

**Cognitive Testing of a Brief Dietary Screener:  
A Comparison of Analysis Methods**

by

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## **Author's Declaration**

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis.

I understand that my thesis may be made electronically available to the public.

## Statement of Contributions

This thesis consists in part of two manuscripts that have been prepared for publication.

Exceptions to sole authorship include:

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As the co-first authors of Chapter 5, my colleague Joy M. Hutchinson and I contributed equally to the paper. Alongside our co-authors, we contributed to the conception and design of the study, analysis and interpretation of the data, and drafting the manuscript, with significant editorial contributions from our advisor, Dr. Sharon Kirkpatrick. Our co-authors revised the manuscript critically for important intellectual content and provided final approval of the manuscript for submission.

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As lead author of Chapter 6, and in collaboration with my co-authors, I was responsible for conceptualizing the study design, contributing to the data collection, conducting the data analysis, and drafting the manuscript. My co-authors provided guidance throughout each step of the research process and provided feedback on draft manuscripts, with significant editorial contributions from my advisor, Dr. Sharon Kirkpatrick.

Under Dr. Sharon Kirkpatrick's supervision, I also prepared the remaining chapters in this thesis, which were not written for publication.

## Abstract

**Background:** Dietary assessment is crucial to understanding the dietary risk factors that contribute to noncommunicable disease outcomes. It is therefore essential to ensure that instruments to measure dietary intake are reasonably valid and reliable, and acceptable to both researchers and respondents. Following the 2019 release of the updated Canada's Food Guide, Health Canada identified the need to develop a brief screener to assess overall alignment of adults' eating patterns with the guide's 'food choices' recommendations. The process of development included cognitive testing, a qualitative method used to investigate how respondents understand and interpret a survey or screener to ensure that each question can achieve its intended purpose. Though cognitive testing is common practice in the evaluation of data collection instruments, including dietary assessment tools, methods vary widely and are often not well-documented, particularly in the case of cognitive testing data analysis.

**Objectives:** The objectives of this thesis were to: (1) Develop and conduct cognitive testing of a brief screener, in English and French, to assess overall alignment of adults' dietary intake with the Canada's Food Guide-2019 healthy food choices guidance; (2) Compare two approaches to the analysis of data from cognitive interviews conducted in English, including an informal approach using brief notes, and an in-depth approach based on the framework analysis method applied to interview transcripts.

**Methods and results:** The first manuscript (Chapter 5) describes the development of the screener, including defining guiding principles, scanning existing screeners, and mapping the healthy food choices guidance to inform questions and response options. Once a draft screener was developed, it was iteratively refined based on three rounds of cognitive interviews in each of English (n=17) and French (n=16) to assess understanding of questions and face validity, along with face and content validity testing with a panel of experts (n=13 English, 3 French). Notes from cognitive interviews were coded and analyzed informally to identify issues with inclusion and exclusion criteria, readability, keywords, and response errors. The testing indicated that the screener was well-understood overall but informed refinements to improve comprehension of the questions and their alignment with the healthy food choices guidance. The resulting Canada's Food Guide-2019 Healthy Food Choices Screener includes 16 questions to assess alignment of

intake with the key components of the 2019 Canada's Food Guide healthy food choices guidance, including healthy foods and foods to limit.

The second manuscript (Chapter 6) presents a subsequent comparative analysis of two approaches to analyzing the data from the cognitive interviews conducted in English (n=17). The initial informal coding of interview notes was compared to the in-depth application of the framework analysis method to interview transcripts, to identify differences in issues identified, as well as time and resources associated with each method. The informal method identified issues with inclusion criteria, keywords, readability, and response errors in the screener, including some issues that were not captured by the in-depth method. The in-depth method identified infrequent issues with comprehension, recall and judgment that were not identified by the informal approach, as well as additional instances of issues identified using the informal approach. The informal method required less time, but necessitated a note-taker, whereas the in-depth approach took more time and required transcription and coding software. Potential implications of the differences in the issues identified by the two data analyses approaches for the screener were determined to be minimal.

**Conclusions:** The Canada's Food Guide-2019 Healthy Food Choices Screener allows for rapid assessment of the overall alignment of adults' dietary intake with the healthy food choices guidance within Canada's Food Guide. Appropriate use of the screener can inform policies and programs to narrow the gap between current dietary intake and the guidance. Cognitive testing was imperative to the screener's development to ensure it can be understood consistently and in the way it is intended among the target population. The comparative analysis of cognitive interview data revealed trade-offs regarding the results identified and resources required for each method. The in-depth approach required more time and resources to conduct but reduced likelihood of misinterpretation. Comparatively, the informal method was quicker and simpler to conduct and identified most but not all issues with the screener, however, employment of an additional person is required for note-taking. Overall, the identified discrepancies between methods were unlikely to have meaningfully impacted the Canada's Food Guide-2019 Healthy Food Choices Screener. However, this thesis contributes to a scarce body of literature on cognitive testing methods and will help to inform selection of data analysis methods for future development of dietary assessment and other survey tools.

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## List of Abbreviations

- CFG** Canada's Food Guide
- CIRF** Cognitive Interview Reporting Framework
- HEFI** Healthy Eating Food Index
- ORE** Office of Research Ethics
- REB** Research Ethics Board

# **CHAPTER 1: Introduction**

## **1.1 Overview and scope**

Dietary patterns are a crucial risk factor for noncommunicable disease worldwide, contributing to both morbidity and mortality (1–5). To understand the impact of dietary risk factors on health and disease outcomes, it is essential that researchers can measure dietary intake as reliably and accurately as possible (6,7). Self-report dietary assessment tools, such as 24-hour recalls, food frequency questionnaires, and dietary screeners, can facilitate measurement of the total diet or components of the diet (8,9). A range of pre-testing methods, including face and content validity testing, are available to assess whether dietary assessment tools are reasonably valid and perform equivalently across contexts (10,11). As part of the process of developing tools, cognitive testing may be conducted to ensure that each question achieves its intended purpose and can be understood consistently in the way researchers intend (12–14). Although cognitive testing has long been considered standard practice in the design and evaluation of surveys, questionnaires, screeners, and other tools (15), cognitive testing methods are often not well-described and there is a lack of standardized procedures for the collection, and particularly, the analysis of cognitive testing data (13,16).

Following the 2019 release of the latest iteration of Canada’s Food Guide (CFG-2019) (17), Health Canada identified the need to develop a brief screener measuring alignment of adults’ dietary intake with the “healthy food choices” recommendations presented in the guidance. As part of the screener development process, cognitive interviews were conducted to assess respondents’ understanding of screener questions. This thesis describes the process of developing and evaluating the screener and draws upon data conducted during cognitive interviews to compare two methods for analyzing cognitive testing data.

## **1.2 Thesis organization**

This thesis aims to present an example and examination of cognitive testing methods, particularly data analysis methods, via the development of a brief dietary screener measuring alignment of adults’ dietary intake with the guidance presented in the latest iteration of Canada’s

Food Guide (17). To achieve this overarching aim, this thesis consists of several chapters, including two chapters prepared as manuscripts for submission to peer-reviewed journals.

Chapter 2 provides an overview of the context for this research, summarizing literature related to national dietary guidance and the relevance of dietary assessment tools and cognitive testing. Chapter 3 summarizes the rationale and specific research objective for this thesis, while Chapter 4 outlines cognitive interview methods. Chapters 5 and 6 are comprised of manuscripts that have been prepared for publication.

The first manuscript, presented in Chapter 5, describes the development of a self-administered dietary screener, in English and French, to assess alignment of adults' dietary intake with the "healthy food choices" guidance within CFG-2019. The screener's development involved steps including mapping the guidance, consultation with expert advisors, and content validity testing with a separate panel of experts, as described in Chapter 5. However, my role in this work was to lead cognitive interviews and conduct the resultant data analysis. Cognitive testing and methods for cognitive testing data analysis are therefore the focus of Chapters 2-4 and 6-7. Development of the scoring system for the screener and testing of its construct validity have been undertaken but are not within the scope of this thesis.

The second manuscript, presented in Chapter 6, compares an informal data analysis method as used in the screener's development, to an in-depth approach based on the framework analysis method (18–20) applied to interview transcripts. Discrepancies in the issues related to the screener's comprehensibility between the methods were identified to infer possible implications for the screener, and trade-offs related to time and resources associated with each approach were discussed.

Finally, Chapter 7 provides a general discussion of both manuscripts, including a summary of key findings and the strengths and limitations of each study, as well as their implications for future research.



## CHAPTER 2: Background

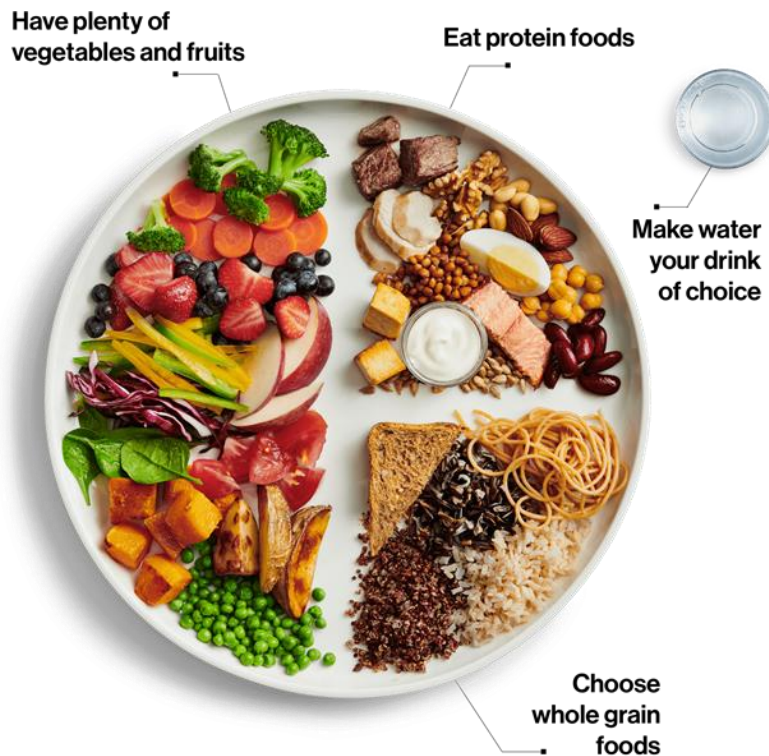
Diets high in sodium or low in whole grains, fruits, nuts and seeds, vegetables, and omega-3 fatty acids have been shown to be responsible for more deaths globally than any other risk factor, including tobacco smoking (5). Furthermore, dietary and physical activity risk factors were collectively attributable to 10% of disability-adjusted life years, a measure of overall disease burden, lost globally in 2010 (4). Agriculture and food production are additionally responsible for a substantial proportion of greenhouse gas emissions and freshwater and land use (21). Eating patterns thus have the potential to impact not only human but also planetary health through their contribution to climate change, biodiversity loss, and use of natural resources (22,23).

### 2.1 National food-based dietary guidance

To translate the extensive body of evidence on dietary risk factors and human and planetary health, many countries worldwide publish national food-based dietary guidance presenting “specific, culturally appropriate, and actionable recommendations” to the general public (24). Such guidance is intended to influence both food- and nutrition-related policy, as well as consumer behaviour, to ultimately improve the nutritional health and well-being of individuals and populations (24,25). Population-level nutrition guidelines have been disseminated in Canada since 1942. Canada’s first Food Guide, the Official Food Rules, was introduced as an educational tool to prevent nutritional deficiencies during wartime food rationing (26). Seven additional Food Guides were subsequently published over the following decades, to reflect expanding knowledge and evidence on nutritional requirements for Canadians (26).

In 2019, Health Canada released its most recent Canada's Food Guide (CFG-2019) with a focus on overall eating patterns, including not only ‘food choices’ but also ‘eating habits’ (17). While previous iterations of Canada’s Food Guide presented more prescriptive advice for serving sizes of conventional food groups, CFG-2019 instead emphasizes proportionality (17). The consumer-targeted visual representation of this guidance includes the image of a plate (**Figure 1**), indicating that half should consist of fruits and vegetables, with the remaining two quarters dedicated to whole grain foods and protein foods, especially plant-based proteins like lentils or beans, respectively (17).

**Figure 1: Food Guide Snapshot from Canada's Food Guide-2019**



Canada's updated Food Guide has the potential to support both human and planetary health by encouraging healthy and sustainable eating patterns at multiple levels within the Canadian food system (27). However, as the current food system, supply, and environments that influence dietary choices do not align with the guidance, implementing the CFG-2019 recommendations in practice presents certain challenges (27). Prior studies have shown that although self-reported awareness of past iterations of Canada's Food Guide was high, knowledge of key messages was low (28), and adherence to the guidance was suboptimal (29). Adherence to nutritional guidance is particularly challenging for those who face structural barriers, including racialized populations (30), those experiencing food insecurity (31), or those living in rural or remote regions, including Indigenous populations (32).

To support informed decision-making regarding health policies and programs within the current food system, it is of interest to conduct population-level surveillance on the alignment of dietary intake with the CFG-2019 recommendations. The Healthy Eating Food Index-2019 (HEFI-2019) facilitates assessment of the alignment of dietary intake with CFG-2019 guidance on healthy food choices in situations in which comprehensive dietary intake data, such as from

24-hour dietary recalls, are available (33,34). However, 24-hour dietary recalls can be time consuming to collect, may not be amenable to all settings, and require substantial expertise and extensive data cleaning and analytic efforts (9,35). Health Canada therefore identified the need to develop a brief tool or screener measuring adherence to CFG-2019 that would be amenable to contexts where resources are limited, including community-based settings and cohort studies.

## **2.2 Dietary assessment methods**

A variety of self-report dietary assessment tools, including 24-hour recalls, food frequency questionnaires, and dietary screeners, are available to assess dietary intake. Each method provides unique advantages and disadvantages, and researchers must consider trade-offs regarding the research question, study population, available resources, and potential for error when selecting an assessment tool (8). For example, while 24-hour dietary recalls and food frequency questionnaires can be used to capture the total diet, dietary screeners obtain brief information about one or a few components of the diet (9). In some cases, they may be multifactorial, aiming to assess dietary intake relative to food-based dietary guidance (36–38). However, 24-hour dietary recalls and food frequency questionnaires are more resource-intensive and onerous for participants to complete, while dietary screeners are comparatively quicker, simpler, and less expensive (39).

Typically requiring less than 15 minutes to complete, brief dietary screeners are used to rapidly estimate eating patterns over a given period, such as the past month or year (9). They can provide quick insights about dietary intake in a range of settings including public health, community, and clinical settings. Dietary screeners are commonly used in national surveillance, including the use of the Dietary Screener Questionnaire in the National Health and Nutrition Examination Survey (40), the use of the Behavioral Risk Factor Surveillance System fruit and vegetable module in Canadian Community Health Survey cycle 2.2 (39,41), and the dietary screener included in the California Health Information Survey (42).

## **2.3 Cognitive testing**

Cognitive testing is a qualitative, psychologically oriented method used to investigate the ways in which research participants interpret and respond to survey questions, typically via individual interviews (12,43–45). The goal of cognitive testing is to determine whether the survey and each question within it achieves its intended purpose and can be understood

consistently in the way researchers intend (12–14). Cognitive interviewing is said to provide a “window into the mind” that can reveal insights about survey, screener, or questionnaire questions by analyzing the cognitive processes research participants use in responding (16). Testing may reveal a range of issues with proposed questions, including question-specific problems with wording (with respect to structural, cognitive, or culturally specific deficiencies); the need for improved specificity in the intent of the question; problems with the sequence of questions or sections; issues related to participant burden; and limitations on the tool’s ability to capture the desired information using the intended methods (45). By summarizing and analyzing these deficiencies, researchers can modify questions, if necessary, to make them easier for respondents to understand and answer (43).

Since the mid-1980s, cognitive testing has been recognized as standard practice in the design and evaluation of data collection tools (15). Early examples include Statistics Canada’s creation of a respondent-friendly questionnaire for the 1991 census (46), as well as the development of Business Survey Questionnaires (47). More recently, cognitive testing has been used in the development of Statistics Canada’s upcoming Survey on Mental Health and Stressful Events (48), The National Cancer Institute’s Food Attitudes and Behaviors Survey (49), and a population-based cannabis survey in the International Cannabis Policy Study (50), among others.

Despite its prominence in survey research, cognitive testing methods are often mentioned only in passing as part of a larger survey development process. Methods vary widely in terms of sample size (e.g., from 5 to 150), interview approach (e.g., concurrent or retrospective), target population, probing methods, and data analysis (16). This is in part due to a lack of standardized methods for qualitative evaluation and cognitive testing data collection, compared to psychometric methods for capturing validity and reliability (13). Though variation is not in itself problematic, the lack of documentation between studies makes it difficult to replicate the process of a particular investigation, or to compare the efficacy of different approaches (16).

Though Boeije and Willis have published guidelines for the organization and reporting of cognitive interview research studies, their framework has yet to be widely adopted, and many reports fail to specify key details of their methodological processes (16,51). One reason for this dearth of formal reporting is that in some cases, the primary audience for cognitive testing reports is typically the sponsors of the tool being developed, who may be more interested in results than methodological specificities (45). Notably, cognitive interview data analysis is

“largely uncharted territory” (45) and remains the “least-developed aspect” of the cognitive testing process (16,52).

### **2.3.1 Theoretical framework**

Cognitive testing draws upon insights from psychology regarding the cognitive processes involved in responding to survey questions. Tourangeau’s 4-stage model describes these operations, which include 1) comprehension, 2) retrieval of information, 3) judgment or estimation, and 4) selection of a response to the question (53).

In the first stage, comprehension, survey respondents attempt to understand and interpret what is being asked of them, including key terms that are used, as well as the meaning of the question itself. Most cognitive testing procedures target the level of comprehension, as this is where problems most often occur (12,44). In the retrieval of information stage, respondents recall relevant information from their memory. In the judgment or estimation stage, respondents decide or estimate which answer to report. In the final stage, response, respondents present an answer that, ideally, matches the requirements of the survey.

