation, and the way in which data will be used and shared. The findings from this chapter also highlight the vulnerability of dietary research to trading on gender stereotypes, and the implications of this for surveillance activities, and ultimately the appropriateness and effectiveness of programmes and policies informed by these data collection efforts. As LMICs, including Sri Lanka, are encouraged to expand their dietary surveillance activities, more setting-specific attention should therefore be paid to the relationship between data quantity, quality, and equity.

Chapter 3 interviewees also identified a need for more research evidence relevant to dietary intervention development and implementation. Chapter 6 therefore explored some of the context-specific factors that might impact the success of dietary interventions aimed at

influencing day-to-day practice. Findings from this study suggest that although women in Sri Lanka shoulder a disproportionate burden of food-related labour, this responsibility is not always a proxy for dietary decision-making power. However, while men are often absent from the kitchen, their role in food purchasing and payment is prominent in many households. Together, these findings suggest that diet improvement efforts should not be targeted at women exclusively, but rather directed to all family members, especially men and children whose attitudes and preferences are a crucial determinant of what and how family members eat. This study also provides evidence against the hypothesis that 'traditional' age- and gender-based consumption hierarchies with negative nutrition consequences for women and children are common in Sri Lankan households.

Chapter 2 is an important part of the history of this thesis, and hopefully will have an important impact on the future of diet-related health research and interventions in Sri Lanka if published as a peer-reviewed paper or if its results are disseminated in other ways. Improving the assessment of nutrition behaviours requires consideration of the context in which people make food purchase and consumption decisions, factors that will help to target interventions better. The systematic review of the literature presented in Chapter 2 identified 12 studies conducted in China, India, the Philippines, and Uganda that investigated the association between urbanicity and measures of dietary intake, of which 17 were in a direction consistent with the hypothesis that urbanisation leads to more Western-style diets. The limited number of studies identified indicates a paucity of research in this area, an observation that might, in part, be explained by the lack of context-specific research tools available to support the measurement of this association. This review identified four different multicomponent urbanicity measurement methods that have been

used in studies that investigate this association. Crucially, these tools measured a limited number of food-specific features of an urban environment, which is not entirely unexpected given that they were not originally created to investigate the impact of urban environments on diet. Adaptation and modification of these methods is therefore required to support research on the factors that might help explain and improve context-specific urbanicity and diet associations in Sri Lanka.

Taken individually and together, the findings from this dissertation can help to target interventions better and inform policies with the aim of improving nutrition outcomes and reducing the diet-related NCD burden in Sri Lanka.

7.4 Key strengths and limitations of this dissertation

The strengths and limitations of the studies included in this thesis are detailed in the discussion section of each chapter. The purpose of this section is to outline the key strengths and limitations of the dissertation as a whole, as well as those that are common to multiple chapters.

The key strengths of this thesis are primarily related to its contextually-sensitive and responsive approach to research. This approach inspired the aim and objectives of this thesis, the selection of research methods, and the writing and publication of findings.

Although the termination of the SLNCDS was unfortunate, this situation provided a unique opportunity to investigate the research generation and policymaking environments in Sri Lanka, and it was this initial inquiry that ultimately informed research that was responsive

to the needs of local stakeholders. The importance of this approach is exemplified by the necessary shift in the focus of this thesis, which originally focussed on urbanicity and diet, to one which ended up primarily focussing on the assessment of nutrition-related behaviours so as to target interventions better and inform policy. The use of both qualitative and quantitative methods in this thesis is another key strength, the complementary nature of which is demonstrated nicely by Chapters 4 and 5.

The final key strength of this thesis is related to one of the key barriers to both evidence generation and uptake discussed by Chapter 3 interviewees: a lack of data sharing and publishing. This often meant that context-specific research methods and results were not available in the public domain, leading to concerns that 1) important intervention and policy-relevant information could not be accessed by intended audiences; and 2) researchers were unnecessarily duplicating research efforts. Chapter 3 interviewees also raised the issue of limited publication opportunities for local researchers and the inaccessibility of papers and reports laden with scientific jargon. It was therefore a priority of this DPhil project to publish the SLBDS tool and intervention-relevant findings in open-access journals, and to avoid the use of scientific jargon where possible. At the time of thesis submission, the work that contributes to Chapters 4 and 6 has been published in peer-reviewed academic journals and the work covered in Chapter 5 is under review for publication.