For example, the cognitive processing of the question “In the past month, how often did you eat fruit?” requires the respondent to understand and interpret key words and phrases, including “how often did you eat” and “fruit”; to recall the correct answer by thinking about how frequently they eat fruit; to decide what number to report, which may involve over- or under-estimation; and finally, providing an answer that matches the categories available within the questionnaire (e.g., “2 times per week” rather than “sometimes”).

These processes are not a solely “cognitive” or individual matter; rather, progression through each of the 4 stages of the model is an interpretive process that is heavily influenced by social location, life experience, and cultural context (43). It is therefore recommended for the cognitive testing sample to cover as wide a demographic range as possible within the bounds of what is relevant to the survey itself, to ensure a variety of perspectives are represented (12,13,54).

### **2.3.2 Cognitive interview procedures**

The cognitive interview process involves administering the survey or measurement tool to the participant, while collecting information regarding their understanding of the survey

questions (44). Such information is collected using two main procedures: think-aloud and verbal probing (Table 1). These procedures may be used independently but are commonly employed in unison, with an emphasis on probing (45).

**Table 1: Comparison of think-aloud and probing methods for cognitive interviews**

	<b>Think-aloud</b>	<b>Probing</b>
<b>Guided by</b>	Respondent	Interviewer
<b>Approach to data collection</b>	Passive	Active
<b>Burden on interviewer</b>	Low	High
<b>Burden on respondent</b>	High	Low
<b>Appropriate for</b>	Self-completion questionnaires	Both interviewer-administered and self-completion questionnaires
<b>Example</b>	“How did you arrive at that answer?”	“What does the term (X) mean to you?”

### **Think-aloud**

Using the think-aloud procedure, the interviewer guides the participant in verbalizing their thought processes while responding to the survey (13,54). The process is driven by the respondent, while the interviewer aims to intervene as little as possible (13,14). The interviewer may encourage the participant to explain or expand on their responses using open-ended probes (for example, “can you explain how you arrived at that answer?”) but specific questions about elements of survey questions are not asked. The think-aloud method is not ideal for testing interviewer-administered surveys, as it can be difficult for both the interviewer and respondent to switch between survey interviewing and cognitive interviewing (14). However, think-aloud can work well for self-administered questionnaires (14).

### **Probing**

Using the probing procedure, the interviewer asks the respondent direct and specific questions designed to generate detailed information about the survey (12–14). Probing is ideal for both self-completion and interviewer-administered surveys, as the technique can be administered either concurrently, as the participant completes the survey, or retrospectively, after the participant has completed the survey independently (43). Probes can be developed prior to testing or asked spontaneously in response to participant behaviour (i.e., something a participant says that indicates an apparent problem (12,13)).

Examples of the various types of probes that may be employed during the verbal probing procedure can be found in **Table 2**. Each probe should be designed to target a particular issue within the survey, or one of the four stages of cognitive processing (12,44,54).

**Table 2: Cognitive probing types**

<b>Type</b>	<b>Purpose (12,14,43,54)</b>	<b>Example(s)</b>
Think-aloud/General	Non-specific probing to encourage participant to verbalize their thought processes while answering a survey question.	“How did you go about answering that question?”
Comprehension/ Interpretation	Exploring how respondents understand the question itself, including key terms used.	“What does the term ‘plant-based protein’ mean to you?”
Recall	Investigating how respondents went about recalling relevant information to answer the question.	“How do you know that you consume fruit 2-3 times per day?”
Confidence judgment	Asking participants to evaluate the reliability of/confidence in the accuracy of their answer.	“How certain are you that you consumed sugary snacks 3 times in the last month?”
Paraphrasing	Asking participants to rephrase the survey question in their own words.	“Can you repeat that question using your own words?”
Elaborative	Asking participants to provide further information about an answer they’ve given.	“Can you tell me a little more about that?”
Sorting	Investigating how participants assign items or terms to different categories.	“Which food items would you classify as ‘highly processed’, and which would you not?”

Probes used to identify problems at the level of comprehension are generally more successful than those used to detect other difficulties, such as problems that arise indirectly from the cognitive load of responding to survey questions (44). Similarly, specific and direct probes are generally more successful than open-ended or indirect probes (13). Such probes may cause confusion for the participant in terms of understanding what is being asked of them and are ineffective for cases in which the interviewer is interested in specific information (44). For example, if the interviewer wishes to assess whether a participant is having difficulty selecting an appropriate response category from the options, it would be most effective to ask directly whether they feel the options provided are adequate, rather than asking how the respondent felt about the question overall (44).

Paraphrasing probes can be useful to assess the respondents' comprehension of survey questions, but may prove problematic, particularly for respondents of lower literacy levels (14,54). Inability to paraphrase does not necessarily indicate misunderstanding; rather, a participant may know the meaning of the concepts presented but nonetheless be unable to provide synonyms (44). However, asking the respondent to define key terms may be a useful exercise to investigate the contextual nuances that influence the respondents' understanding of the question (44).

### **2.3.3 Cognitive testing data analysis**

Analysis of cognitive testing data is a qualitative endeavour in which interviews are coded for different cognitive processes or problem categories (12,13,43,54). For example, codes may include "comprehension difficulty" or "ambiguous wording". After individual interviews are analyzed, codes are aggregated across interviews to identify common themes and detect cases in which survey questions deviate from their intended meaning (12,43,54).

Interview transcription is common practice in qualitative research and is often used in the analysis of cognitive interviews (54–57). However, cognitive testing is one of many steps in the development of a survey or screener, and researchers must be judicious about the time, budget, and resources available to them for a given project. Thus, an informal approach may be taken, wherein codes are assigned based on notes taken during the interview, rather than the complete transcription of an interview recording (12,13,43,45).

Because data analysis for cognitive interviews has not been well documented, Willis (45) notes that there are significant unanswered questions regarding the efficacy of different coding and analysis methods, including whether it is worthwhile to invest resources into interview transcription and formal coding, or if more informal methods are sufficient. Further, specific processes for either strategy have not been identified nor standardized.

## **2.4 Summary**

Dietary assessment tools that are reasonably valid and reliable, as well as understood as intended, are crucial to understanding the impact of dietary risk factors for health and disease outcomes. Cognitive testing can help to ensure that dietary assessment tools are acceptable to both researchers and respondents, by identifying issues with survey questions and informing strategies to address them. However, cognitive testing methods vary widely between studies and



specific processes are often not well-documented, particularly in the case of cognitive testing data analysis. It is therefore important that cognitive testing processes are reported clearly and comprehensively in survey development research. Additionally, there is a need for further research investigating results and trade-offs between different cognitive testing data analysis methods.

# **CHAPTER 3: Study Rationale and Objectives**

## **3.1 Study rationale**

For research and surveillance purposes, it is of interest to assess alignment of eating patterns and practices with Canada's Food Guide-2019 (CFG-2019), for example, to inform targeted interventions to address disparities in alignment with the guidance among population subgroups. The Healthy Eating Food Index-2019 (HEFI-2019) has been developed to assess alignment of dietary intake with CFG-2019 using 24-hour dietary recall data. However, a brief tool was desired for settings in which comprehensive dietary assessment, such as the administration of 24-hour dietary recalls, and subsequently the HEFI-2019, is not feasible. Health Canada therefore identified the need to develop a brief dietary screener to provide rapid insight into alignment with CFG-2019 guidance for self-administration in both English and French by adults aged 18-65 years with marginal and higher health literacy. The resulting screener is known as the CFG-2019 Healthy Food Choices Screener.

As part of the screener development process, cognitive interviews were conducted to assess face validity and understanding of screener questions. As previously noted, cognitive testing is a crucial step in the development of dietary assessment tools to ensure that questions are understood by respondents in the way researchers intend. However, methods for cognitive testing data analysis are not well-documented and it is unclear whether more in-depth data analysis, common to qualitative methods, results in substantively different findings. It is thus of interest to examine whether an alternative analysis of the interview data from cognitive testing of the CFG-2019 Healthy Food Choices Screener would reveal additional or conflicting insight, and to explore trade-offs in terms of the time and resources required for the two methods.

## **3.2 Research objectives**

This thesis aims to present a rigorous example and examination of cognitive testing methods for the development of a brief dietary screener measuring adherence of adults' dietary intake with the guidance presented in the latest iteration of Canada's Food Guide. The specific objectives are to:

1. Develop and conduct cognitive testing of a brief screener to assess overall alignment of adults' dietary intake with CFG-2019 healthy food choices guidance.

2. Compare two approaches to the analysis of cognitive data from the English interviews conducted in the development of the CFG-2019 Healthy Food Choices Screener: an informal approach using brief notes, and an in-depth approach based on the framework analysis method (18–20) applied to interview transcripts.

## **CHAPTER 4: Methods**

### **4.1 Screener development**

To develop the Canada's Food Guide-2019 (CFG-2019) Healthy Food Choices Screener, guiding principles were first defined in collaboration with Health Canada. It was determined that the screener should be brief and simple to use and score, with consideration of the numeracy and literacy levels of the target population. Additionally, the screener should assess adherence to the CFG-2019 guidance overall rather than specific components, consider equivalence in capturing the guidance across population subgroups, and demonstrate reasonable construct validity. These guiding principles helped inform initial decisions about the screener's format. For example, it was decided that the screener should capture frequency rather than proportions of consumption, and capture food and beverages rather than specific nutrients.

Next, existing screeners (36,58–61) were scanned to provide insight into format and possible questions and response options for inclusion in the CFG-2019 Healthy Food Choices Screener. CFG-2019 guidance was mapped to provide a roadmap against which to develop screener questions to ensure content validity. Initial screener questions were developed and revised iteratively based on feedback from Health Canada and a team of advisors, including nutrition researchers and practitioners. The screener was initially developed in English and translated to French. The draft screener was then tested through face and content validity testing, as well as cognitive interviews.

Further detail on the screener's development can be found in Chapter 5. The present chapter is primarily focused on methods for cognitive testing, as that is the focus of this thesis.

### **4.2 Data collection**

Cognitive interviews were conducted from April 2021 to June 2021. Interviews in English were conducted by researchers at the University of Waterloo and those in French by researchers at Université Laval. Interviewers (myself, for interviews in English, and Alexandra Bédard, for interviews in French) had training in qualitative methods. Ethics review and approval was obtained from the University of Waterloo Office of Research Ethics (ORE #42994), the Université Laval Research Ethics Board (REB #2021-088), and the Health Canada and Public Health Agency of Canada Research Ethics Board (REB #2020-044H).

Sample size recommendations for cognitive testing range from 10 to 30 total participants, or five to 15 participants per round for two to three rounds of testing (12,13,43). To adequately probe for potential issues with comprehension of the screener amongst individuals with varied sociodemographic characteristics, a sample of approximately 32 participants, with 16 interviews in each English and French, was planned. Interviews were conducted in three rounds of testing in each language, with four to eight participants per round, to allow for iterative refinement of the screener.

Potential participants were recruited through community organizations and social media (for interviews in English), or through community organizations and a database of potential research participants (for interviews in French) and directed to an eligibility questionnaire. Recruitment materials can be found in [Appendix A](#). Eligible individuals were aged 18-65 years, lived in Canada, and were able to read the screener and complete a 45- to 60-minute virtual interview in English or French. The eligibility questionnaire also collected demographic data, and quota sampling was used to seek a balance of participants with varying educational attainment. Purposive sampling was used to attempt to balance other demographic characteristics, including age, gender identity, racial identity, and perceived income adequacy, assessed by asking, “Thinking about your total monthly income, how difficult is it for you to make ends meet?”, with response options including very difficult, difficult, neither easy nor difficult, easy, and very easy) (62).

Eligible participants who were selected relative to planned quotas and purposive sampling criteria were invited to participate via email. Those who agreed to participate were sent an information letter and informed consent form in advance of the interview (see [Appendix A](#)). These forms were reviewed at the beginning of the interview, at which time the participant was asked to provide verbal informed consent. Participants who completed an interview received a \$20 honorarium in appreciation of their time. Additional information on the sample and recruitment for cognitive interviews can be found in Chapters 5 and 6.

### **4.3 Cognitive interview guide and approach to testing the screener**

As the lead on the cognitive testing for the CFG-2019 Healthy Food Choices Screener, I led the development of the cognitive testing interview guide and interview procedures. I developed a cognitive interview guide (see [Appendix A](#)) in English (later translated to French by

Health Canada), using a semi-structured approach to allow for flexibility to collect open-ended data. The guide included both verbal probing and think-aloud prompts.

Using the interview guide, I conducted the cognitive interviews in English using Zoom (Zoom Video Communications, San Jose, CA) teleconferencing software or over the phone, whereas the interviews in French were conducted by the team at Université Laval using Microsoft Teams (Microsoft Corporation, Redmond, WA). Interviews lasted 30 to 60 minutes. Because the screener is intended for self-administration, participants were first asked to complete it independently, before reviewing their responses with the interviewer. Following the interview guide, interviewers used verbal probing to gauge understanding and thought processes. Each probe targeted one or more levels of cognitive processing. For example, the probe, “are there any words or ideas in this question that were difficult to understand?” addresses comprehension. Think-aloud probing, such as “can you walk me through how you arrived at that number?”, was also used to encourage participants to verbalize their thought processes. Interviews were conducted in rounds to allow for iterative refinement of the screener. During interviews, a note-taker, either a PhD student involved in the development and evaluation of the screener or an undergraduate co-operative education student who supported the project (e.g., ethics applications), captured details of participant responses. Most interviews were audio-recorded (with participants’ consent).

Reporting of the conduct and analysis of cognitive interviews in Chapter 5 was guided by the Cognitive Interview Reporting Framework (CIRF) proposed by Boeije and Willis to help researchers ensure that their cognitive testing reports are not missing any key pieces of information, and that the information is presented in a clear and comprehensive manner (16).

## **4.4 Data analysis**

### **4.4.1 Informal data analysis**

As is common in cognitive testing (12,13,43,45), the interview notes and recordings were initially coded informally to inform the development of the CFG-2019 Healthy Food Choices Screener. Coding was conducted by highlighting and commenting on interview notes in Microsoft Word (Microsoft Corporation, Redmond, WA) to identify potential problem categories based upon Tourangeau’s model of cognitive processing (i.e., errors in comprehension, recall, judgment, and response (53)). After each round of interviews in each language, issues (i.e.,

instances in which screener questions might fail to achieve their intended purpose or be interpreted as intended (12–14)) identified for each question and falling under various problem categories were identified and summarized across interviews (43,54). The teams conducting interviews in English and French debriefed between rounds and following the final round and modified the screener iteratively to address issues identified in each language. Additional information about the informal data analysis method applied to the CFG-2019 Healthy Food Choices Screener can be found in Chapters 5 and 6.

#### **4.4.2 In-depth data analysis: Transcription & the framework analysis method**

Subsequent to the development of the screener, a secondary analysis of the screener’s cognitive testing data in English was conducted as a comparative exercise to explore differences between informal and in-depth approaches to data analysis. For the in-depth approach, the cognitive interview recordings were transcribed, or in cases in which recordings were not available (n=3), interview notes were used in their place. Then, transcripts were analyzed using the framework analysis method. This method of thematic analysis was developed in the mid-1980s by Jane Ritchie and Liz Spencer in the context of applied qualitative policy research (19). It has since become increasingly prominent in medical and health research (18,20). Its defining feature is the “matrix” chart created by indexing data from qualitative interview transcripts into an organized structure in which the researcher can analyze themes by code, which form the columns of the matrix, and cases, i.e., participants, which form the rows.

Ritchie and Spencer describe five key stages of the framework method of qualitative data analysis (19). First, in the *Familiarization* stage, the researcher becomes immersed in the data by listening to interview recordings, reading transcripts, and reviewing observational notes. They will concurrently reflect on and document recurring themes and ideas within the data. Next, to *Identify a thematic framework*, the researcher returns to the notes collected during the previous stage to identify key issues, concepts, and themes within the data in an iterative process. They will draw upon a priori issues informed by the original research questions, emergent issues raised by research participants, and analytical themes that arise from recurring ideas, views, or experiences within the interview data. *Indexing* systematically applies the thematic framework to the data in a process similar to line-by-line coding, which is common in qualitative research. Then, during the *Charting* stage, the data are taken from their original context and rearranged

according to thematic references in a matrix. Once all the data have been sorted by core themes, the researcher enters the *Mapping and interpretation* stage. At this point, the matrix and notes are reviewed to compare data and identify patterns and explanations for these connections within the data. This final stage is highly dependent on the research goal which might involve defining concepts, mapping the nature of phenomena, or developing strategies, among others.

In the case of the current study, codes were based on Tourangeau's model of cognitive processing, identifying errors in comprehension, recall, judgment, and response (53). Specific errors under each of these categories were assigned their own codes, such as "comprehension: unclear criteria for what to include or exclude in response" or "judgment: lack of confidence in response". Codes were grouped into themes (problem categories which aligned with the four steps of cognitive processing (53)) and sub-themes (specific issues under each category) to develop working analytical frameworks for each round of interviews.

To compare the in-depth analysis method with the informal analysis method, potential implications for the screener were surmised based on whether there were meaningful differences in the issues identified by each method. However, because the iterative process used to refine the screener between rounds of testing could not be fully replicated with this secondary analysis, the potential implications for the screener are somewhat speculative.

Chapter 6 provides further detail on the application of the framework analysis method to transcripts from cognitive interviews conducted in English during the evaluation of the CFG-2019 Healthy Food Choices Screener.

## **4.5 Reflexivity**

Reflexivity is a crucial practice in qualitative research. It is commonly viewed as the process of acknowledging and critically reflecting on the way that the researcher's positionality, including personal experiences, background, education, and social position, as well as their intersections, might play a role in the research process and outcome (63,64). I am a White, educated, young adult, Canadian woman with a background in public health nutrition and considerable familiarity with the CFG-2019 Healthy Food Choices Screener project. To minimize the extent to which my positionality impacted my role in this research, which included developing the cognitive interview guide; conducting cognitive interviews; analyzing results and



presenting recommendations for the screener; as well as conducting a secondary analysis of the cognitive testing results, I prioritized a reflexive approach to the research process.

As cognitive testing is, by definition, a “cognitive” endeavour, it is important to recognize the role that my own cognitive processes might have played in my expectation of the outcomes of testing. For example, although I might interpret a survey question in a certain way or with minimal difficulty, individuals with differing perspectives and positionality may understand the question differently or encounter problems that I may not anticipate. While designing the interview guide, I reflected on the way that my background and experiences might influence my expectations of the research and tried to include a range of probes that might detect unforeseen issues. During interviews, I allowed for unexpected insights to emerge by asking spontaneous probes when a participant’s remarks challenged my expectations. After each interview, I completed an interviewer debrief form to reflect on my initial reactions and impressions of the interview. This form was reviewed as interview data were coded and analyzed.

During the secondary analysis of the cognitive testing data, I was even more familiar with themes and insights in the data, which may have further impacted my expectations and perspective while conducting the in-depth analysis. I again reflected on my positionality throughout the analysis process and aimed to engage in reflexive practice. For example, while charting the data into the framework matrix, I attempted to paraphrase excerpts from transcripts using terms and phrases as consistent with the participants’ original wording as possible, recognizing that these words might be uniquely meaningful to the participant.

Further reflections on my positionality and reflexivity in conducting and analyzing the cognitive interviews are provided in the overall discussion of this thesis (Chapter 7).

**CHAPTER 5: Development of the Canada's Food Guide-2019 Healthy Food Choices Screener to assess alignment of adults' dietary intake with the healthy food choices guidance**

Target journal: *Applied Physiology, Nutrition, & Metabolism (APNM)*. In preparation.

Supplementary materials for this chapter can be found in [Appendix B](#).

## **5.1 Overview**

The objective of this project was to develop a brief self-administered dietary screener, in English and French, to assess alignment of adults' dietary intake with the 2019 Canada's Food Guide "healthy food choices" guidance. In consultation with Health Canada and external advisors (n=15), foundational principles were defined. Existing screeners were scanned, and the healthy food choices guidance was mapped to inform questions and response options. Cognitive interviews were conducted in English (n=17) and French (n=16) with adults aged 18-65 years from April to June 2021 to assess understanding of questions and face validity; recruitment emphasized variation in sociodemographic characteristics. Face and content validity were assessed with academics, dietitians/nutritionists, and federal employees (n=13 English, 3 French) from April to May 2021. The testing indicated that the screener was well-understood overall but informed refinements to improve comprehension of the questions and their alignment with the healthy food choices guidance. The resulting Canada's Food Guide-2019 Healthy Food Choices Screener includes 16 questions to assess alignment of intake with the key components of the 2019 Canada's Food Guide healthy food choices guidance, including healthy foods and foods to limit.

## **5.2 Introduction**

Suboptimal dietary patterns are a key risk factor for noncommunicable chronic diseases in Canada and globally (Afshin et al. 2019; Lim et al. 2012; Lozano et al. 2012; Micha et al. 2017; Vajdi and Farhangi 2020). Diets low in whole grains, fruits, vegetables, nuts and seeds, and omega-3 fatty acids and high in sodium have been shown to be responsible for more deaths globally than any other risk factor (Afshin et al. 2019). To promote healthy eating and reduce chronic disease risk, many countries publish food-based dietary guidelines, presenting "specific, culturally appropriate, and actionable recommendations" (Food and Agriculture Organization 2022; Herforth et al. 2019). In 2019, Health Canada released an updated Canada's Food Guide (CFG-2019), with guidance on "healthy food choices" and "healthy eating habits" (Health Canada 2021, Health Canada 2022a). In a shift from prior iterations, CFG-2019 does not provide recommendations on the number of servings per day and serving sizes for food groups based on age and sex. Instead, through the healthy food choices guidance, CFG-2019 recommends eating a variety of healthy foods each day, including fruits and vegetables, whole-grain foods, and

protein foods, emphasizing more frequent consumption of plant-based protein foods. The CFG-2019 plate provides a visualization of the desirable proportions of foods from these categories in relation to one another (Health Canada 2022a). CFG-2019 aims to promote healthy eating and overall nutritional well-being, as well as to support improvements to the food environment (Health Canada 2022b).

For research and surveillance purposes, it is of interest to assess alignment of eating patterns and practices with CFG-2019, for example, to inform targeted interventions to address disparities in alignment with the guidance among population subgroups. The Healthy Eating Food Index-2019 (HEFI-2019) facilitates assessment of the alignment of dietary intake with CFG-2019 guidance on healthy food choices in situations in which comprehensive dietary intake data, such as from 24-hour dietary recalls, are available (Brassard et al. 2022a, 2022b). Data from dietary recalls are recommended for characterizing the dietary intake of populations and subgroups due to their comprehensiveness, as well as their greater accuracy relative to frequency-based tools (Freedman et al. 2014; Freedman et al. 2015; Kirkpatrick et al. 2022a; National Cancer Institute 2015; Thompson et al. 2015). However, while online self-administered recall platforms have eased researcher and respondent burden (Lafrenière et al. 2017; Subar et al. 2012), recalls can be time consuming to collect and may not be amenable to all settings. Further, appropriate use of recall data requires substantial expertise and extensive cleaning and analytic efforts (Kirkpatrick et al. 2022b).

In contrast, brief dietary questionnaires, informally called “screeners,” can be used for rapid assessment of food and beverage intake over a given period, such as the past month or year (National Cancer Institute 2015, Thompson et al. 2015). Screeners often focus on specific dietary components (e.g., fruits and vegetables, fibre) (Centers for Disease Control and Prevention n.d.; Hedrick et al. 2010; Tangney et al. 2019) but may be multifactorial (Colby et al. 2020; de Rijk et al. 2021; Fulkerson et al. 2012; Gnagnarella et al. 2018; Lafrenière et al. 2019; Thompson et al. 2004). Prior multi-factorial screeners have aimed to assess dietary intake relative to food-based dietary guidance (Colby et al. 2020; de Rijk et al. 2021; Gabe and Jaime 2019).

The objective of this study was to develop a brief screener to assess overall alignment of adults’ dietary intake with CFG-2019 healthy food choices guidance. The screener was developed for use with adults, aged 18-65 years, with marginal and higher health literacy, and is intended for self-administration in English and French. The current paper describes the

development process, including cognitive testing to assess whether screener questions were understood as intended, and face and content validity with a panel of experts. An accompanying paper describes the screener's scoring system and construct validity (Hutchinson et al., submitted). A separate brief questionnaire, the Eating Practices Screener, has been developed to assess adults' alignment with the CFG-2019 healthy eating habits guidance (Wallace et al., submitted).

## **5.3 Materials and Methods**

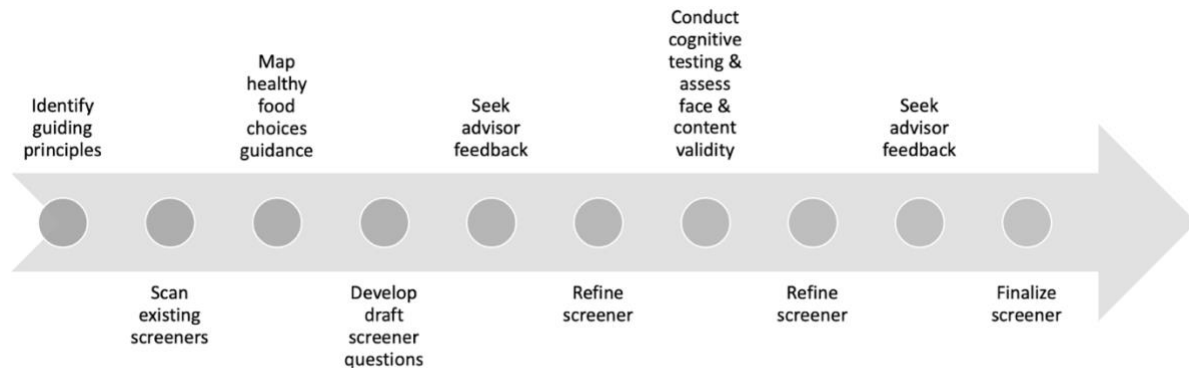
### **5.3.1 Development of the screener**

Screener development and evaluation were undertaken in collaboration with Health Canada and guided by a team of advisors, including nutrition researchers and practitioners ([Appendix B](#)); this group included English- and French-speaking individuals. Many of the advisors were involved in the development of the HEFI-2019 (Brassard et al. 2022a, 2022b), supporting consistent interpretation of the underlying dietary guidance and alignment of the screener with the HEFI-2019.

The development of the screener drew upon the messaging related to healthy food choices in CFG-2019, including the plate depicting the recommended proportions of the food categories (Health Canada 2022a). Also considered were the food choice components within the Healthy Eating Recommendations, which provide simple and actionable messages for consumers (Health Canada 2020), and the Dietary Guidelines, which are intended primarily for health professionals and policymakers (Health Canada 2022b). In addition to the guidance, the components included in the HEFI-2019 and their construction (e.g., inclusion or exclusion of particular foods) (Brassard et al. 2022a, 2022b) informed the screener questions. We also drew upon available information on the dietary intake of Canadians (e.g., key sources of food categories and nutrients such as saturated fats) (Harrison et al. 2019; Kirkpatrick et al. 2019a; Tugault-Lafleur and Black 2019).

The steps in the screener development and evaluation process are illustrated in **Figure 2** and outlined below.

**Figure 2: Process for development of the Canada's Food Guide-2019 Healthy Food Choices Screener to assess alignment of adults' dietary intake with the healthy food choices guidance**



### **Defining guiding principles for the screener**

The development and evaluation of the screener were informed by guiding principles, defined in collaboration with Health Canada *a priori* (**Box 1**). These principles related to the development of a brief screener that is simple to use and score, assesses alignment with the healthy food choices guidance overall, and considers the numeracy and literacy levels of the target population. Equivalence or comparability (Frongillo et al., 2019) in capturing alignment with the CFG-2019 healthy food choices guidance across population subgroups was also considered. Additionally, the screener should demonstrate reasonable construct validity, which was assessed and is described in the accompanying paper (Hutchinson et al., submitted). These principles were discussed with the advisors and informed initial decisions about the format and content of the screener. These decisions included assessing frequency of consumption versus proportions, capturing foods and beverages versus nutrients, and using the screener to assess alignment with the healthy food choices guidance overall.

### **Box 1: Guiding principles for the development of the Canada's Food Guide-2019 Healthy Food Choices Screener**

- Simple to use and score.
- Brief (<10 minutes).
- Assess adherence to the food choices guidance overall, not specific recommendations.
- Consider the numeracy and literacy levels of the target population.
- Consider equivalence (i.e., comparability) in capturing the construct (food choices guidance) across subgroups of the target population.
- Demonstrate reasonable validity for capturing the construct (food choices guidance) in the target population.

First, although the CFG-2019 plate identifies the proportions to be contributed by vegetables and fruit, whole-grain foods, and protein foods, the screener does not focus on proportionality. This is because screeners do not capture total dietary intake so a denominator, which would be needed to calculate proportions allocated to different types of foods, is unavailable. To capture usual consumption, participants could be asked to average proportions across eating occasions over some period, such as a month. However, this approach was hypothesized to be cognitively challenging, as well as difficult to score. Alternatively, repeat administrations of a screener focused on proportions on a given day could be used to capture usual proportions, but this would add burden to researchers and participants, undermining the goal of a brief screener. Furthermore, not all CFG-2019 guidance related to healthy food choices is expressed using proportionality, such as the recommendations to limit intake of highly processed foods and make water the drink of choice. Given the guiding principles related to literacy and numeracy demands, a frequency-based screener was thus developed, with the hypothesis that patterns of frequency of intake of different foods and beverages would provide an indication of the degree of alignment with CFG-2019. The past month, which is the typical period queried by screeners (Centers for Disease Control and Prevention n.d.; England et al. 2017; National Cancer Institute 2021; Wijnhoven et al. 2018), was selected as the time frame of interest. A focus on the past month provides an indication of longer-term intake (versus intake on a given day) and may reduce error compared to recalling and averaging frequency of consumption over a longer period, such as a year (National Cancer Institute 2015). The screener does not query portion sizes, which is common for brief instruments (National Cancer Institute 2015).

Second, the screener focuses on frequency of intake of foods and beverages and not nutrients. Although the Dietary Guidelines include recommendations related to intake of free sugars, saturated fats, and sodium (Health Canada 2022b), the guidance is food-based overall. A screener specifically focused on one of these nutrients would likely include many questions and even then, may not accurately estimate nutrient intake (Tangney et al. 2019). Per the guidance and examinations of dietary intake among the population (Harrison et al. 2019; Kirkpatrick et al. 2019a), highly processed foods account for high proportions of intake of sugars, saturated fats, and sodium; thus, questions on highly processed foods were expected to provide a moderately strong signal in terms of the extent of alignment of dietary intake with the healthy food choices guidance.

Finally, it was determined that scoring should focus on alignment with the guidance overall, given that a brief multi-factorial screener cannot, by design, provide accurate estimates of intake of particular food categories.

### **Scanning existing screeners, mapping the healthy food choices guidance, developing screener questions, and soliciting feedback from advisors**

Screener development and evaluation were informed by existing screeners that have undergone validation (Centers for Disease Control and Prevention n.d.; Colby et al. 2020; England et al. 2017; Gadowski et al. 2020; Gnagnarella et al. 2018; National Cancer Institute 2019; Tangney et al. 2019). These screeners provided insights into format and possible questions for inclusion, as well as response options. CFG-2019 guidance pertaining to healthy food choices was then mapped (**Table 3**) to provide a roadmap against which to develop screener questions to ensure content validity. Initial screener questions were developed and revised iteratively based on feedback from Health Canada and the advisors. The screener was developed in English and then translated to French. Translations were conducted by Health Canada and reviewed by bilingual researchers at Université Laval.

Given the guiding principles, a key emphasis in seeking advisor feedback on the draft questions was weighing trade-offs between a nuanced screener mapped closely to the guidance versus a simple screener. It was expected that more detail would result in higher cognitive load and accordingly, more reporting error (Natarajan et al. 2010). This reporting error may be differential between individuals with different characteristics, for example, with respect to



literacy (Choi and Cawley 2018; Keogh et al. 2020), resulting in less utility of the screener for use with diverse populations and potentially masking differences in alignment with the guidance among subgroups. There was accordingly consensus among the advisors that the screener did not need to capture every nuance of the guidance (e.g., differentiating fruits canned in syrup from those not canned in syrup, capturing specific sources of unsaturated fats such as avocado); such nuances can be more adequately addressed using more comprehensive methods, such as 24-hour dietary recalls.

The iterative feedback from the experts led to consensus on wording questions as simply as possible, avoiding technical terms (e.g., fortified); querying foods of interest using colloquial terms (e.g., plant-based milks); including examples of commonly consumed foods and relevant exclusions but avoiding lengthy, exhaustive lists; using consistent question structure and response options; and ordering questions such that earlier questions cue responses to later questions. We sought to avoid combining different types of foods (e.g., meats, cheese, and milk) in a single question to the extent possible, while also aiming for a short screener. This approach was deemed useful for minimizing cognitive load and ensuring clarity in what foods to consider in responding to each question, as well as providing flexibility to account for emphases of the guidance, for example, on plant- versus animal-based protein foods, in the screener's scoring system (Hutchinson et al., submitted).

The version of the screener evaluated in the first round of cognitive testing and in face and content validity testing consisted of 15 questions ([Appendix B](#)). Response options were adapted from the Dietary Screener Questionnaire and the Diet History Questionnaire (National Cancer Institute 2021; National Cancer Institute 2022; Millen et al. 2006; Subar et al. 2001; Thompson et al. 2017) and ranged from never to 6 or more times per day.