The limitations of this thesis principally relate to the challenges associated with conducting international fieldwork and interviews, as well as the time and resource constraints associated with DPhil research. Whilst on the one hand this dissertation is a testament to

what can be achieved on a relatively tight research budget and with the support of dedicated colleagues, it is also revealing of some of the common barriers – namely funding – to conducting both field research and follow-up studies. The funding received for the fieldwork conducted in this thesis did not cover follow-up studies. This meant that the test-retest reliability and scalability of the SLBDS have not yet been investigated. These further tests, however, are necessary to improve tool validity and feasibility and to encourage its widespread use. They are also necessary to overcome a barrier to evidence use identified in Chapter 3: ‘Research evidence based on pilot projects that has not been scaled is seen as less appealing and less relevant to policymaking’.

In-person data collection, whilst an important aspect of this study, may present a barrier to closing the ‘follow-up gap’ mentioned by Chapter 3 participants. Research tools that make data collection and re-collection easier are greatly needed and the current COVID-19 pandemic has highlighted the importance of investing in context-appropriate online research methods to support this process. While this thesis demonstrates that online interviews are a viable data collection method when used with fellow researchers and policymakers in Sri Lanka, this thesis does not explore the use of such methods with the general public.

All of the data collection in this thesis was undertaken by female researchers. As discussed in Chapter 5, the research topics covered in this dissertation may be sensitive to ‘sex of interviewer’ effects (161). Without comparison data, this thesis could not explore the potential impacts that researcher positionality (specifically gender) may have had on the accuracy of data collected.

My positionality was both a strength and limitation of this thesis. The benefits, drawbacks, and issues associated with conducting qualitative research as an outsider to the research context have been well-documented in the literature, as have the pros and cons of being an insider or 'member' of the group being studied (197). On the one hand, as an Australian studying at a UK institution, I am an outsider to the Sri Lankan context. On the other hand, I am a researcher working in the areas of NCDs, nutrition, and urban health and so, in a wider sense, identify as a member – *“characterised by a shared language, identity, and experiential base with the study population”* (198) – of the researcher contingent of Chapter 3 participants. Occupying the space between insider and outsider for this particular study appeared to create a level of trust and openness with participants that may not have been possible otherwise. Being an outsider to the context also meant that participants often generously took the time to explain contextual nuances and differences to me. It is also possible, however, that participants may have over-assumed a level of shared knowledge or that I may have missed important information conveyed through idiomatic phrases, figures of speech, or non-verbal communication. Real-time member checking (discussed in section 3.3.1), open ended interview questions, detailed field notes, the assessment of data saturation, and consultation with a local researcher during the data analysis phase helped to ensure that participant experiences were represented accurately. However, without another interviewer who occupied a different status and proximity to participants for direct comparison, it is not possible to fully ascertain the costs and benefits of my positionality on the research.

In contrast to Chapter 3 where I conducted and transcribed audio-recorded interviews and analysed data, two Sri Lankan researchers collected data for Chapters 4, 5, and 6 and I conducted the analysis. This allowed for interviews to be conducted in participants' preferred language and provided an opportunity for Sri Lankan researchers to be intimately involved in the study; this collaboration increased study ownership, supported the communication of research findings, and built capacity for potential follow-up studies. At the same time, analysing interview data that I had not collected myself brought with it particular challenges, as I was unable to refer back to my detailed fieldnotes and interview reflections. Many of the interviews had also been translated from Sinhala into English, a process that *"involves converting ideas expressed in one language for one social group to another language for another social group, which entails a process of cultural decoding"* (199). It is therefore possible that some original meanings may have been lost in the translation process. I was very aware of my outsider status and distance from the data collection process when conducting the analysis for Chapter 6, where I deductively coded for gender differences in anticipation of confirming or challenging Sri Lankan gender norms. I therefore ensured that, where available, findings were contrasted with both concordant and discordant literature. Data extracts as well as codes and themes were also discussed at length with a local member of the research team (SF) who conducted and translated interviews to ensure that any 'lost in translation' incidents were minimised.

7.5 Avenues for further investigation

This thesis is composed of pilot and exploratory studies that prompt many opportunities for future research. The multiple avenues for further investigation arising from this thesis can

be divided into two categories: 1) further research tool development and 2) future research directions.

7.5.1 Further research tool development

The findings from Chapters 4 and 5 indicate that the SLBDS requires further improvement and testing before scaling, specifically the investigation of test-retest reliability. Survey improvements should focus on more accurately and consistently measuring salt, oil, and coconut intake within the Sri Lankan population as well as revising the survey structure to increase recall ease. Methods to improve the social validity and gender-responsiveness of the survey should also be explored. Future research might also investigate online delivery of the SLBDS to further reduce administration and analysis burden; potential interviewer and social desirability bias; the time and cost associated with administering repeat surveys; and to support real-time translation of data for evidence-informed decision-making.

There remains an outstanding need for a Sri Lanka-specific urbanicity measurement method to support nutrition, NCD, and urban health research, and subsequent intervention and policy development: *“The problem is that for urbanisation for urbanicity there is no proper tool available. There is no tool to kind of assess the urbanisation and for that we kind of try and develop a tool that was actually done for the Tamil Nadu and it was a concept that has been given and it’s called the urbanicity index and so that is used to measure the relationship between urbanisation and NCDs but still it’s very difficult to capture everything, all the aspects of urbanisation, in that tool. So far, we haven’t come up with a good tool as yet” (Participant 6, Chapter 3).*

7.5.2 Future research directions

This thesis identified particular questions to be addressed by future research. Many of these questions are embedded in the discussion sections of Chapters 2, 3, 4, 5, and 6. This section highlights future avenues for research (not outlined in section 7.5.1 above), by chapter, that would further contribute to the achievement of the thesis aim.

Chapter 2

Chapter 2 highlighted the need for research on the longitudinal association between dietary intake and urbanicity in Sri Lanka so as to provide further insight on which features of urban environments should be targeted for intervention. This research should be supported by context-specific dietary and urbanicity measurement methods.

Chapter 3

It has been well-documented that the COVID-19 pandemic has impacted the ability of countries to address and respond to NCDs and their key risk factors (200). The study presented in Chapter 3 was conducted before the COVID-19 pandemic. Future investigations of the barriers to and facilitators of NCD, nutrition, and urban health EBPM in Sri Lanka should therefore explore the potential impacts (both positive and negative) of the pandemic on research agendas, funding priorities, and political attention and action. Such information might also help to inform a context-specific approach to the WHO's call for countries to 'build back better' (200). Given Sri Lanka's success in the areas of vaccine-preventable diseases and maternal and child health (201), a comparative study of the similarities and differences between the barriers and facilitators of EBPM in these areas compared with those presented in Chapter 3, could provide further insight into tailoring

contextually-appropriate and effective approaches. The study undertaken in Chapter 3 could also be expanded and scaled so as to assess the experiences of more and diverse stakeholders (civil society members, non-English speaking policymakers, and additional research funders). A less resource intensive research method, such as surveys, could facilitate this endeavour.

Chapter 4

Chapter 4 findings showed that Sri Lankan adults' diets are more diverse than the food items and categories detailed in the SLFBDGs. These findings reinforce the need to assess the appropriateness and comprehensiveness of the current SLFBDGs that were last updated in 2011, as well as the health benefits of meeting guideline recommendations (32).

Undertaking these investigations might be assisted by and/or contribute to the continual improvement of the SLBDS. A recent modelling study that analysed the environmental impacts of adopting the SLFBDGs indicated that guideline adherence only contributes to the achievement of one of five global environmental targets based on greenhouse-gas emissions, land-system change, water use, and nitrogen and phosphorus pollution (150). Future research should therefore also focus on updating the SLFBDGs to integrate environmental sustainability considerations that contribute to the achievement of local and global environmental targets.

Chapter 5

From the responses and reactions of Chapter 5 participants when directly invited to suggest SLBDS improvements, it is clear that a greater level of context-specific attention and planning needs to be invested in creating conducive conditions for participant engagement

in the research co-creation process. Further investigation is therefore required to understand what successful co-creation with research participants in the Sri Lanka context might look like.

Chapter 5 participants indicated that women interviewing women and doctors (irrespective of gender) interviewing both women and men provided conducive conditions for sharing reliable data. Participants did not discuss, however, whether male participants would feel more comfortable being interviewed by male researchers, and no comparison data are available in this thesis to empirically test this hypothesis as female researchers conducted Chapter 5 interviews. Future research should therefore investigate which gender pairing(s) might generate the greatest rapport with male participants who were described as being generally *“less expressive”*.