**Table 3: Dietary guidance mapped to final questions within the Canada’s Food Guide-2019 Healthy Food Choices Screener, in English and French, developed to assess alignment of intake with the healthy food choices guidance among adults aged 18-65 years**

Dietary Guideline	Healthy Eating Recommendation and/or other guidance	Final Screener Questions in English	Final screener questions in French
Vegetables, fruit, whole grains, and protein foods should be consumed regularly	Eat plenty of vegetables and fruit	Over the past month, how often did you eat potatoes, including baked, boiled, or mashed potatoes, or sweet potatoes? <b>Do not include</b> french fries, poutine, home fries, or hash browns.	Au cours du dernier mois, à quelle fréquence avez-vous consommé des pommes de terre, y compris des pommes de terre au four, bouillies ou en purée, ou des patates douces? <b>N’incluez pas</b> les frites, les frites maison, la poutine, les pommes de terre rissolées et les galettes de pommes de terre (hash browns).
		Over the past month, how often did you eat fresh, cooked, frozen, or canned vegetables? <b>Do not include</b> potatoes, french fries, poutine, or other deep-fried vegetables, or vegetable juices and drinks.	Au cours du dernier mois, à quelle fréquence avez-vous consommé des légumes crus, cuits, congelés ou en conserve? <b>N’incluez pas</b> les pommes de terre, les frites ou autres légumes frits, la poutine, les jus de légumes et les boissons de légumes.
		Over the past month, how often did you eat fresh, frozen, canned, or dried fruit? <b>Do not include</b> fruit juices and drinks.	Au cours du dernier mois, à quelle fréquence avez-vous consommé des fruits frais, congelés, en conserve ou séchés? <b>N’incluez pas</b> les jus de fruits et les boissons aux fruits.
	Eat whole grain foods	Over the past month, how often did you eat <b>whole wheat or whole grain</b> breads, bagels, pasta, noodles, quinoa, oats, brown or wild rice, breakfast cereals, or other whole wheat or whole grain foods? <b>Do not include</b> white	Au cours du dernier mois, à quelle fréquence avez-vous consommé du pain, des bagels, des pâtes, des nouilles, du quinoa, du gruau, du riz brun ou sauvage, des céréales à déjeuner ou tout autre <b>aliment fait de blé</b>

	<p>bread, bagels, pasta, noodles, rice, or refined breakfast cereals.</p>	<p><b>entier ou de grains entiers? N'incluez pas</b> le pain blanc, les bagels blancs, les pâtes ou les nouilles blanches, le riz blanc et les céréales à déjeuner raffinées.</p>
Eat protein foods	<p>Over the past month, how often did you eat eggs, beef, pork, wild meat, chicken or other poultry, fish, shellfish, or other animal-based sources of protein? Include canned fish and canned poultry. <b>Do not include</b> fast food, hot dogs, sausages, beef jerky, bacon, ham, or other deli or luncheon meats.</p>	<p>Au cours du dernier mois, à quelle fréquence avez-vous consommé des œufs, du bœuf, du porc, du gibier, du poulet ou autre volaille, du poisson, des fruits de mer ou d'autres sources de protéines d'origine animale? Incluez le poisson en conserve et le poulet ou autre volaille en conserve. <b>N'incluez pas</b> le fast-food, les hot-dogs, les saucisses, le bœuf séché (beef jerky), le bacon, le jambon et autres viandes de charcuterie ou froides.</p>
	<p>Over the past month, how often did you eat nuts, seeds, tofu, beans and lentils, peanut butter or other nut butters, or other plant-based sources of protein? <b>Do not include</b> green beans or packaged veggie burgers and plant-based meats.</p>	<p>Au cour du dernier mois, à quelle fréquence avez-vous consommé des arachides, des noix, des graines, du tofu, des lentilles ou autres légumineuses, du beurre d'arachides ou autres beurres de noix, ou d'autres sources de protéines d'origine végétale? <b>N'incluez pas</b> les haricots verts et les hamburgers végétariens prépréparés du commerce et les simili-viandes d'origine végétale prépréparées du commerce.</p>
	<p>Over the past month, how often did you eat yogurt, kefir, or cheese?</p>	<p>Au cours du dernier mois, à quelle fréquence avez-vous consommé du yogourt, du kéfir ou du fromage?</p>

<p>Among protein foods, consume plant-based more often</p>	<p>Choose protein foods that come from plants more often</p>	<p>Over the past month, how often did you eat nuts, seeds, tofu, beans and lentils, peanut butter or other nut butters, or other plant-based sources of protein? <b>Do not include</b> green beans or packaged veggie burgers and plant-based meats.</p>	<p>Au cours du dernier mois, à quelle fréquence avez-vous consommé des arachides, des noix, des graines, du tofu, des lentilles ou autres légumineuses, du beurre d'arachides ou autres beurres de noix, ou d'autres sources de protéines d'origine végétale? <b>N'incluez pas</b> les haricots verts et les hamburgers végétariens prépréparés du commerce et les simili-viandes d'origine végétale prépréparées du commerce.</p>
<p>Water should be the beverage of choice</p>	<p>Make water your drink of choice</p> <ul style="list-style-type: none"> <li>• Replace sugary drinks with water</li> </ul> <p>Healthy drink options other than water can include:</p> <ul style="list-style-type: none"> <li>• White milk (0% and 1% milk)</li> <li>• Unsweetened fortified plant-based beverages such as soy beverage or almond beverage</li> <li>• Unsweetened coffee and tea</li> </ul>	<p>The screener does not assess water consumption.</p> <p>Over the past month, how often did you have <b>white</b> cows' milk or <b>unsweetened</b> plant-based beverages (e.g., soy, almond, or oat milk)? <b>Do not include</b> small amounts in coffee or tea, or chocolate and other sweetened milk.</p> <p>Over the past month, how often did you have chocolate milk or other <b>flavoured</b> milk or <b>sweetened</b> plant-based beverages (e.g., soy, almond, or oat milk)? <b>Do not include</b> small amounts in coffee or tea, or diet/artificially-sweetened or sugar-free beverages.</p>	<p>Le questionnaire court ne demande la consommation pas d'eau.</p> <p>Au cours du dernier mois, à quelle fréquence avez-vous consommé du lait de vache ou des boissons d'origine végétale <b>non sucrées</b> (par exemple, du lait de soya, du lait aux amandes, du lait d'avoine) ? <b>N'incluez pas</b> les petites quantités dans le café ou le thé, le lait au chocolat et autres laits aromatisés sucrés.</p> <p>Au cours du dernier mois, à quelle fréquence avez-vous consommé du lait au chocolat ou autres laits <b>aromatisés sucrés</b> ou des boissons d'origine végétale <b>sucrées</b> (par exemple, du lait de soya, du lait aux amandes, du lait d'avoine). <b>N'incluez pas</b> les petites quantités dans le café ou le thé, les</p>

		Over the past month, how often did you drink fruit juice, fruit-flavoured drinks, soda or pop, <b>sweetened</b> sports or energy drinks, <b>sweetened</b> hot or iced coffee or tea, or <b>sweetened</b> waters? <b>Do not include</b> diet/artificially-sweetened or sugar-free beverages, such as diet soda.	boissons diètes, les boissons sucrées avec des édulcorants et les boissons sans sucre.  Au cours du dernier mois, à quelle fréquence avez-vous consommé des jus de fruits, des boissons aromatisées aux fruits, des boissons gazeuses <b>contenant du sucre</b> , des boissons sportives <b>sucrées</b> , des boissons énergisantes <b>sucrées</b> , des cafés <b>sucrés</b> ou thés <b>sucrés</b> , chauds ou glacés, ou des eaux <b>sucrées</b> ? <b>N'incluez pas</b> les boissons diètes, les boissons sucrées avec des édulcorants et les boissons sans sucre, comme les boissons gazeuses diètes.
Foods that contain mostly unsaturated fat should replace foods that contain mostly saturated fat	Choose foods with healthy fats instead of saturated fats	Over the past month, how often did you have margarine or vegetable oils (e.g., olive, canola, or sunflower oil)? <b>Do not include</b> lard, coconut oil, palm oil, or butter.	Au cours du dernier mois, à quelle fréquence avez-vous consommé de la margarine ou des huiles végétales (par exemple, l'huile d'olive, l'huile de canola, l'huile de tournesol)? <b>N'incluez pas</b> le saindoux, l'huile de coco, l'huile de palme et le beurre.
Processed or prepared foods and beverages that contribute to excess sodium, free sugars, or saturated fat undermine healthy eating and should not be consumed regularly	Limit highly processed foods. If you choose these foods, eat them less often and in small amounts. • Prepare meals and snacks using ingredients that have little to no added sodium,	Over the past month, how often did you eat hot dogs, sausages, beef jerky, bacon, ham or other deli or luncheon meats? <b>Do not include</b> fast food, canned fish, canned poultry, or packaged veggie burgers and plant-based meats.	Au cours du dernier mois, à quelle fréquence avez-vous consommé des hot-dogs, des saucisses, du bœuf séché ( <i>beef jerky</i> ), du bacon, du jambon ou autres viandes de charcuterie ou froides? <b>N'incluez pas</b> le fast-food, le poisson en conserve, le poulet ou autre volaille en conserve, les hamburgers végétariens préparés du commerce et les simili-viandes d'origine végétale préparées du commerce.

<p>sugars or saturated fat</p> <ul style="list-style-type: none"> <li>Choose healthier menu options when eating out</li> </ul>	<p>Over the past month, how often did you eat food from fast food restaurants, such as burgers, french fries, poutine, pizza, submarine sandwiches, fried chicken, burritos, or tacos?</p> <p>Over the past month, how often did you eat cookies, cakes, muffins, pastries, granola bars, protein bars, ice cream, candy, chocolate, sugary breakfast cereals, or other sugary foods?</p> <p>Over the past month, how often did you eat crackers, chips, pretzels, popcorn, or other salty snacks?</p> <p>Over the past month, how often did you eat <b>white</b> breads, bagels, rice, pasta, noodles, or other refined grains, such as breakfast cereals? <b>Do not include</b> whole wheat or whole grain foods.</p>	<p>Au cours du dernier mois, à quelle fréquence avez-vous consommé de la nourriture provenant d'un restaurant de type <i>fast-food</i>, comme des hamburgers, des frites, de la poutine, de la pizza, des sous-marins, du poulet frit, des burritos ou des tacos?</p> <p>Au cours du dernier mois, à quelle fréquence avez-vous consommé des biscuits, des gâteaux, des muffins, des pâtisseries, des barres tendres, des barres protéinées, de la crème glacée, des bonbons, du chocolat, des céréales à déjeuner sucrées ou d'autres aliments sucrés?</p> <p>Au cours du dernier mois, à quelle fréquence avez-vous consommé des craquelins, des croustilles, des bretzels, du maïs soufflé ou autres collations salées?</p> <p>Au cours du dernier mois, à quelle fréquence avez-vous consommé du pain <b>blanc</b>, des bagels <b>blancs</b>, du riz <b>blanc</b>, des pâtes et des nouilles <b>blanches</b> ou d'autres grains <b>raffinés</b>, comme les céréales à déjeuner raffinées ? <b>N'incluez pas</b> les aliments à base de blé entier ou de grains entiers.</p>
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## **Cognitive testing**

Cognitive testing is a qualitative, psychologically oriented method to investigate the ways in which research participants interpret and respond to survey questions, typically via individual interviews (Foddy 1996; Willis 2005; Willis and Artino 2013; Willis and Miller 2011). The goal is to determine whether each question is understood consistently in the way researchers intend (Collins 2003; Beatty and Willis 2007; Willis and Artino 2013). Cognitive testing draws upon insights from psychology regarding the cognitive processes involved in responding to survey questions. Tourangeau's four-stage model describes these processes, which include 1) comprehension, 2) retrieval of information, 3) judgment or estimation, and 4) selection of a response to the question (National Research Council 1984). Most cognitive testing procedures target the level of comprehension because this is where problems most often occur (Foddy 1996; Willis et al. 2013). A cognitive interviewing reporting framework proposed by Boeije and Willis (2013) was used to guide reporting of this aspect of the screener's evaluation.

### *Data collection*

Cognitive interviews were conducted from April to June 2021. The interviews in English were conducted by researchers at the University of Waterloo and those in French by researchers at Université Laval and were led by researchers (TEW and AB) with training in qualitative methods. Ethics review and approval was obtained from the University of Waterloo Office of Research Ethics (ORE #42994), the Université Laval Research Ethics Board (REB #2021-088), and the Health Canada and Public Health Agency of Canada Research Ethics Board (REB #2020-044H).

While cognitive testing is often conducted informally, research suggests small sample sizes may fail to detect problems with survey questions, including those that may introduce measurement error (Blair et al. 2006). Recommendations for sample size range from 10 to 30 total participants, or five to 15 participants per round for two to three rounds (Beatty and Willis, 2007; Willis and Artino, 2013; Willis and Miller, 2011). To adequately probe for potential issues with comprehension of the screener with individuals with varied sociodemographic characteristics, a sample of approximately 32 participants, comprised of 16 interviews in French and 16 in English, was sought. Interviews were conducted in three rounds in each of English and

French, with four to eight participants per round, to allow for iterative refinement of the screener (Beatty and Willis 2007).

Potential participants were recruited through community organizations and social media (English), and through community organizations and a database of potential research participants (French). For the testing in English, potential participants completed an eligibility questionnaire hosted on Qualtrics (Qualtrics, Provo, UT). For the testing in French, potential participants completed an eligibility questionnaire and returned it to the research coordinator via email. Eligible individuals were aged 18-65 years, lived in Canada, and were able to read the screener and complete a 45- to 60-minute interview using online teleconferencing software in English or French. The eligibility questionnaire also captured information on age, gender identity, racial/ethnic identity, educational attainment, and perceived income adequacy. Quota sampling was used to seek a balance of participants with varying educational attainment. Specifically, the aim was for half of participants in the study to have not completed post-secondary education, as a proxy for lower literacy levels. An approximate balance between women and men was sought, with a desire to include some individuals identifying as non-binary. Purposive sampling was used to maximize variation in other sociodemographic characteristics, including age, racial/ethnic identity (Black, East/Southeast Asian, Indigenous, Latino, Middle Eastern, South Asian, White), and perceived income adequacy (“Thinking about your total monthly income, how difficult is it for you to make ends meet?”, with response options including very difficult, difficult, neither easy nor difficult, easy, and very easy) (Litwin and Sapir, 2009).

Eligibility questionnaire data were reviewed relative to the quotas and purposive sampling criteria on an ongoing basis, and eligible individuals were invited by email to participate in an interview. Those who agreed were sent an information letter and informed consent form in advance. These documents were reviewed at the beginning of the interview, at which time the participant was asked to provide verbal informed consent. Interviews in English were conducted using Zoom (Zoom Video Communications, San Jose, CA), with the exception of one conducted by telephone because the participant did not have Internet access, and interviews in French were conducted using Microsoft Teams (Microsoft Corporation, Redmond, WA). A note-taker captured details of participants’ responses during the interview. Most interviews were audio-recorded, with participant consent, to allow researchers to review recordings as needed. Participants who completed an interview received a \$20 CAD honorarium



via Interac e-transfer in appreciation of their time. Following each interview, the interviewer and note-taker completed a debriefing form to note overall impressions and reflections on the interview process. By the end of the third round in each language, diminishing returns (Beatty and Willis 2007) were noted, in that few new problems were being identified, and recruitment and data collection were concluded.

### *Cognitive interview guide*

Because the screener is intended for self-administration, participants were asked to complete it independently before they reviewed each question and their response process with the interviewer using a think-aloud approach (e.g., “can you walk me through how you arrived at that number?”) (Beatty and Willis 2007; Lenzner et al. 2016). The interviewer then used open-ended verbal probes to gauge understanding and thought processes, using a semi-structured interview guide developed in English and translated to French. The probes were aligned with the cognitive stages of processing. For example, processing of the question, “In the past month, how often did you consume fresh, frozen, and canned fruit?”, requires the respondent to understand and interpret keywords and phrases, including “how often”, “consume”, and “fruit”; to recall the correct response by thinking about how frequently they consumed fruit in the past month and to make a judgment about what number to report; and finally, to provide a response that matches the options available within the screener (e.g., “2 times per week”). The corresponding probes asked, “are there any words or ideas in this question that were difficult to understand?”, targeting comprehension, and “how sure or unsure are you that the number you provided is accurate?”, targeting retrieval of information and judgment. Sorting of foods and beverages across questions and assessment of face and content validity were integrated by asking respondents what kinds of fruits they thought of and those they excluded when answering each question. This process was repeated for each screener question.

To ensure comparability of testing approaches (Willis and Miller 2011), the English- and French-speaking teams used consistent interview guides, and the lead interviewer from the French-speaking team observed pilot interviews conducted in English with graduate students not involved in this research.

### *Data analysis*

As is common in cognitive testing (Willis 2005; Beatty and Willis 2007; Willis and Artino 2013; Willis and Miller 2011), the interview notes and recordings were informally coded. After each round of interviews in each language, issues that may have required changes to ensure that questions were understood as intended were identified and summarized (Lenzner et al, 2016; Willis and Miller 2011). The two teams debriefed between rounds and following the final round, and modified the screener iteratively to address issues identified in each language. To ensure translational equivalency, a decentering approach was applied that recognized that problems identified in one language may require changes to the screener in both languages (Brislin 1970; Willis et al. 2008). Prior to the final round of testing in English and the second round of testing in French, issues that had arisen were discussed with the advisors, who provided feedback and suggested modifications to the screener for the next round of interviews.

For reporting purposes, the issues identified were subsequently grouped into problem categories, or themes related to cognitive processes (Bobrovitz et al, 2015; Lenzner et al, 2016; Thompson et al, 2022; Willis and Miller 2011).

### **Face and content validity testing**

Face and content validity testing was conducted to examine whether the screener was well-constructed and grounded in an understanding of the underlying phenomenon of interest (Frongillo, et al. 2019; Kirkpatrick et al. 2019b). This testing was completed by Health Canada from April to May 2021. Content experts were identified by Health Canada based on existing networks, including advisors on the update of CFG-2019 and other projects, and invited by email to participate. Expert advisors involved in the development of the screener ([Appendix B](#)) were not invited to participate in this phase. Ethics approval was obtained from the Health Canada and Public Health Agency of Canada Research Ethics Board (REB# 2020-044H). According to the associated policies for ethical research conduct, the face and content validity experts were not considered participants since they were not themselves the focus of the research; therefore, informed consent was not required.

Content experts who agreed to participate were sent, via email, the version of the screener tested in the first round of cognitive testing ([Appendix B](#)) and a Microsoft Excel (Microsoft Corporation, Redmond, WA) spreadsheet prompting them to comment on whether each screener

question reflected the guidance it was intended to capture and was easy to understand. The spreadsheet was returned to Health Canada staff via email and the results summarized, including identifying questions that did not perform well according to multiple participants, as well as any global feedback on the screener. These results were shared with the cognitive testing teams and informed modifications to the screener in advance of the final rounds of cognitive interviews in each language.

## **5.4 Results**

### **5.4.1 Cognitive testing**

For the interviews in English, 193 potential participants completed the eligibility questionnaire, of whom 136 met the eligibility criteria. A total of 22 individuals were contacted, and 17 completed an interview. For recruitment of French-speaking participants, 101 potential participants completed the eligibility questionnaire, of whom 97 were eligible, and 16 were contacted and completed an interview. A total of 33 interviews (17 in English and 16 in French) were conducted. In total, 21 participants identified as women and 12 identified as men (**Table 4**). No participants identified their gender as non-binary. Participants represented a mix of racial identities, though the majority (n=19) identified as White. About half of the participants (n=13) had less than post-secondary education.

Issues with the screener questions identified during cognitive testing generally fell into one of four themes, mainly related to comprehension, outlined below.

**Table 4: Characteristics of participants in cognitive interviews in English and French to evaluate the comprehension and face validity of the Canada’s Food Guide-2019 Healthy Food Choices Screener**

	English	French	Total
	<b>n</b>		
<b>Total</b>	17	16	33
<b>Age (years)</b>			
18-24	3	3	6
25-34	5	3	8
35-44	2	3	5
45-54	3	3	6
55-65	4	4	8
<b>Gender identity</b>			
Man	5	7	12
Woman	12	9	21
<b>Racial identity</b>			
White	9	10	19
Indigenous	0	4	4
East/Southeast Asian	4	0	4
Black	2	0	2
Middle Eastern	0	1	1
South Asian	1	0	1
Latino	0	1	1
Prefer not to answer	1	0	1
<b>Perceived income adequacy</b>			
Very easy	2	2	4
Easy	5	4	9
Neither easy nor difficult	6	8	14
Difficult	3	2	5
Very difficult	1	0	1
<b>Educational attainment<sup>1</sup></b>			
High school graduate	2	7	9
Some college	1	0	1
Some university	4	0	4
College graduate	2	3	5
University graduate	6	6	12
Postgraduate training or degree	2	0	2

<sup>1</sup> The French eligibility screener did not offer “Some college”, “Some university”, or “Postgraduate training or degree” as response options.