Chapter 6

Chapter 6 explored the context-specific factors that might impact the success of dietary interventions within the household context in the Colombo, Kalutara, and Trincomalee districts in Sri Lanka. Previous research has investigated the barriers to healthy dietary choice amongst students in the Monaragala and Ampara districts (202). Future investigations should extend these qualitative inquiries to other geographical locations and settings, such as workplaces, to support further the development, implementation, and evaluation of the various place-based interventions and awareness raising marketing campaigns outlined in the National Multisectoral Action Plan (32).

7.6 Conclusion

The central message of this thesis is that *context is everything*. What works to improve health depends on context, and context is complex. Setting-specific mixed-methods research evidence is therefore required to inform appropriate, effective, and equitable intervention development and implementation. Responding to local stakeholder needs, this thesis has: developed a novel brief dietary survey for use in multi-risk factor NCD studies in Sri Lanka; explored the social validity and suitability of this survey with its intended study population; and explored some of the factors that might impact the success of household dietary interventions informed by these data collection efforts. The dietary survey tool that has been developed and validated in this thesis can also be used to monitor population adherence to the SLFBDGs, and therefore the success of the multiple national policies and interventions based on their promotion.

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Appendix I. Table A1: Search terms for systematic literature review (all databases)

Database	Search terms
MEDLINE, Embase, CAB Abstracts, and Global Health	[(urbanicity.mp.) or (urban* adj3 (scor* or index or questionnaire* or tool* or indicator* or measure* or scale*)).mp.] AND [(Feeding Behavior/ or Food preferences/ or Energy Intake/ or Healthy Diet/ or *Diet/ or ((Diet/ or Eating/) and exp *Food/ Diet/ and (exp carbonated beverages/ or energy drinks/ or "fruit and vegetable juices"/ or milk/)) or ((food or feeding or eating or diet* or nutrition*) adj2 (habit? or behavior? or behaviour?)).ti,ab. or ((food or diet* or calorie* or calorific or nutrition*) adj2 (intake? or consumption or consume?)).ti,ab. or (healthy eating or healthful eating or unhealthy eating).ti,ab.]
CINAHL	[Urbanicity or (urban* N3 (scor* or index or questionnaire* or tool* or indicator* or measure* or scale*))] AND [(MH "Eating Behavior") OR (MH "Energy Intake") OR (MH "Food Intake") OR (MM "Diet") OR (MM "Food") OR (MH "Fruit+") OR (MH "Health Food") OR (MH "Vegetables+") OR (MH "Food Habits") OR (MH "Carbonated Beverages") OR (MH "Fruit Juices+") OR (MH "Milk") OR (MH "Sports Drinks") OR (MH "Energy Drinks") or ((food or feeding or eating or diet* or nutrition*) N2 (habit? or behavior? or behaviour?)) or ((food or diet* or calorie* or calorific or nutrition*) N2 (intake? or consumption or consume?)) or (healthy eating or healthful eating or unhealthy eating)]
Web of Science	[TS=(urbanicity) OR TS=((urban* NEAR3 (scor* or index or questionnaire* or tool* or indicator* or measure* or scale*)))] AND [TS=(((food or feeding or eating or diet* or nutrition*) NEAR2 (habit? or behavior? or behaviour?)))]

	OR TS=((food or diet* or calorie* or calorific or nutrition*) NEAR2 (intake? or consumption or consume?))) OR TS=(healthy eating or healthful eating or unhealthy eating) OR TI=(food or diet* or calorie* or calorific or nutrition*)]
The Avery Index to Architecture Periodicals	[Urbanicity or (urban* N3 (scor* or index or questionnaire* or tool* or indicator* or measure* or scale*))] AND ((food or feeding or eating or diet* or nutrition*) N2 (habit? or behavior? or behaviour?)) or ((food or diet* or calorie* or calorific or nutrition*) N2 (intake? or consumption or consume?)) or (healthy eating or healthful eating or unhealthy eating)]
ProQuest	[noft(urbanicity) or noft((urban* NEAR/3 (scor* or index or questionnaire* or tool* or indicator* or measure* or scale*)))] AND [noft(((food or feeding or eating or diet* or nutrition*) NEAR/2 (habit? or behavior? or behaviour?))) or noft(((food or diet* or calorie* or calorific or nutrition*) NEAR/2 (intake? or consumption or consume?))) or noft((healthy eating or healthful eating or unhealthy eating))]

Appendix II. Table A2: Definitions of included urbanicity tool components

Tool components	Definitions of included tool components		
	Jones-Smith & Popkin, 2010	Dahly & Adair, 2008 and Allender et al., 2010	Riha et al., 2014 (Adapted from Novak et al., 2012)
Population size		Not specified	Population of locality
Population density	Total population of the community divided by community area	Not specified	
Communications	Availability of a cinema, newspaper, postal service, telephone service, and percent of households with a computer, percent of households with a television, and percent of households with a cell phone	The presence of phone service, mail, newspapers, the internet, cable TV, and cellular phones	Proportion of houses with availability of communication services (public internet, movie theatre, public telephone) in locality
Transportation	Most common type of road, distance to bus stop, and distance to train stop	The density of paved roads, and the availability of public transportation	
Built environment			Road type in the locality, availability and utilization of sewage services in locality, and availability and utilization of electricity in locality
Healthcare services/infrastructure	Number and type of health facilities in or nearby the community and number of pharmacies in community	The presence of health services, including hospitals, medical clinics, maternal health clinics, family planning clinics, and community health centres	Types of health facilities available in the locality, types of health workers present in locality
Education	Average education level among adults >21 years old	The presence of educational institutions, including primary and secondary schools, colleges, and vocational schools	Types of educational facilities in the locality, average education of mothers in the locality

Market access/type	See traditional and modern markets	The number of Sari-Sari stores (small, retail shops), and the presence of drug stores, grocery stores, and gas stations	
Traditional markets	Distance to the market and number of days of operation for eight different types of market, including food and fuel markets		
Modern markets	Number of supermarkets, cafes, internet cafes, indoor restaurants, outdoor fixed and mobile eateries, bakeries, ice cream parlours, fast food restaurants, fruit and vegetable stands, bars within the community boundaries		
Economic factors	Typical daily wage for ordinary male worker and percent of the population engaged in non-agricultural work		Proportion of population listing agriculture as their primary occupation
Social services	Provision of preschool for children under 3 years old, availability of commercial medical insurance, free medical insurance, and/or insurance for women and children		
Sanitation	Proportion of households with treated water and prevalence of households without excreta present outside the home		
Housing	Average number of days a week that electricity is available to the community, percent of community with indoor tap water, percent of community with flush toilets, and percent of community that cooks with gas		
Diversity	Variation in community education level and variation in community income level		Variance in years of education among mothers

Appendix III. Table A3: Risk of bias for included studies: NIH Quality Assessment Tool for Observational Cohort and Cross-sectional Studies (n=12)

Reference	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
<i>Allender et al., 2010</i>	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	N	NA	Y	9
<i>Batis et al., 2014</i>	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	Y	Y	11
<i>Chang et al., 2018</i>	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	Y	Y	11
<i>Dahly & Adair, 2007</i>	Y	N	NR	Y	N	N	Y	Y	Y	Y	y	N	N	Y	8
<i>Huang, Wang & Tian, 2017</i>	Y	Y	NR	Y	N	N	Y	Y	Y	Y	Y	N	Y	Y	10
<i>Jones-Smith & Popkin, 2010</i>	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	9
<i>Kelles & Adair, 2009</i>	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	Y	Y	11
<i>Riha et al., 2014</i>	Y	Y	Y	Y	N	N	N	Y	Y	N	Y	NR	NA	Y	8
<i>Xu et al., 2015</i>	Y	Y	Y	Y	N	N	N	Y	Y	N	Y	N	NA	Y	8
<i>Xu et al., 2015</i>	Y	Y	Y	Y	N	N	N	Y	Y	N	Y	N	NA	Y	8
<i>Xu et al., 2015</i>	Y	Y	Y	Y	N	N	N	Y	Y	N	Y	N	NA	Y	8
<i>Wang et al., 2012</i>	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	Y	Y	11

Y, yes; N, no; NR, not reported; NA, not applicable

Quality assessment criteria

1. Was the research question or objective in this paper clearly stated?
2. Was the study population clearly specified and defined?
3. Was the participation rate of eligible persons at least 50%?
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?
5. Was a sample size justification, power description, or variance and effect estimates provided?
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
10. Was the exposure(s) assessed more than once over time?
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
12. Were the outcome assessors blinded to the exposure status of participants?
13. Was loss to follow-up after baseline 20% or less?
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?

Appendix IV. Participant consent form

Certificate of Consent

Please initial box

I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions.

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.

I consent voluntarily to be a participant in this study.