### **Lack of clarity about what to include or exclude**

Lack of clarity about what to include or exclude in responses to screener questions related to groupings of foods and forms of foods that can be consumed in different ways. With respect to food groupings, in some cases, participants were uncertain about the types of foods that should be reported in response to a given question. Such problems most often occurred due to a lack of detail or examples in a question (**Table 5, example 1**). Contrarily, confusion also occurred when examples were too specific, as participants were unsure whether to “think outside the box” or report only the foods listed (**Table 5, examples 2 and 3**). These ambiguities were addressed by adding detail to existing questions or adding new questions to the screener, as well as through formatting and ordering of questions.

Many foods can be consumed in multiple ways. For example, milk can be consumed as a beverage or used in a sauce or added to a bowl of cereal. Similarly, oil can be used in cooking or as part of a salad dressing. In cognitive testing, some participants were unsure whether certain foods should be reported only if consumed by a particular method and may have overlooked other methods (**Table 5, example 4**). To address this ambiguity, general terms were used to encompass all methods of consumption (e.g., *have* instead of *drink* milk).

### **Keyword confusion**

Some questions in the initial screener included keywords that were unclear or vague to participants, particularly in the testing in French, creating opportunities for misinterpretation (**Table 5, examples 5 and 6**). This sometimes occurred due to awkward or imperfect translation from the English screener to the French version. Lack of clarity was addressed by using more specific keywords (e.g., “lait de vache” instead of lait and “cow’s milk” instead of milk) to describe the foods that should be included in each category.

### **Readability**

Readability issues occurred when the structure of a question hindered participants’ comprehension. When encountering lengthy lists of examples, participants tended to miss details and consequently believed they had provided inaccurate responses (**Table 5, examples 7 and 8**). Including parentheses within a question to provide additional examples of particular food categories hindered readability, as participants felt the parentheses cued them to stop reading

(Table 5, **example 9**). Such problems were alleviated through formatting changes and by rewording and simplifying phrasing, for example, by reducing the number or changing the order of examples or breaking a single question into multiple questions.

### **Response option errors**

There were a few cases in which participants reported quantity, rather than frequency of consumption, referencing serving sizes detailed by prior versions of CFG (Table 5, **example 10**). Because the screener instructs participants to report frequency in both the preamble and each question, no changes were made.

**Table 5: Examples of issues identified in cognitive interviews in English and French to evaluate the comprehension and face validity of the Canada’s Food Guide-2019 Healthy Food Choices Screener<sup>2</sup>**

Example	Problem category	Focus of Question	Cognitive issue	Modifications
1	Lack of clarity about what to include or exclude/Food groupings	Vegetables	Several participants did not consider potatoes in their response related to frequency of consuming vegetables. Participants explained they view potatoes as a starch rather than a fresh vegetable, and some felt potatoes should be reported with grain foods instead.	A question probing potato consumption, prior to the vegetable question, was added.  This modification was tested in the final rounds of cognitive testing in English and French and appeared to help participants understand where to include potato consumption.
2	Lack of clarity about what to include or exclude/Food groupings	Pre-made and ready-to-eat meals	The initial version of the screener asked, “How often did you consume deep-fried foods and ready-to-heat or ready-to-eat dishes?” (in French, “Au cours du <u>dernier mois</u> , à quelle fréquence avez-vous consommé des aliments frits et des plats prêts à réchauffer ou prêts à manger?”). Several participants expressed difficulty understanding which foods to include in their responses to this question.  This question also did not perform well in face and content validity testing with experts.	“Ready-to-heat or ready-to-eat” was simplified to “pre-made meals”. However, in the next rounds of interviews, participants were uncertain whether all take-out foods, or only deep-fried and fast foods, should be reported.  This question was then replaced with a more specific one probing frequency of consumption of fast foods, such as pizza, burgers, and French fries, to clarify inclusion criteria, while aligning with examples of highly processed foods

<sup>2</sup> The versions of the screener, in English and French, tested in the initial round of cognitive interviews, as well as in face and content validity testing with experts, are available in [Appendix B](#).

				<p>within CFG-2019 healthy food choices guidance.</p> <p>The updated question was tested in subsequent rounds of cognitive interviews in English and French and found to be easier to understand compared to previous iterations.</p>
3	Lack of clarity about what to include or exclude/Food groupings	Sugary foods	<p>The initial version of this question included example foods such as sugary breakfast cereals, cookies, and cakes (in French, des céréales sucrées pour le déjeuner, des biscuits, des gâteaux). In cognitive testing in French, some participants were uncertain whether the list of examples was exhaustive, or whether sugary snacks not specifically mentioned should be included.</p>	<p>To indicate that the list of examples was not exhaustive, “or other sugary foods” (“ou d’autres aliments sucrés”) was added after the list of examples.</p> <p>This modification was tested in subsequent rounds of cognitive interviews in English and French and appeared to help participants to “think outside the box” and consider foods not specifically mentioned in the question.</p>
4	Lack of clarity about what to include or exclude/ Foods consumed in multiple ways	<p>Unsweetened milks</p> <p>Oils</p>	<p>The screener question probing unsweetened milk consumption originally asked, “how often did you drink milk and unsweetened plant-based beverages”? (in French, “à quelle fréquence avez-vous bu du lait et des boissons d’origine végétale non sucrées ”). In cognitive testing in both English and French, participants expressed uncertainty about whether to report only milk drunk in a glass or if it</p>	<p>The phrases “drink” (“boire”) and “cook with or add” (“cuisiner ou ajouter”) were changed to the more general keyword, “consume” (“consommer”) to indicate that the foods could be consumed in multiple ways. Though using “consommer” appeared to resolve the issue in French, three participants in the second round of testing in English reported confusion with the word “consume”.</p>



		<p>was appropriate to report milk used as an ingredient or component of a dish.</p> <p>Similarly, the question probing oil consumption asked respondents, “how often did you cook with or add vegetable oils or soft margarines to your foods?” (in French, “combien de fois avez-vous cuisiné avec des margarines molles ou des huiles végétales[...] ou en avez-vous ajoutées à vos aliments?”). In cognitive testing in both English and French, several participants did not consider oils or margarines used outside of cooking, such as in salad dressing or spread on toast, until prompted by the interviewer.</p>	<p>In the English version of the screener, the question was rephrased using the word “have” (e.g., “how often did you have milk and unsweetened plant-based beverages?”). A direct translation of the term “have” was not available in French, and the term “consommer” (to consume) did not elicit the same issues in the cognitive testing in French. Comprehensibility was prioritized over translational equivalency in this case, retaining “consommer” (“à quelle fréquence avez-vous consommé du lait de vache et des boissons d’origine végétale non sucrées”) in French.</p> <p>The modifications were tested in subsequent rounds of cognitive interviews in English and French, and the problems did not recur.</p>
5	<p>Keyword confusion</p> <p>Unsweetened milks</p>	<p>In cognitive testing in French, several participants were uncertain whether “lait” (“milk”) referred only to cow’s milk or other types of milk, such as plant-based beverages or milk from other animals. This issue did not occur in cognitive testing in English.</p>	<p>To clarify that “lait” refers to cow’s milk, the phrase was replaced with “lait de vache” (“cow’s milk”) in the French version of the screener. To maintain translational equivalency, “milk” was replaced with “cow’s milk” in the English version of the screener.</p> <p>The modifications were tested in the final rounds of cognitive interviews in English and French and found to perform well.</p>

				This specification (inclusion of cow's milk/lait de vache) was not included in the question on sweetened flavoured milks because the issue did not arise for that question, and so adding another keyword to the question was not warranted.
6	Keyword confusion	Animal-based proteins	The animal-based protein question originally queried consumption of "lean red meat" (in French, "viande rouge maigre"). In cognitive testing in French, several participants were uncertain which types of meats would be considered "lean" ("maigre"). This issue did not occur in cognitive testing in English.	<p>The phrase "lean red meat" ("viande rouge maigre") was replaced with the more specific keywords, "beef and pork" ("du boeuf et du porc"). Changes were made to both versions of the screener to maintain translational equivalency.</p> <p>This wording was found to perform well in the final rounds of cognitive interviews in English and French.</p>
7	Readability	Animal-based proteins	This question initially placed eggs at the end of a list of animal-based proteins including red meat, poultry, and shellfish. A participant in the first round of cognitive interviews in English explained they only skimmed the question after reading the first few examples and assumed only meat products should be included. They therefore did not consider eggs until prompted by the interviewer.	<p>Since the other example foods listed were meat (and shellfish) products, eggs were moved to the front of the list of example food items.</p> <p>This modification was tested in the second round of cognitive interviews in English and French, and the problem did not recur.</p>
8	Readability	Salty snacks	Crackers were initially placed at the end of a list of salty snacks such as chips and pretzels. Several participants in the English interviews did not consider	Crackers were moved to the front of the list of example food items.

			crackers in their responses, as they assumed the question was asking about foods conventionally viewed as “junk” foods. In contrast, crackers are generally considered “healthier”.	This modification was tested in the final rounds of cognitive interviews in English and French, and the problem did not recur.
9	Readability	Plant-based proteins  Oils  Sweetened milks	Initial drafts of the screener included parentheses within some questions containing examples of specific foods that should be considered in responding. In cognitive interviews in French, several participants expressed that the parentheses made the question difficult to read and understand. They noted that they stopped reading when they encountered parentheses, causing foods listed within the parentheses to be overlooked.	In both the English and French versions, parentheses were removed or moved to the end of the question to enhance readability.  These modifications were tested in the second rounds of cognitive interviews in English and French and the problem did not recur.
10	Response errors	Vegetables  Whole grains	Two participants in the English interviews reported their responses as quantities rather than frequencies for the vegetable question, and one of those participants did the same for whole grains. Both referenced “servings” as specified by prior iterations of Canada’s Food Guide.	No changes were made to the screener, as respondents are instructed to report frequency in both the preamble and in each individual screener question.

### 5.4.2 Face and content validity testing

For the testing in English, 21 experts were invited and 13 accepted and for the testing in French, five experts were invited and three accepted. These experts were academics; dietitians/nutritionists, including practice-based advisors on the revision of CFG-2019 and federal-provincial-territorial nutritionists; and employees of Health Canada, the Public Health Agency of Canada, and Statistics Canada. Sociodemographic information was not collected from the content experts, but there was some variation in sex and race/ethnicity.

Overall, the experts generally agreed that the initial screener questions reflected the guidance and were easy to understand. Issues that were raised were often consistent with those arising in the cognitive interviews. For example, the experts noted that the question assessing highly processed foods was overly complicated, with too many examples, such that it would not be understood by those with lower literacy levels. The experts' feedback supported simplification of this question and others. Some experts suggested aligning the screener questions and structure more closely with the guidance, for instance, by ordering questions in a manner consistent with the guidance and including more detail, such as specifying more example foods noted in the guidance.

### 5.4.3 Refinements to the screener

Although questions were generally well-understood in both languages, changes were made to the order of the screener's questions as well as examples within each question to improve clarity and to make the screener more intuitive for respondents (Table 5, **examples 7 and 8**). Rearranging questions and examples appeared to improve readability and comprehension by cueing respondents on which foods to include or exclude and emphasizing aspects of the question that were otherwise overlooked. In alignment with the guiding principle to develop a screener that is simple to use and with the cognitive testing findings, changes were not made to address suggestions from the content experts to order questions consistent with the guidance itself and to include more example foods.

More substantial modifications included the addition of a question to assess frequency of potato consumption (Table 5, **example 1**) because cognitive testing revealed that some participants tended not to include potatoes when asked about their vegetable consumption. Instead, they viewed potatoes as a starchy food that might belong with grain foods. The question

regarding highly processed foods was simplified to clarify what foods should and should not be included in responses.

In some cases, issues identified in one language entailed changes to the screener in both languages. For example, the expression “viande rouge maigre” (“lean red meat”) was unclear to participants in the cognitive testing in French, although the issue did not arise in English (Table 5, **example 6**). To ensure translational equivalency, the phrase was replaced with “du boeuf et du porc” (“beef and pork”) in both versions of the screener. In other cases, changes were required in only one language. For example, in the cognitive testing in English, the term “have” (i.e., “how often did you have”) improved comprehension of the screener compared to terms like “drink”, which were overly specific and tended to limit respondents’ thought processes (Table 5, **example 4**). However, a direct translation of the term “have” was not available in French, and the term “consommer” (to consume) did not elicit the same issues in the French cognitive testing. Comprehensibility was prioritized over translational equivalency in this case, retaining “consommer” in French and “have” in English.

Formatting was used strategically, including line spacing and judicious use of bolding for emphasis; however, underlining and italics were avoided in the final screener to improve accessibility (City of Peterborough 2014; Kovac 2018).

#### **5.4.4 Final screener**

The final version of the screener in each language includes 16 questions (Table 3). Nine assess consumption of healthy foods to “eat each day”, including fruit; vegetables; potatoes; animal-based protein foods; plant-based protein foods; yogurt, kefir, and cheese; unsweetened cow’s milk and plant-based beverages; whole-grain foods; and margarine and vegetable oils. Seven questions assess “foods to limit”, including processed meat, fast food, sweetened cow’s milk and plant-based beverages, other sugary beverages, sugary snacks, salty snacks, and refined grains. The final screener is available, in both English and French, in [Appendix B](#).

### **5.5 Discussion**

The CFG-2019 Healthy Food Choices Screener, available in English and French, assesses overall alignment of dietary intake with the healthy food choices guidance in CFG-2019. The screener is intended for use with adults, aged 18-65 years, with marginal and higher health

literacy. The screener was developed and evaluated through an iterative process that included three rounds of cognitive interviews in each language along with ongoing feedback from expert advisors, as well as formal face and content validity testing by a separate panel of experts. Results suggested that the screener was well understood in both languages, and informed refinements to question wording and screener structure to improve comprehension and minimize cognitive load. The screener can be completed in approximately five minutes.

Cognitive testing is a valuable method for identifying and correcting problems within a survey or screener and goes beyond conventional pre-testing to comprehensively examine respondents' understanding of each question (Beatty and Willis 2007; Foddy 1996). Previous cognitive testing studies have revealed issues with ambiguous language and keyword misinterpretation (Bobrovitz et al, 2015; Eland et al, 2022), which was also observed in the present study. Small details, including individual words, can change a question's meaning; thus, the cognitive interviews were valuable to ensure the screener questions were understood as intended. Seemingly minor tweaks to the language and structure, such as changing "drink" to "have" (in the English screener) and rearranging example items, improved comprehension, helping to address the guiding principle related to an easy-to-use screener. Cognitive interviews also exposed the challenge of designing questions that are specific enough to cue respondents on what to include and exclude, while not being so overly specific that they limit respondents' thinking. Thompson et al. (2022) found a similar issue in the development of a food literacy questionnaire, wherein participants thought too narrowly about a particular context if the frame of reference was not well-defined. To address this issue in the current screener, example lists were kept as short and simple as possible, and in some cases, reference to "other" foods (e.g., other plant-based protein foods, other salty snacks) indicates that the list is not exhaustive. Providing exclusion criteria also appeared to help guide respondents on what should be included when responding to each question.

The screener captures the main elements of the healthy food choices guidance from CFG-2019; however, given its brevity, it cannot be comprehensive. For example, it does not query all examples of highly processed foods (e.g., frozen entrées, sauces), though a range of foods noted as highly processed within the guidance (Health Canada 2022a) are included. Given challenges in accurately measuring water intake, for example, due to consumption throughout the day that is not structured around meals (Gandy 2015), the screener does not query frequency of water

intake. Further, the screener assesses intake over the past month, consistent with other screeners (Centers for Disease Control and Prevention n.d.; England et al. 2017; National Cancer Institute 2021; Wijnhoven et al. 2018). Adaptation to the past week or year is possible, but these time frames have not been evaluated.

The screener was developed and evaluated for use with adults aged 18-65 years. It may be amenable to self-administration by older children without substantial modification. However, recalling and reporting frequency of intake over the past month is likely to be cognitively challenging for younger children. It has been suggested that children can begin to conceptualize time at around ages seven to eight years and to self-report their own intake using a frequency-based measure starting at around 10 years (Livingstone et al. 2004). Future research could evaluate the administration of the screener to caregivers as proxy reporters for younger children, similar to the implementation of 24-hour recalls in national surveillance (Health Canada 2006; Health Canada 2017). Future research could also evaluate the screener for use with older adults. Comparison to 24HDR data suggested that the Canadian Longitudinal Study on Aging screener performs differentially among younger versus older adults (Gilsing et al. 2018), suggesting unique considerations related to age. Within that evaluation, considerations related to digital literacy among older adults were raised, but it is likely these concerns are lessening in the digital era. Data from Statistics Canada indicate that the proportion of adults aged 65 years and older who accessed the Internet for personal use in the last three months increased from 48% in 2012 to 71% in 2018 (Statistics Canada 2019).

A guiding principle for the development and evaluation of the screener was to consider equivalence across population subgroups in capturing alignment with the healthy food choices guidance. Equivalence relates to comparability (Boer et al. 2018; Frongillo et al., 2019; He and van de Vijver 2012) and can be threatened by construct bias, such that the construct intended to be measured is not the same across groups, as well as item bias, such that items have different meanings across groups (Boer et al. 2018; He and van de Vijver 2012). With respect to language, French-speaking expert advisors were involved throughout the process and versions in English and French were tested and modified simultaneously to maximize translational equivalency (Hebestreit et al. 2017; Kwon et al. 2020; Vieira et al. 2020). Nonetheless, English-speaking individuals were more heavily represented among the advisors and the content experts.

With respect to the appropriateness of the screener for use with diverse populations, a variety of foods are included. For instance, the screener queries a range of animal-based protein foods, such as beef, pork, wild meat, chicken, and shellfish, and various types of grains, including rice, pasta, noodles, and breads, that are consumed by diverse populations. Further, reasonable variation in sociodemographic characteristics among cognitive testing participants was achieved, supporting relatively broad perspectives, including on the specific foods queried. However, the sample was skewed toward women, no participants identified as non-binary, and few identified as Black or Indigenous. The development process was also informed by input from researchers and practitioners from Canada, the USA, and Brazil, including experts in food-based dietary guidance and dietary assessment. Nonetheless, the field of nutrition and dietetics in Canada and elsewhere is relatively homogeneous (McBurney 2022) and structural barriers, including racism and heteronormativity, uphold this homogeneity (White 2018; Carter 2020; Burt et al. 2021; Joy and McSweeney-Flaherty 2022). Given the lack of representation of individuals with diverse and intersecting gender, racial/ethnic, and other identities, important perspectives related to dietary intake and its measurement among subgroups of the population may have been overlooked. Further evaluation of the screener with specific subgroups may thus be warranted to assess whether interpretation of the questions and their face and content validity is consistent. Moreover, it is critical to improve diversity and representation in the field to ensure that heterogeneity of the population is appropriately considered, as well as to heighten consideration of cross-context equivalence within dietary assessment.

Additional considerations are salient to the development of the screener. The sample size was consistent with recommendations for cognitive testing (Beatty and Willis 2007; Willis and Artino 2013; Willis and Miller 2011). Regardless of sample size, however, some cognitive processes are difficult to verbalize, and it is possible that interviews may identify problems that would not occur when the screener is administered in the field or fail to identify issues that would emerge in the field (Beatty and Willis 2007). Informal coding has been used successfully in cognitive testing research, especially when time and resource constraints limit the ability to conduct full transcription of interview recordings (Willis 2005; Beatty and Willis 2007; Willis and Artino 2013; Willis and Miller 2011). To assess the potential impact of more intensive coding, the recordings of the interviews in English were subsequently transcribed and coded using the Framework Method (Gale et al. 2017; Ritchie and Spencer 1994). Although additional



instances of comprehension of specific questions were noted, most of the issues were identified by the informal coding and no new issues likely to have prompted refinements to the screener were noted (Williams et al., Chapter 6).

## **5.6 Conclusion**

The CFG-2019 Healthy Food Choices Screener allows for rapid assessment of the overall alignment of adults' dietary intake with the healthy food choices guidance within CFG-2019. Collaboration with a range of advisors, along with cognitive interviews and face and content validity testing, facilitated development of a simple screener in both English and French intended for use with adults with marginal and higher health literacy. Moderate construct validity of the screener has been observed, as reported in the accompanying paper (Hutchinson et al., submitted). The screener requires about five minutes to complete and is amenable to contexts in which it is not possible to conduct comprehensive dietary assessment. Along with the HEFI-2019 (Brassard et al. 2022a, 2022b), appropriate use of the screener can promote consistent assessment of alignment of adults' dietary intakes with CFG-2019 healthy food choices guidance. This is critical to creating an evidence base that can be synthesized to inform policies and programs to narrow the gap between current dietary intake and the guidance.

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## 5.7 References for Chapter 5

- Afshin, A., Sur, P.J., Fay, K.A., Cornaby, L., Ferrara, G., Salama, J.S., et al. 2019. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*. **393**(10184): 1958–1972. doi:10.1016/S0140-6736(19)30041-8. PMID:30954305.
- Beatty, P.C., and Willis, G.B. 2007. Research synthesis: The practice of cognitive interviewing. *Public Opinion Quarterly*. **71**(2): 287–311. doi:10.1093/poq/nfm006.
- Blair, J., Conrad, F., Ackermann, A., and Claxton, G. 2006. The effect of sample size on cognitive interview findings. *Proceedings of the American Statistical Association*: 4041–4046.
- Bobrovitz, N., Santana, M.J., Kline, T., Kortbeek, J. and Stelfox, H.T. 2015. The use of cognitive interviews to revise the Quality of Trauma Care Patient-Reported Experience Measure (QTAC-PREM). *Quality of Life Research*. **24**(8): 1911–1919. doi:10.1007/s11136-015-0919-5. PMID:25589232.
- Boeije, H., and Willis, G. 2013. The Cognitive Interviewing Reporting Framework (CIRF). *European Journal of Research Methods for the Behavioral and Social Sciences*. **9**(3): 87–95. doi:10.1027/1614-2241/A000075.
- Boer, D., Hanke, K., and He, J. 2018. On detecting systematic measurement error in cross-cultural research: a review and critical reflection on equivalence and invariance tests. *Journal of Cross-Cultural Psychology*. **49**(5): 713–734. doi:10.1177/0022022117749042.
- Brassard, D., Elvidge Munene, L.-A., St-Pierre, S., Gonzalez, A., Guenther, P.M., Jessri, M., et al. 2022b. Evaluation of the Healthy Eating Food Index (HEFI)-2019 measuring adherence to Canada’s Food Guide 2019 recommendations on healthy food choices. *Applied Physiology, Nutrition, and Metabolism*. **47**(5): 582-594. doi:10.1139/APNM-2021-0416. PMID:35030069.
- Brassard, D., Elvidge Munene, L.-A., St-Pierre, S., Guenther, P.M., Kirkpatrick, S.I., Slater, J., et al. 2022a. Development of the Healthy Eating Food Index (HEFI)-2019 measuring adherence to Canada’s Food Guide 2019 recommendations on healthy food choices. *Applied Physiology, Nutrition, and Metabolism*. **47**(5): 595–610. doi:10.1139/APNM-2021-0415. PMID:35030038.
- Brislin, R.W. 1970. Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*. **1**(3): 185–216. doi:10.1177/135910457000100301.
- Burt, K.G., Lopez, R., Landaverde, M., Paniagua, A., and Avalos, E. 2021. Systemic and institutionalized racism, not achievement gap factors, limit the success of Black, Indigenous, and People of Color in dietetics education and credentialing. *Journal of Critical Dietetics*. **6**(1).
- Carter, S. 2020. Systemic racism and implicit bias in nutrition and dietetics. *Food & Nutrition Magazine*. Available from <https://foodandnutrition.org/blogs/stone-soup/systemic-racism-implicit-bias-nutrition-dietetics/> [Accessed 3 August 2022].

- Centers for Disease Control and Prevention. (n.d.). Surveillance of fruit and vegetable intake using the Behavioral Risk Factor Surveillance System. Centers for Disease Control and Prevention, Atlanta, GA. Available from [https://www.cdc.gov/brfss/pdf/fruits\\_vegetables.pdf](https://www.cdc.gov/brfss/pdf/fruits_vegetables.pdf) [Accessed 3 August 2022].
- Choi, A., and Cawley, J. 2018. Health disparities across education: the role of differential reporting error. *Health Economics*. **27**(3): e1–e29. doi:10.1002/HEC.3609. PMID:29210133.
- City of Peterborough. Guide to Accessible Documents - AODA. 2014. Version 3. City of Peterborough, Peterborough, ON. Available from <https://iwscc.ca/wp-content/uploads/2017/06/Guide-to-Accessible-Documents.pdf> [Accessed 3 August 2022].
- Colby, S., Zhou, W., Allison, C., Mathews, A.E., Olfert, M.D., Morrell, J.S., et al. 2020. Development and validation of the short healthy eating index survey with a college population to assess dietary quality and intake. *Nutrients*. **12**(9): 1–24. doi:10.3390/nu12092611. PMID:32867172.
- Collins D. 2003. Pretesting survey instruments: an overview of cognitive methods. *Quality of life research*. **12**(3): 229–38. doi:10.1023/a:1023254226592. PMID:12769135.
- De Rijk, M.G., Slotegraaf, A.I., Brouwer-Brolsma, E.M., Perenboom, C.W.M., Feskens, E.J.M., and de Vries, J.H.M. 2021. Development and evaluation of a diet quality screener to assess adherence to the Dutch food-based dietary guidelines. *British Journal of Nutrition*. 1–11. doi:10.1017/S0007114521004499. PMID:34776025.
- Eland, N.D., Strand, L.I., Ostelo, R.W., Kvåle, A. and Magnussen, L.H. 2022. How do physiotherapists understand and interpret the “Pain Attitudes and Beliefs Scale”? A cognitive interview study. *Physiotherapy Theory and Practice*. **38**(4): 513–527. doi:10.1080/09593985.2020.1774949. PMID:32520655.
- England, C., Thompson, J., Jago, R., Cooper, A., and Andrews, R. 2017. Development of a brief, reliable and valid diet assessment tool for impaired glucose tolerance and diabetes: the UK Diabetes and Diet Questionnaire. *Public Health Nutrition*. **20**(2): 191–199. doi:10.1017/S1368980016002275. PMID:27609314.
- Foddy, W. 1996. The in-depth testing of survey questions: a critical appraisal of methods. *Quality and Quantity*. **30**(4): 361–370. doi:10.1007/BF00170142.
- Food and Agriculture Organization. 2022. Food-based dietary guidelines. Food and Agriculture Organization, Rome, Italy. Available from <https://www.fao.org/nutrition/education/food-dietary-guidelines/background/en/> [Accessed 3 August 2022].
- Freedman, L.S., Commins, J.M., Moler, J.E., Arab, L., Baer, D.J., Kipnis, V., et al. 2014. Pooled results from 5 validation studies of dietary self-report instruments using recovery biomarkers for energy and protein intake. *American Journal of Epidemiology*. **180**(2): 172–88. doi:10.1093/aje/kwu116. PMID:24918187.
- Freedman, L.S., Commins, J.M., Moler, J.E., Willett, W., Tinker, L.F., Subar, A.F., et al. 2015. Pooled results from 5 validation studies of dietary self-report instruments using recovery

- biomarkers for potassium and sodium intake. *American Journal of Epidemiology*. **181**(7): 473–487. doi:10.1093/aje/kwu325. PMID:25787264.
- Frongillo, E.A., Baranowski, T., Subar, A.F., Tooze, J.A., and Kirkpatrick, S.I. 2019. Establishing validity and cross-context equivalence of measures and indicators. *Journal of the Academy of Nutrition & Dietetics*. **119**(11): 1817-1830. doi:10.1016/j.jand.2018.09.005. PMID:30470590.
- Fulkerson, J.A., Lytle, L., Story, M., Moe, S., Samuelson, A., and Weymiller, A. 2012. Development and validation of a screening instrument to assess the types and quality of foods served at home meals. *International Journal of Behavioral Nutrition and Physical Activity*. **9**. doi:10.1186/1479-5868-9-10. PMID:22313614.
- Gabe, K., and Jaime, P. 2019. Development and testing of a scale to evaluate diet according to the recommendations of the Dietary Guidelines for the Brazilian Population. *Public Health Nutrition*. **22**(5): 785–796. doi:10.1017/S1368980018004123. PMID:30744711.
- Gadowski, A., McCaffrey, T., Heritier, S., Curtis, A., Nanayakkara, N., Zoungas, S., et al. 2020. Development, relative validity and reproducibility of the Aus-SDS (Australian Short Dietary Screener) in adults aged 70 years and above. *Nutrients*. **12**(5). doi:10.3390/NU12051436. PMID:32429271.
- Gandy J. 2015. Water intake: validity of population assessment and recommendations. *European Journal of Nutrition*. **54**(2): 11-6. doi:10.1007/s00394-015-0944-8. PMID:26048039.
- Gnagnarella, P., Dragà, D., Misotti, A.M., Sieri, S., Spaggiari, L., Cassano, E., et al. 2018. Validation of a short questionnaire to record adherence to the Mediterranean diet: an Italian experience. *Nutrition, Metabolism and Cardiovascular Diseases*. **28**(11): 1140–1147. doi:10.1016/J.NUMECD.2018.06.006. PMID:3007749.
- Harrison, S., Brassard, D., Lemieux, S., and Lamarche, B. 2019. Consumption and sources of saturated fatty acids according to the 2019 Canada Food Guide: data from the 2015 Canadian Community Health Survey. *Nutrients*. **11**(9): 1964. doi:10.3390/NU11091964. PMID:31438574.
- He, J., and van de Vijver, F. 2012. Bias and equivalence in cross-cultural research. *Online Readings in Psychology and Culture*. **2**(2). doi:10.9707/2307-0919.1111.
- Health Canada. 2006. Canadian Community Health Survey. Cycle 2.2, Nutrition (2004): A guide to accessing and interpreting the data. Health Canada, Ottawa, ON. Available from [https://www.hc-sc.gc.ca/fn-an/alt\\_formats/hpfb-dgpsa/pdf/surveill/cchs-guide-escce-eng.pdf](https://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/surveill/cchs-guide-escce-eng.pdf) [Accessed 3 August 2022].
- Health Canada. 2017. Reference Guide to Understanding and Using the Data 2015 Canadian Community Health Survey—Nutrition. Health Canada, Ottawa, ON. Available from [https://www.canada.ca/content/dam/hc-sc/documents/services/food-nutrition/food-nutrition-surveillance/ReferenceGuide2015CCHS-Nutr\\_Eng\\_Final\\_06192017.pdf](https://www.canada.ca/content/dam/hc-sc/documents/services/food-nutrition/food-nutrition-surveillance/ReferenceGuide2015CCHS-Nutr_Eng_Final_06192017.pdf) [Accessed 3 August 2022].

- Health Canada. 2020. Healthy Eating Recommendations. Health Canada, Ottawa, ON. Available from <https://food-guide.canada.ca/en/healthy-eating-recommendations/> [Accessed 3 August 2022].
- Health Canada. 2021. Revision process for Canada's Food Guide. Health Canada, Ottawa, ON. Available from <https://www.canada.ca/en/health-canada/services/canada-food-guide/about/revision-process.html> [Accessed 3 August 2022].
- Health Canada. 2022b. Canada's Dietary Guidelines for Health Professionals and Policy Makers. Health Canada, Ottawa, ON. <https://food-guide.canada.ca/en/guidelines/> [Accessed 3 August 2022].
- Health Canada. 2022a. Canada's Food Guide. Health Canada, Ottawa, ON. Available from <https://food-guide.canada.ca/en/> [Accessed 3 August 2022].
- Hebestreit K., Yahiaoui-Doktor M., Engel C., Vetter W., Siniatchkin M., Erickson N., et al. 2017. Validation of the German version of the Mediterranean Diet Adherence Screener (MEDAS) questionnaire. *BMC Cancer*. **17**(1): 341. doi:10.1186/s12885-017-3337-y. PMID:28521737.
- Hedrick, V.E., Comber, D.L., Estabrooks, P.A., Savla, J., and Davy, B.M. 2010. The Beverage Intake Questionnaire: determining initial validity and reliability. *Journal of American Dietetic Association*. **110**(8): 1227–1232. doi:10.1016/J.JADA.2010.05.005. PMID:20656099.
- Herforth, A., Arimond, M., Álvarez-Sánchez, C., Coates, J., Christianson, K., and Muehlhoff, E. 2019. A global review of food-based dietary guidelines. *Advances in Nutrition*. **10**(4): 590. doi:10.1093/ADVANCES/NMY130. PMID:31041447.
- Joy, P., and McSweeney-Flaherty, J.M. 2022. Moving dietetics forward with queer pedagogy: a post-structural qualitative study exploring the education and training experiences of Canadian dietitians for LGBTQ care. *Journal Academy of Nutrition and Dietetics*. doi:10.1016/J.JAND.2022.02.011. PMID:35217245.
- Keogh, R.H., Shaw, P.A., Gustafson, P., Carroll, R.J., Deffner, V., Dodd, K.W., et al. 2020. STRATOS guidance document on measurement error and misclassification of variables in observational epidemiology: Part 1 – basic theory and simple methods of adjustment. *Statistics in Medicine*. **39**(16): 2197. doi:10.1002/SIM.8532. PMID:32246539.
- Kirkpatrick, S.I., Baranowski, T., Subar, A.F., Tooze, J.A., and Frongillo, E.A. 2019b. Best practices for conducting and interpreting studies to validate self-report dietary assessment methods. *Journal Academy of Nutrition and Dietetics*. **119**(11): 1801–1816. doi:10.1016/j.jand.2019.06.010. PMID:31521583.
- Kirkpatrick, S.I., Raffoul, A., Lee, K.M., and Jones, A.C. 2019a. Top dietary sources of energy, sodium, sugars, and saturated fats among Canadians: insights from the 2015 Canadian Community Health Survey. *Applied Physiology, Nutrition and Metabolism*. **44**(6): 650–658. doi:10.1139/APNM-2018-0532. PMID:30951373.
- Kirkpatrick, S.I., Guenther, P.M., Subar, A.F., Krebs-Smith, S.M., Herrick, K.A., Freedman, L.S., et al. 2022b. Using short-term dietary intake data to address research questions