I agree to the interview **(please tick one of the boxes below)**.

Yes

☐

No

☐

I agree to the interview being audio recorded **(please tick one of the boxes below)**.

Yes

☐

No

☐

I agree to the use of anonymised quotes in publications **(please tick one of the boxes below)**.

Yes

☐

No

☐

Name of participant:

Date (day/month/year):

Signature:

Name of researcher/person taking consent:

Date (day/month/year):

Signature:

Appendix V. Sri Lankan Brief Dietary Survey (SLBDS)

About you:	Sex:	Age:	Grama Niladari division:	Are you a vegetarian? Yes / No
	Ethnicity:			Are you on a special diet? Yes / No If yes, what is the diet name:
What was the day yesterday? (Please circle) Monday / Tuesday / Wednesday / Thursday / Friday / Saturday / Sunday				
Please tell us about what you ate <u>yesterday</u>...				
Name of food group	Did you consume this food group? (Please circle)	How much did you consume? [1 cup = 200ml teacup]		
Rice, bread, other cereals and yams	Yes / No	Number of coconut spoons of rice = _____ Number of pieces of milk rice = _____ Number of bread slices = _____ Number of hoppers = _____ and string hoppers = _____ Number of roti = _____, dosa = _____ and pittu = _____ Number of coconut spoons of pasta/noodles = _____ Number of coconut spoons of yams/potatos/jackfruit = _____		
Fruits	Yes / No	Number of medium size fruit = _____ Number of pieces of large fruit = _____ Number of cups of fruit salad = _____ Number of glasses of fresh fruit juice = _____		
Vegetables	Yes / No	Number of tablespoons of cooked vegetables = _____ Number of tablespoons of dark green leaves (Mallums) = _____		
Fish, pulses, meat and eggs	Yes / No	Number of pieces of meat/poultry/fresh fish = _____ <i>(1 piece is approximately the size of a small matchbox)</i> Number of coconut spoons of cooked pulses = _____ <i>(Examples: Chickpea, green gram, cowpea, soybean, ulundu, lentil)</i> Number of whole eggs = _____ Pieces/small squares of dried fish = _____		
Milk or milk products	Yes / No	Number of cups of fresh milk = _____ Number of cups of yoghurt = _____ Number of cups of curd = _____ Number of teaspoons of milk powder = _____		

Nuts and oil seeds	Yes / No	Number of handfuls of nuts = _____ Type(s) of oil added to cooking = _____ Was this oil reheated oil? Yes / No (If known) number of tablespoons of oil added to cooking = _____ Per household: Number of whole coconuts = _____ Number of packets of coconut powder = _____ How many people did you cook for? _____
Sweetened drinks, sweets and desserts	Yes / No	Number of glasses of sweet fizzy drink = _____ Number of medium size sweets = _____ Number of medium size desserts (ice cream, pudding) = _____
Fast food	Did you eat Western fast food yesterday? Yes / No <i>(Examples: French fries, pizza, McDonald's, KFC, pattie, cutlet, Chinese roll, pastries)</i> Did you eat Local fast food yesterday? Yes / No <i>(Examples: samosa, papadam, egg role, wadai, murukku, manioc chips)</i>	
Salt	Yesterday, during cooking or after, did you add salt, sauce/ketchup or chutney/chilli paste to your Breakfast Yes / No Lunch Yes / No Dinner Yes / No Snack Yes / No Total pinches of salt added = _____	
Tea	How many cups of tea did you have yesterday? _____ How many teaspoons of sugar did you add to each cup? _____ How many pieces of Jaggery did you have with each cup? _____	
Would you consider yesterday a 'typical day' that represents the type and amount of food you usually consume? Please circle one response: Yes / No / to some extent Please explain your response:		

Appendix VI. Table A4: Cohen's kappa for agreement between achievement of the Sri Lankan Food Based Dietary Guideline recommendations calculated from the SLBDS and 24DR, by participant sex