- related to usual dietary intake among populations and subpopulations: assumptions, statistical techniques, and considerations. *Journal Academy of Nutrition and Dietetics*. **122**(7): 1246-1262. doi:10.1016/J.JAND.2022.03.010. PMID:35283362.
- Kirkpatrick, S.I., Troiano, R.P., Barrett, B., Cunningham, C., Subar, A.F., Park, Y., et al. 2022a. Measurement error affecting web- and paper-based dietary assessment instruments: insights from the multi-cohort Eating and Activity Study for Understanding Reporting Error. *American Journal of Epidemiology*. **191**(6): 1125–1139. doi:10.1093/AJE/KWAC026. PMID:35136928.
- Kovac L. 2018. Accessible Writing Style. Accessibility for Ontarians with Disabilities Act. Accessibility for Ontarians with Disabilities Act. Available from <https://aoda.ca/accessible-writing-style/> [Accessed 3 August 2022].
- Kwon, Y.-J., Lee, H., Yoon, Y., Kim, H.M., Chu, S.H., and Lee, J.-W. 2020. Development and validation of a questionnaire to measure adherence to the Mediterranean diet in Korean adults. *Nutrients*. **12**(4): 1102. doi:10.3390/nu12041102. PMID:32316107.
- Lafrenière, J., Lamarche, B., Laramée, C., Robitaille, J., and Lemieux, S. 2017. Validation of a newly automated web- based 24-hour dietary recall using fully controlled feeding studies. *BMC Nutrition*. **3**(34): 1–10. doi:10.1186/s40795-017-0153-3. PMID: 32153814
- Lafrenière, J., Harrison, S., Laurin, D., Brisson, C., Talbot, D., Couture, P., et al. 2019. Development and validation of a Brief Diet Quality Assessment Tool in the French-speaking adults from Quebec. *International Journal of Behavioral Nutrition and Physical Activity*. **16**(1): 1-0. doi:10.1186/s12966-019-0821-6. PMID:31387609.
- Lenzner, T., Neuert, C., and Otto, W. 2016. GESIS Survey Guidelines: Cognitive Pretesting. Mannheim, Germany. doi:10.15465/gesis-sg\_en\_010.
- Lim, S.S., Vos, T., Flaxman, A.D., Danaei, G., Shibuya, K., Adair-Rohani, H., et al. 2012. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*. **380**(9859): 2224–60. doi:10.1016/S0140-6736(12)61766-8. PMID:23245609.
- Litwin, H. and Sapir, E.V., 2009. Perceived income adequacy among older adults in 12 countries: findings from the survey of health, ageing, and retirement in Europe. *The Gerontologist*. **49**(3): 397-406. doi:10.1093/geront/gnp036. PMID:19386829.
- Livingstone, M.B.E., Robson, P.J., and Wallace, J.M.W. 2004. Issues in dietary intake assessment of children and adolescents. *British Journal of Nutrition*. **92**(S2): S213-22. doi:10.1079/BJN20041169. PMID:15522159.
- Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V., et al. 2012. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*. **380**(9859): 2095–128. doi:10.1016/S0140-6736(12)61728-0. PMID:23245604.
- McBurney, M.I. 2022. Are professors of human nutrition faculty at Canadian universities representative with respect to common social constructs of gender and race? *Applied*



- Physiology, Nutrition and Metabolism. **47**(5): 517–520. doi:10.1139/apnm-2021-0771. PMID:35138933.
- Micha, R., Shulkin, M.L., Peñalvo, J.L., Khatibzadeh, S., Singh, G.M., Rao, M., et al. 2017. Etiologic effects and optimal intakes of foods and nutrients for risk of cardiovascular diseases and diabetes: systematic reviews and meta-analyses from the nutrition and chronic diseases expert group (NutriCoDE). *Public Library of Science ONE*. **12**(4). doi:10.1371/journal.pone.0175149. PMID:28448503.
- Millen, A.E., Midthune, D., Thompson, F.E., Kipnis, V., and Subar, A.F. 2006. The National Cancer Institute Diet History Questionnaire: validation of pyramid food servings. *American Journal of Epidemiology*. **163**(3): 279-288. doi:10.1093/aje/kwj031. PMID:16339051.
- Natarajan, L., Pu, M., Fan, J., Levine, R., A, Patterson, R.E., Thomson, C.A., et al. 2010. Measurement error of dietary self-report in intervention trials. *American Journal of Epidemiology*. **172**(7): 819-27. doi:10.1093/aje/kwq216. PMID:20720101.
- National Cancer Institute. 2015. Dietary Assessment Primer. National Cancer Institute, Bethesda, MD. Available from <https://dietassessmentprimer.cancer.gov/> [Accessed 3 August 2022].
- National Cancer Institute. 2019. Dietary Screener in the 2009 California Health Interview Survey. National Cancer Institute, Bethesda, MD. Available from <https://epi.grants.cancer.gov/diet/screeners/CHIS2009.pdf> [Accessed 3 August 2022].
- National Cancer Institute. 2021. Dietary Screener Questionnaire in the NHANES 2009-10: Background. National Cancer Institute, Bethesda, MD. Available from <https://epi.grants.cancer.gov/nhanes/dietscreen/> [Accessed 3 August 2022].
- National Cancer Institute. 2022. Diet History Questionnaire III. Available from <https://epi.grants.cancer.gov/dhq3/> [Accessed 3 August 2022].
- National Research Council. 1984. Cognitive aspects of survey methodology: building a bridge between disciplines. National Academies Press, Washington, D.C. doi:10.17226/930.
- Ritchie, J., Spencer, L. 1994. Qualitative data analysis for applied policy research. *Analyzing Qualitative Data*. Routledge, London. pp. 173–94.
- Subar, A.F., Kirkpatrick, S.I., Mittl, B., Zimmerman, T.P., Thompson, F.E., Bingley, C., et al. 2012. The Automated Self-Administered 24-hour dietary recall (ASA24): a resource for researchers, clinicians, and educators from the National Cancer Institute. *Journal of the Academy of Nutrition and Dietetics*. **112**(8): 1134–1137. doi:10.1016/j.jand.2012.04.016. PMID: 22704899.
- Subar, A.F., Thompson, F.E., Kipnis, V., Midthune, D., Hurwitz, P., McNutt, S., et al. 2001. Comparative validation of the Block, Willett, and National Cancer Institute food frequency questionnaires: The Eating at America’s Table Study. *American Journal of Epidemiology*. **154**(12): 1089-1099. doi:10.1093/aje/kwj031. PMID:16339051.
- Tangney, C., Rasmussen, H., Richards, C., Li, M., and Appelhans, B. 2019. Evaluation of a brief sodium screener in two samples. *Nutrients*. **11**(1). doi:10.3390/NU11010166. PMID:30646541.



- Thompson, F.E., Midthune, D., Subar, A.F., Kahle, L.L., Schatzkin, A., and Kipnis, V. 2004. Performance of a short tool to assess dietary intakes of fruits and vegetables, percentage energy from fat and fibre. *Public Health Nutrition*. 7(8): 1097–1106. doi:10.1079/PHN2004642. PMID:15548349.
- Thompson C, Adams J, Vidgen HA. 2022. Progressing the development of a food literacy questionnaire using cognitive interviews. *Public Health Nutrition*. 25(7):1968-78. doi:10.1017/S1368980021004560. PMID:34743775.
- Thompson, F.E., Kirkpatrick, S.I., Subar, A.F., Reedy, J., Schap, T.E., Wilson, M.M., et al. 2015. The National Cancer Institute’s Dietary Assessment Primer: a resource for diet research. *Journal of the Academy of Nutrition and Dietetics*. 115(12): 1986–95. doi:10.1016/j.jand.2015.08.016. PMID:26422452.
- Thompson, F.E., Midthune, D., Kahle, L., and Dodd, K.W. 2017. Development and evaluation of the National Cancer Institute’s Dietary Screener Questionnaire scoring algorithms. *The Journal of Nutrition*. 147(6): 1226-1233. doi:10.3945/jn.116.246058. PMID:28490673.
- Tugault-Lafleur, C.N., and Black, J.L. 2019. Differences in the quantity and types of foods and beverages consumed by Canadians between 2004 and 2015. *Nutrients*. 11(3): 526. doi:10.3390/NU11030526. PMID:30823448.
- Vajdi, M., and Farhangi, M.A. 2020. A systematic review of the association between dietary patterns and health-related quality of life. *Health and Quality of Life Outcomes*. 18(1): 337. doi:10.1186/s12955-020-01581-z. PMID:33046091.
- Vieira, L.M., Gottschall, C.B.A., Vinholes, D.B., Martinez-Gonzalez, M.A., Marcadenti, A. 2020. Translation and cross-cultural adaptation of 14-item Mediterranean Diet Adherence Screener and low-fat diet adherence questionnaire. *Clinical Nutrition ESPEN*. 39: 180-189. doi:10.1016/j.clnesp.2020.06.018. PMID:32859314.
- White, J. 2018. Barriers to becoming registered dietitians identified by African American students and practitioners. *Journal of Critical Dietetics*. 4(1): 41-46. Available from <https://criticaldieteticsblog.files.wordpress.com/2018/07/41-46-white.pdf>
- Wijnhoven, H., Elstgeest, L., de Vet, H., Nicolaou, M., Snijder, M., and Visser, M. 2018. Development and validation of a short food questionnaire to screen for low protein intake in community-dwelling older adults: The Protein Screener 55+ (Pro55+). *Public Library of Science ONE*. 13(5). doi:10.1371/JOURNAL.PONE.0196406. PMID:29791454.
- Willis, G.B. 2005. *Cognitive Interviewing*. SAGE Publications, Inc. doi:10.4135/9781412983655.
- Willis, G.B., and Artino, A.R. 2013. What do our respondents think we’re asking? Using cognitive interviewing to improve medical education surveys. *Journal of Graduate Medical Education*. 5(3): 353–356. doi:10.4300/jgme-d-13-00154.1. PMID:24404294.
- Willis, G.B., and Miller, K. 2011. Cross-cultural cognitive interviewing: seeking comparability and enhancing understanding. *Field Methods*. 23(4): 331-341. doi:10.1177/1525822X11416092.

Willis, G.B., Lawrence, D., Hartman, A., Stapleton Kudela, M., Levin, K., and Forsyth, B. 2008. Translation of a tobacco survey into Spanish and Asian languages: the Tobacco Use Supplement to the Current Population Survey. *Nicotine Tobacco Research*. 10(6): 1075–84. doi:10.1080/14622200802087572. PMID:18584471.

**CHAPTER 6:** A comparison of two approaches to analyzing cognitive interview data: Application to cognitive interviews to develop a brief dietary screener

Target journal: *Journal of Nutrition Education and Behaviour (JNEB)*. In preparation.

## 6.1 Overview

**Objective:** To assess trade-offs associated with informal and in-depth analytic approaches to cognitive interviews conducted to inform a dietary screener.

**Design:** Interviews were structured to align with the stages of cognitive processing, including comprehension, recall, judgement, and response. Informal coding of interview notes was compared to the in-depth application of the framework analysis method to interview transcripts.

**Setting and participants:** Interviews were conducted, online or over the phone, with 17 adults to inform the refinement of a dietary screener. Quota sampling was used to over-sample individuals with lower educational attainment as a proxy for lower literacy levels, and purposive sampling was used to balance other demographic characteristics.

**Variables Measured:** Instances in which screener questions might fail to achieve their intended purpose or be interpreted as intended, as well as the time, software, and personnel requirements associated with the two analytic approaches.

**Analysis:** Results were compared to identify differences in issues identified and their possible implications for the screener. Resource requirements associated with each method were compared.

**Results:** Using the informal method, four themes were identified, including lack of clarity about what to include or exclude, keyword confusion, readability, and response errors. Example issues included cases where participants were uncertain about what foods to report due to a lack of detail or examples that were too specific; cases of unclear or vague wording leading to misinterpretation; and cases where a question's structure hindered comprehension. The application of the in-depth transcription and framework method identified infrequent issues with comprehension, recall and judgment that were not identified by the informal approach, as well as additional instances of issues identified using the informal approach. In some cases, unique issues were identified using the informal method, mainly due to the use of notes that incorporated some interpretation by the note-taker. The informal method required less time, but required a note-taker, whereas the in-depth approach took more time and required transcription and coding software.

**Conclusions and Implications:** The in-depth approach required more time and resources but reduced likelihood of misinterpretation. Comparatively, the informal method was quicker and simpler and identified most but not all issues with the screener, however, employment of an additional person is required for note-taking. The identified discrepancies between each method were unlikely to have meaningfully impacted the dietary screener examined in this study. Each method brings trade-offs with respect to the results generated and the time and resources required, which must be considered in the context of the scope of the project and tool being evaluated.

## 6.2 Introduction

Dietary patterns are a crucial risk factor for noncommunicable disease worldwide, contributing to morbidity and mortality (1–5). To promote healthy eating patterns, many countries publish national dietary guidance, presenting “specific, culturally appropriate, and actionable recommendations” (6). In 2019, Health Canada released an updated Canada's Food Guide (CFG-2019), with a focus on overall eating patterns, including ‘healthy food choices’ (7). To support decision-making regarding health policies and programs, it is of interest to conduct population-level surveillance on the alignment of dietary intake with the CFG-2019. In particular, Health Canada identified the need for a brief dietary screener (8–12) to provide rapid insights into alignment of adults’ intake with the CFG-2019 healthy food choices guidance, for use in contexts where it is not possible to conduct detailed dietary assessment.

The 16-question CFG-2019 Healthy Food Choices Screener was thus developed to assess alignment of adults’ dietary intake over the past month with the Food Guide’s “healthy food choices” guidance (Williams et al., Chapter 5). The screener was developed and evaluated simultaneously in English and French through an iterative process, including face and content validity testing with a panel of experts and three rounds of cognitive interviews in English and French. Since the mid-1980s, cognitive testing, a psychologically oriented method to investigate the ways in which research participants interpret and respond to questions (13–16), has been recognized as standard practice in the design and evaluation of data collection tools (17). Cognitive testing may inform refinements to tools by revealing item-specific problems with wording, for example, with respect to structural, cognitive, or culturally specific deficiencies; the need for improved specificity in the intent of the question; problems with the sequence of items

or sections; issues related to participant burden; and limitations in the tool’s ability to capture the desired information using the intended methods (16).

However, cognitive testing methods are often mentioned only in passing as part of the process of developing dietary screeners or other nutrition-related tools (10,12,18,19), and there is a lack of standardized methods compared to those for evaluating validity and reliability (20). Notably, cognitive interview data analysis is “largely uncharted territory” (16) and remains the “least-developed aspect” of the cognitive testing process (21,22). An informal approach to analysis is commonly taken, involving assigning codes to interview notes as opposed to transcribing interview recordings (13,14,16,20) and coding using methods and frameworks common to qualitative research (23). Because data analysis has not been well documented, Willis (16) notes there are unanswered questions regarding the efficacy of different coding and analysis methods, including whether it is worthwhile to invest resources into interview transcription and formal coding, or if informal methods are sufficient.

We therefore drew upon data from cognitive interviews conducted to inform the CFG-2019 Healthy Food Choices Screener to compare two methods of analysis: an informal approach using brief notes, and an in-depth approach based on the framework method (24–26) applied to interview transcripts. Specifically, we examined whether the in-depth approach to analysis revealed additional or conflicting issues related to the comprehensibility of the screener compared to the informal approach, and explored trade-offs related to the time and resources associated with each approach (27). Potential implications for the screener will also be discussed.

## **6.3 Methods**

### **6.3.1 Participants and recruitment**

As part of the process to develop the CFG-2019 Healthy Food Choices Screener, cognitive interviews were conducted from April 2021 to June 2021 in both English and French. An informal coding approach was applied to the interview data in both languages to refine the screener. Due to restrictions associated with the ethics clearance for the interviews in French, only the recordings and notes from the interviews in English were available for further analysis; this comparison thus makes use of data from the interviews conducted in English. Ethics approval was obtained from the University of Waterloo Office of Research Ethics (ORE #

42994) and the Health Canada and Public Health Agency of Canada Research Ethics Board (REB #2020-044H).

Recommended sample sizes for cognitive testing range from 10 to 30 total participants, or five to 15 participants per round of testing for two to three rounds (13,14,16,20). To adequately probe for potential issues with comprehension of the screener among individuals with varying sociodemographic characteristics, 16 interviews in English were planned. Potential participants were recruited through community organizations and social media and directed to an online eligibility questionnaire on Qualtrics (Qualtrics, Provo, UT). To meet eligibility criteria, potential participants were aged 18 to 65 years, resided in Canada, and indicated they were comfortable completing the screener in English and participating in a 45- to 60-minute interview using online teleconferencing software. A key guiding principle for the screener was to keep the questions as simple as possible so they could be understood by individuals with a range of literacy levels. Quota sampling was thus used to achieve a balance of individuals with lower educational attainment as a proxy for lower literacy levels. Purposive sampling was used to attempt to balance other demographic characteristics, including age, gender identity, racial identity, and perceived income adequacy, assessed by asking, “Thinking about your total monthly income, how difficult is it for you to make ends meet?”, with response options including very difficult, difficult, neither easy nor difficult, easy, and very easy (28).

Eligibility questionnaire data were reviewed on an ongoing basis to select potential participants relative to planned quotas and purposive sampling criteria. Eligible individuals were invited to participate via email, and those who accepted were provided with an information letter and informed consent form. These documents were reviewed with the participant at the beginning of the interview and participants were then asked to provide verbal informed consent. Participants who completed an interview received a \$20 honorarium in appreciation of their time. Interviews were conducted in three rounds, with four to eight interviews per round, to allow for iterative refinement of the screener. Recruitment was discontinued once diminishing returns (20) were noted, in that few new problems were being identified.

A total of 193 potential participants completed the online eligibility questionnaire, 136 of whom were considered eligible and 22 of whom were contacted for an interview. A total of 17 interviews were conducted over three rounds. Audio recordings were available for 14 interviews,

because one participant did not consent to recording, the interviewer forgot to begin the recording for one interview, and one interview was conducted over the phone.

The sociodemographic characteristics of the sample have been reported elsewhere (Williams et al., Chapter 5). In brief, 12 participants identified as women and 5 identified as men. Participants represented a mix of racial/ethnic identities, though the majority (n=9) identified as White. Similar proportions of participants from each age group were represented. Seven participants had completed less than post-secondary education.

### **6.3.2 Interview procedures**

Interviews were conducted by TEW using Zoom (Zoom Video Communications, San Jose, CA) or over the phone and lasted 30 to 60 minutes. During interviews, a note-taker, who was either a PhD student involved in the development and evaluation of the screener (JMH) or an undergraduate co-operative education student who supported the project (e.g., ethics applications) (AMW), captured details of participant responses. Participants were asked to provide consent to have their interviews audio-recorded.

Because the screener is intended for self-administration, participants were asked to complete it independently before reviewing their responses for each question with the interviewer to gauge their understanding and thought processes. Drawing upon a semi-structured interview guide, the interviewer used open-ended verbal probes aligned with the cognitive processes involved in responding to survey questions (29). In the first stage, comprehension, survey respondents attempt to understand and interpret what is being asked of them, including key terms in the question, as well as the meaning of the question overall. Most cognitive testing procedures target the level of comprehension, as this is where problems most often occur (13,15). In the next stage, retrieval of information, respondents recall relevant information from their memory. In the third stage, involving judgment or estimation, respondents decide or estimate which answer to report. In the final stage, respondents present a response that, ideally, matches the options available. Each probe therefore targeted one or more levels of cognitive processing. For example, the probe, “are there any words or ideas in this question that were difficult to understand?” addressed comprehension. Confidence in judgment and recall were addressed by asking “how confident are you that the number you provided is accurate?”. Participants were asked to expand on their responses and explain their thinking when necessary.