Food groups	Female (n=62)			Male (n=32)		
	% female participants who achieved SLFBDG recommendation (95% CI)		κ value (95% CI)	% male participants who achieved SLFBDG recommendation (95% CI)		κ value (95% CI)
	SLBDS	24DR		SLBDS	24DR	
Rice, bread, other cereals and yams	43.6 (31.2, 55.9)	68.6 (57.2, 80.3)	0.74 (0.57, 0.91)	46.8 (29.5, 64.1)	78.1 (63.8, 92.5)	0.76 (0.51, 1.00)
Fruit	17.7 (8.2, 27.3)	34.4 (22.6, 46.2)	0.76 (0.54, 0.98)	14.5 (2.3, 26.7)	28.1 (12.6, 43.7)	0.86 (0.66, 1.00)
Vegetables	6.5 (0.2, 12.6)	9.4 (2.1, 16.6)	0.45 (0.09, 0.81)	12.9 (1.3, 24.5)	12.5 (1.0, 24.0)	0.84 (0.54, 1.00)
Fish, pulses, meat and eggs	59.7 (47.5, 71.9)	75.0 (64.2, 85.8)	0.60 (0.40, 0.80)	75.8 (61.0, 90.6)	84.4 (71.8, 97.0)	0.71 (0.42, 1.00)
Milk and dairy products	35.5 (23.6, 47.4)	31.3 (19.7, 42.8)	0.60 (0.40, 0.80)	33.9 (17.5, 50.3)	25.0 (10.0, 40.0)	0.69 (0.42, 0.97)

Appendix VII: Table A5. Cohen's kappa for agreement between number of participants reporting consumption > 0 in both the SLBDS and 24DR, by participant sex

Food and beverage item	Female (n=62)			Male (n=32)		
	% female participants that reported consumption > 0 servings (95% CI)		κ value (95% CI)	% male participants that reported consumption > 0 servings (95% CI)		κ value (95% CI)
	SLBDS	24DR		SLBDS	24DR	
Medium size desserts	19.4 (9.5, 29.2)	19.4 (9.5, 29.2)	0.8 (0.6, 1.0)	12.5 (1.0, 24.0)	12.5 (1.0, 24.0)	1.00 (1.00, 1.00)
Medium size sweets	32.3 (20.6, 43.9)	30.7 (19.2, 42.1)	0.6 (0.4, 0.8)	37.5 (20.7, 54.3)	34.4 (17.9, 50.8)	0.93 (0.80, 1.00)
Sweet fizzy drinks	16.1 (7.0, 25.3)	8.1 (1.3, 14.8)	0.6 (0.3, 0.9)	21.9 (7.6, 36.2)	18.8 (5.2, 32.3)	0.90 (0.72, 1.00)
Jaggery	6.5 (0.3, 12.6)	4.8 (0.0, 10.2)	0.9 (0.6, 1.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	-
Sugar	61.3 (49.2, 73.4)	69.4 (57.9, 80.8)	0.8 (0.6, 0.9)	75.0 (60.0, 90.0)	68.8 (52.7, 84.8)	0.85 (0.64, 1.00)
Tea/coffee	77.4 (67.0, 87.8)	82.3 (72.8, 91.8)	0.8 (0.5, 1.0)	90.6 (80.5, 100.0)	84.4 (71.8, 97.0)	0.72 (0.35, 1.00)

Appendix VIII: Table A6. Cohen's kappa for agreement between number of participants reporting consumption of fast food and salt intake in both the SLBDS and 24DR, by participant sex

Food and beverage item	Female (n=62)			Male (n=32)		
	% female participants that reported consumption > 0 servings (95% CI)		κ value (95% CI)	% male participants that reported consumption > 0 servings (95% CI)		κ value (95% CI)
	SLBDS	24DR		SLBDS	24DR	
Fast food	38.7 (26.6, 50.8)	53.1 (40.7, 65.6)	0.76 (0.59, 0.93)	37.1 (20.4, 53.8)	53.1 (35.8, 70.4)	0.87 (0.71, 1.00)
Western	21.0 (10.8, 31.1)	12.9 (4.6, 21.2)	0.72 (0.49, 0.950)	12.0 (0.7, 23.3)	10.0 (-0.4, 20.4)	0.86 (0.68, 1.00)
Local	15.0 (6.1, 23.9)	18.0 (8.4, 27.6)	0.79 (0.62, 0.97)	9.0 (-0.9, 18.9)	9.0 (-0.9, 18.9)	0.85 (0.64, 1.00)
Added salt						
Breakfast	93.6 (87.4, 99.7)	100.0 (100.0, 100.0)	0.15 (0.01, 0.28)	53.2 (35.9, 70.5)	50.0 (32.7, 67.3)	0.00 (0.00, 0.00)
Lunch	93.6 (87.4, 99.7)	100.0 (100.0, 100.0)	0.08 (0.00, 0.17)	38.7 (21.8, 55.6)	50.0 (32.7, 67.3)	0.00 (0.00, 0.00)
Dinner	93.6 (87.4, 99.7)	100.0 (100.0, 100.0)	0.04 (-0.06, 0.14)	41.9 (24.8, 59.0)	46.9 (29.6, 64.2)	0.00 (0.00, 0.00)
Snack	95.2 (89.8, 100.0)	100.0 (100.0, 100.0)	0.04 (-0.01, 0.10)	30.7 (14.7, 46.6)	21.9 (07.6, 36.2)	0.00 (0.00, 0.00)

Appendix IX: Table A7. Cohen's kappa for agreement between number of participants reporting cooking oil and coconut consumption data in both the SLBDS and 24DR

	Total (N=94)		
	% participants that reported consumption data (95% CI)		κ value (95% CI)
	SLBDS	24DR	
Oil (used in cooking)			
Amount	70.2 (61.0, 79.5)	0.0 (0.0, 0.0)	0.00 (0.00, 0.00)
Method	71.3 (62.1, 80.4)	96.8 (93.3, 100.0)	0.15 (-0.00, 0.31)
Reheated	80.6 (72.9, 88.8)	0.0 (0.0, 0.0)	0.00 (0.00, 0.00)
Coconut(s) (used in cooking)			
Whole coconut(s)	87.2 (80.5, 94.0)	0.0 (0.0, 0.0)	0.00 (-3.5e-10, 3.5e-10)
Coconut powder	92.6 (87.3, 97.9)	0.0 (0.0, 0.0)	0.00 (0.00, 0.00)

Appendix X: Table A8. Cohen's kappa for agreement between number of participants reporting cooking oil and coconut consumption data in both the SLBDS and 24DR, by participant sex

	Female (n=62)			Male (n=32)		
	% female participants that reported consumption data (95% CI)		κ value (95% CI)	% male participants that reported consumption data (95% CI)		κ value (95% CI)
	SLBDS	24DR		SLBDS	24DR	
Oil (used in cooking)						
Amount	83.9 (74.1, 93.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	43.8 (26.6, 60.9)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)
Method	67.7 (56.1, 79.4)	98.4 (95.3, 100.0)	0.1 (-0.1, 0.2)	78.1 (63.8, 92.5)	93.8 (85.4, 100.0)	0.38 (-0.01, 0.78)
Reheated	87.1 (78.8, 95.4)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	68.8 (52.7, 84.8)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)
Coconut(s) (used in cooking)						
Whole coconut(s)	98.4 (95.3, 100.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	65.6 (49.2, 82.1)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)
Coconut powder	96.8 (92.4, 100.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	84.4 (71.8, 97.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)

Appendix XI. Table A9. Number of participants that reported zero consumption on the SLBDS and 24DR

Food and beverage item	Total (N=94)	
	Number of participants that reported zero consumption	
	SLBDS	24DR
Rice, bread, other cereals and yams		
Bread	65.0	64.0
Dosa	85.0	85.0
Hoppers	88.0	88.0
Milk rice	91.0	91.0
Pasta/noodles	90.0	91.0
Pittu	92.0	91.0
Rice	2.0	1.0
Roti	78.0	78.0
String hoppers	76.0	74.0
Yam/potato/jackfruit/breadfruit	57.0	50.0
Fruit		
Fruit juice	85.0	86.0
Fruit salad	92.0	93.0
Medium size fruit	54.0	60.0
Pieces large fruit	84.0	88.0
Vegetables		
Cooked vegetables	20.0	17.0
Raw vegetables	53.0	50.0
Fish, pulses, meat and eggs		
Cooked pulses	33.0	26.0

Dried fish	79.0	79.0
Dry sprat	84.0	80.0
Meat/poultry/fresh fish	18.0	18.0
Whole eggs	64.0	66.0
Milk and dairy products		
Cheese	91.0	91.0
Curd	91.0	92.0
Fresh milk	80.0	81.0
Milk powder	34.0	33.0
Yoghurt	84.0	92.0
Nuts and oil seeds		
Nuts	83.0	86.0
Other		
Medium size desserts	78.0	78.0
Medium size sweets	62.0	64.0
Sweet fizzy drinks	77.0	83.0
Jaggery	90.0	91.0
Sugar	32.0	29.0
Tea/coffee	17.0	16.0