Think-aloud probing, such as “can you walk me through how you arrived at that number?”, was used to encourage participants to verbalize their thought processes (20,30).

## **6.4 Analysis**

### **6.4.1 Informal approach to coding and analysis**

The development and evaluation of the screener were conducted under time and budgetary constraints, which necessitated the use of informal data analysis methods. Interview notes were informally coded for problem categories based upon Tourangeau's model of cognitive processing (i.e., errors in comprehension, recall, judgement, and response (29)) by highlighting and commenting on the notes in Microsoft Word (Microsoft Corporation, Redmond, WA). Then, issues (i.e., instances in which screener questions might fail to achieve their intended purpose or be interpreted as intended (13,20,31)) identified for each question and falling under various problem categories were summarized across interviews to inform the refinement of the screener (14,30). The summary described the types of issues and number of participants who encountered each issue; for example, “Misreading error: 4 participants did not notice crackers should be included in their response to this question”. For reporting purposes, the issues identified were grouped into themes related to cognitive processes or problem categories (14,30,32,33). The screener development team debriefed between rounds of testing and modified the screener iteratively to address issues identified in cognitive interviews. The updated screener was then tested in the subsequent round of cognitive interviews.

### **6.4.2 In-depth approach to coding and analysis: Transcription & the framework analysis method**

For the in-depth approach, the cognitive interview recordings were transcribed, or in cases in which recordings were not available (n=3), interview notes were used in their place. Transcription was conducted using a web application that applies artificial intelligence to generate speech to text transcription (Otter.ai, Los Altos, CA). The resulting text was manually reviewed against the recordings to correct errors and add contextual cues (e.g., pauses in speech, laughter, emphasized words). Review of the transcripts began the process of familiarization with the data, in which the researcher learns about key ideas and recurrent themes (24,26).

Next, the transcripts and notes were coded with NVivo 12 Pro (QSR International, Burlington, MA) using the framework analysis method (24,25), which seeks identify and analyze patterns of meaning, or themes, in qualitative data (24,34). The defining feature of framework analysis is the “matrix”, created by indexing data from interview transcripts into an organized structure, allowing the researcher to analyze themes by codes, which form the columns of the matrix, and cases, i.e., participants, which form the rows. Matrices are typically organized by theme, but because this project focused on identifying refinements to improve the screener questions, matrices were organized by question. Additionally, coding was conducted by round of interviews since the screener was iteratively refined and differed somewhat from round to round. This resulted in a total of three matrices, based on 15-16 screener questions evaluated over three rounds.

Codes were based on Tourangeau’s model of cognitive processing, identifying errors in comprehension, recall, judgment, and response (29). Specific errors under each of these categories were assigned their own codes, such as “comprehension: unclear criteria for what to include or exclude in response” or “judgment: lack of confidence in response”. Codes were grouped into themes (which aligned with the four steps of cognitive processing (29)) and sub-themes (specific issues under each category) to develop working analytical frameworks for each round of interviews. The matrices were created in Microsoft Excel (Microsoft Corporation, Redmond, WA), with separate sheets pertaining to each screener question, and all themes represented on each sheet.

To chart the interview data, the coded data from the transcripts were summarized or paraphrased in the appropriate cell in the matrix, with reference to the transcript and line number. Interview data were charted in chronological order, corresponding to the interview date and round, to approximate the iterative approach used in the development and refinement of the screener. Themes were modified and additional themes created as new insights were identified. Although the final step in framework analysis is to interpret the dataset as a whole, each of the three matrices were first interpreted for themes and trends in each screener question separately to align with the rounds of testing used to refine the screener. Issues that might impact multiple questions or influence the overall structure of the screener, such as ordering of questions, were also considered.

### **6.4.3 Comparing the two approaches to coding and analysis**

To compare the two approaches, all cases of issues identified by each analysis method were compiled for each screener question. Then, results of each method were compared to identify discrepancies, including themes, cases of issues that were identified by one method but not the other, and issues that were identified by both methods but interpreted differently. Where discrepant cases were found, the interview notes and transcripts were compared, along with the compiled results, to determine whether the discrepancy reflected an error in note-taking, transcription, coding, or analysis. In the implementation of the original informal analysis approach, the screener was iteratively refined across rounds. It was not possible to reproduce that aspect of the process in the application of the in-depth coding approach. Alternatively, when additional or conflicting issues were identified by the in-depth approach, possible implications for the screener (e.g., issues that potentially should have been addressed by refinements to the screener) were noted.

The time and cost involved in implementing each approach were estimated. Cost estimates included the price of software used to prepare and analyze the data, though some software programs were available to the author for free with a student licence. Personnel required for each method was also noted, with implications for human resources costs.

## **6.5 Results**

### **6.5.1 Issues identified using the informal analysis method**

The original, informal method conducted during the development of the CFG-2019 Healthy Food Choices screener revealed a range of issues with proposed screener questions. These issues generally fell into one of four themes, mainly related to comprehension. Themes included lack of clarity about what to include or exclude; keyword confusion; readability; and response errors. Descriptions and examples of each theme can be found in **Table 6**.

**Table 6: Examples of themes and issues identified in cognitive interviews using the informal coding and analysis method, and subsequent modifications to the screener**

<b>Theme</b>	<b>Description</b>	<b>Example</b>
<b>Lack of clarity about what to include or exclude/Food groupings</b>	Participants uncertain about the types of food that should be reported, either due to a lack of detail or examples, or examples that were too specific.	In the question probing vegetable consumption, several participants did not consider including potatoes. Participants explained that they view potatoes as a starch rather than a fresh vegetable. To address this issue, a question probing potato consumption was added to the screener prior to the vegetable question.
<b>Lack of clarity about what to include or exclude/Foods consumed in multiple ways</b>	Participants uncertain whether foods should be reported only if consumed by a particular method.	The question probing unsweetened milk consumption originally asked, “how often did you drink milk...?”. Several participants were uncertain whether to report only milk drunk in a glass, or to additionally report milk used as an ingredient or component of a dish. The question was rephrased using the word “have”, to indicate that milk could be consumed in multiple ways.
<b>Keyword confusion</b>	Unclear or vague keywords that created opportunity for misinterpretation.	In the question probing sweetened milk consumption, a participant assumed that “sweetened” cow’s milk referred to regular dairy milk, because it has naturally-occurring sugars. To address this issue, phrasing was changed to, “how often did you have chocolate milk or other <b>flavoured</b> milk or <b>sweetened</b> plant-based beverages...?”
<b>Readability</b>	Participants’ comprehension hindered due to a question’s structure.	In the question probing salty snack consumption, crackers were initially placed at the end of a list of snacks including chips and pretzels. Several participants did not consider crackers in their response, assuming the question was asking about “junk” foods, while crackers are considered “healthier”. To address this issue, crackers were moved to the front of the list of example items.
<b>Response errors</b>	Participants reported quantity rather than frequency of consumption.	Two participants sometimes reported their responses as quantities rather than frequencies, referencing “servings” as included in earlier versions of Canada’s Food Guide. This issue was not addressed, as participants are instructed to report frequency in each question as well as the preamble.

### **6.5.2 Differences in cognitive interview findings using the in-depth transcription & framework method**

Overall, the majority of issues uncovered using the in-depth approach were also identified using the informal approach (**Table 7**), and no new themes were identified using transcription and the framework method. However, framework analysis identified additional instances of issues also identified by the informal analysis. For example, a recurring issue was uncertainty regarding whether consumption of milk should be reported only if it was consumed as a beverage, or whether consumption in other ways, such as in a sauce or bowl of cereal, should be included (**Table 7, issue 9A**). Though the informal analysis identified three instances of this issue, two additional instances were identified by the in-depth analysis (**Table 7, issue 9F and 10C**). A similar issue occurred in which framework analysis revealed an additional instance of a participant unclear whether they should report consumption of eggs used as an ingredient in baking within a question probing consumption of animal-based protein foods (**Table 7, issues 6C and 6E**).

Similarly, the framework analysis revealed additional instances of potential response errors not captured by the interview notes. Though both methods identified cases in which participants reported quantity rather than frequency of consumption (**Table 7, issue 3F**), the framework analysis approach captured several additional instances in which participants considered quantity before ultimately reporting frequency (**Table 7, issues 12E, 13C and 15H**). The framework analysis also identified some cases in which participants reported difficulty estimating their intake of a particular food over the period of a month (**Table 7, issue 1D and 14G**), or expressed they were not entirely confident in their answer to a question (**Table 7, issues 1E, 5B, and 7F**). These recall and judgment difficulties were either overlooked during note-taking or identified by the note-taker but not coded as part of the informal analysis. The informal approach also failed to identify some instances in which participants asked the interviewer for clarification about inclusion or exclusion criteria. Other issues missed by the informal analysis included lone instances of misreading that did not recur, such as a participant who did not notice coconut oil in the list of exclusions for a question probing oil consumption until reviewing their response during the interview (**Table 7, issue 16E**).

The comparison of methods identified some errors based on the informal method. For example, the informal analysis noted that one participant did not consider sweet potatoes in their

response to the question querying potato consumption (Table 7, **issue 2C**). Review of the transcript revealed the participant did consider sweet potatoes but did not consume them. In another case, the informal analysis identified that a participant did not consider crackers in responding to a question on consumption of salty snacks (Table 7, **issue 13B**). However, the transcript revealed the interviewer did not specifically probe cracker consumption and it is unknown whether crackers were missed in error, or whether the participant did not consume crackers.

In other cases, the informal analysis identified issues that were not immediately evident in the transcripts but were identified by the note-taker. For example, the note-taker noted an instance in which a participant reported chickpeas twice, as both a vegetable and a plant-based protein (Table 7, **issue 7E**). These issues were not specifically discussed during the interview and were consequently overlooked by the coder during framework analysis.

**Table 7: Summary of cognitive testing issues identified by both methods, informal analysis only, and in-depth analysis only, and potential implications of discrepant findings for the CFG-2019 Healthy Food Choices Screener.**

Focus of question	Both methods	Informal approach only	In-depth approach only	Potential implications of discrepant findings
<b>(1) Fruits</b>	<ul style="list-style-type: none"> <li>A. 1 participant requested clarification regarding the difference between juice, cocktails, punch, etc.</li> <li>B. 1 participant did not consider dried fruit</li> <li>C. 1 participant reported servings (portions) rather than frequency; changed answer when probed</li> </ul>		<ul style="list-style-type: none"> <li>D. 2 participants noted difficulty averaging consumption over a 1-month period</li> <li>E. 2 participants not confident in their responses</li> </ul>	<p>Issues 1D and 1E would have required changes to the format and structure of the screener as a whole, and such recall and judgment issues likely would not have been addressed unless they pointed to a larger problem with the screener overall.</p>
<b>(2) Potatoes</b>	<ul style="list-style-type: none"> <li>A. 1 participant uncertain if baked French fries should be included</li> <li>B. 1 participant included home fries</li> </ul>	<ul style="list-style-type: none"> <li>C. 1 participant did not consider sweet potatoes</li> </ul>		<p>Issue 2C was noted by the note-taker in error. No changes were made to the screener in response to this issue, as the issue did not recur for other participants.</p>
<b>(3) Vegetables</b>	<ul style="list-style-type: none"> <li>A. 1 participant included canned chickpeas</li> <li>B. 2 participants considered foods that are not vegetables, but commonly considered as such (tomatoes, avocado)</li> <li>C. 1 participant struggled to differentiate fruits vs. vegetables regarding fruits commonly considered vegetables (e.g., tomatoes, peppers, eggplant)</li> <li>D. 3 participants did not include potatoes</li> <li>E. 1 participant uncertain whether to include potatoes</li> </ul>		<ul style="list-style-type: none"> <li>G. 1 participant uncertain whether to include vegetables in canned soup</li> <li>H. 1 participant initially reported frozen vegetables only</li> </ul>	<p>Issues 3G and 3H were unique and did not recur for other participants, and thus likely would not have been addressed during the screener's development.</p>

<p><b>(4) Fast food/ready to eat (early version)</b></p>	<p>F. 2 participants reported servings (portions) rather than frequency</p> <p>A. 1 participant considered dried pasta as a pre-made dish</p> <p>B. 1 participant uncertain whether to include frozen french fries</p> <p>C. 1 participant uncertain whether to include takeout or only grocery items</p> <p>D. 6 participants uncertain whether to include takeout foods, typically due to confusion regarding the inclusion of the term “deep-fried”</p> <p>E. 3 participants not confident in their responses</p> <p>F. 2 participants uncertain why sub sandwiches should be included if they are made with fresh ingredients</p> <p>G. 3 participants uncertain what to consider as fast food, e.g., Chinese food, Indian food, coffee</p>	<p>H. 1 participant uncertain whether to include homemade french fries</p>	<p>Issue 4H was unique and did not recur for other participants. Further, this question already specified to include “fast food”. Therefore, the issue likely would not have been addressed during the screener’s development.</p>
<p><b>(5) Processed meat</b></p>	<p>A. 1 participant uncertain whether to include bacon</p>	<p>B. 1 participant not confident in their response</p> <p>C. 1 participant uncertain whether to include prosciutto</p> <p>D. 1 participant uncertain whether to include homemade roast beef</p>	<p>Issue 5B would have required changes to the format and structure of the screener as a whole and such judgment difficulties likely would not have been addressed unless they pointed to a larger problem with the screener overall.</p> <p>Issues 5C and 5D were unique and did not recur for other participants, and thus likely would not have been addressed during the screener’s development.</p>



<b>(6) Animal-based protein</b>	<ul style="list-style-type: none"> <li>A. 1 participant initially did not notice that eggs should be included</li> <li>B. 1 participant uncertain whether to include canned ham or spam</li> <li>C. 1 participant uncertain whether to include packaged goods that might contain egg, or eggs used as an ingredient (e.g., in baking)</li> </ul>	<ul style="list-style-type: none"> <li>D. 1 participant uncertain whether to include shrimp</li> </ul>	<ul style="list-style-type: none"> <li>E. 1 (additional) participant uncertain whether to include eggs used as an ingredient (e.g., in baking)</li> </ul>	<p>Issue 6D was unique and did not recur for other participants, and was not addressed during the screener’s development.</p> <p>Issue 6E was an additional instance of a known issue which was considered during the screener’s development, but ultimately was not addressed, as the required modification may have opposed to guiding principle to keep the screener as simple as possible.</p>
<b>(7) Plant-based protein</b>	<ul style="list-style-type: none"> <li>A. 1 participant included plant-based protein supplements</li> <li>B. 1 participant uncertain whether to include flax, hemp and chia seeds</li> <li>C. 1 participant uncertain about “minimum serving sizes”, e.g., whether 3 almonds should be considered an individual eating occasion</li> <li>D. 1 participant uncertain whether to include green beans</li> </ul>	<ul style="list-style-type: none"> <li>E. 1 participant reported chickpea consumption both here and in the vegetable question</li> </ul>	<ul style="list-style-type: none"> <li>F. 1 participant not confident in their response</li> </ul>	<p>Issue 7E was considered during the screener’s development but was not addressed.</p> <p>Issue 7F would have required changes to the format and structure of the screener as a whole and such judgment difficulties likely would not have been addressed unless they pointed to a larger problem with the screener overall.</p>
<b>(8) Dairy</b>	<ul style="list-style-type: none"> <li>A. No participants reported eating low fat/sodium products</li> <li>B. 1 participant did not consider cheese or yogurt used as an ingredient in cooking or baking; noted uncertainty about the word “consume”</li> <li>C. 1 participant uncertain whether to include plant-based or non-cow (e.g., goat) dairy products</li> </ul>	<ul style="list-style-type: none"> <li>D. 1 (additional) participant uncertain whether to include plant-based products</li> </ul>	<p>Issue 8D was considered during the screener’s development (via issue 8C) but was not addressed.</p>	

<b>(9) Unsweetened milk</b>	<p>A. 3 participants did not consider unsweetened milk used as an ingredient, only milk consumed as a beverage</p> <p>B. 1 participant did not think of soy milk as “milk”</p> <p>C. 2 participants uncertain whether to include coconut milk, when probed by interviewer</p> <p>D. 1 participant suggested underlining the word “unsweetened” for emphasis</p> <p>E. 1 participant initially thought this question probed only plant-based milk</p>	<p>F. 1 (additional) participant did not consider unsweetened milk used as an ingredient, only milk consumed as a beverage</p> <p>G. 1 participant noted confusion about the word “consume”</p>	<p>Issue 9F was considered and addressed during the screener’s development (via issue 9A), by changing the keywords “drink” or “consume” to “have”.</p> <p>Issue 9G was considered and addressed (indirectly, via issue 9A) during the screener’s development, by changing the keyword “consume” to “have”.</p>
<b>(10) Sweetened milk</b>	<p>A. 1 participant included sweetened milk used in coffee or tea (an exclusion criterion in this question)</p> <p>B. 1 participant believed “sweetened” cow’s milk referred to regular dairy milk because it has naturally-occurring sugars</p>	<p>C. 1 participant did not consider sweetened milk used as an ingredient, only milk consumed as a beverage</p>	<p>Issue 10C was considered and addressed during the screener’s development (via issue 9A), by changing the keywords “drink” or “consume” to “have”.</p>
<b>(11) Sweetened beverages</b>	<p>A. 1 participant uncertain whether to include tomato juice</p> <p>B. 1 participant included artificially sweetened beverages</p> <p>C. 1 participant initially did not notice that juice should be included</p>	<p>D. 1 participant was uncertain whether to include homemade smoothies</p> <p>E. 1 participant wondered why alcohol was not queried</p> <p>F. 1 participant initially did not notice that sweetened waters should be included</p>	<p>Issue 11D, 11E, and 11F were unique and did not recur for other participants, and thus likely would not have been addressed during the screener’s development.</p>
<b>(12) Sugary snacks</b>	<p>A. 1 participant commented this is a large category to think about over a 1-month period</p> <p>B. 1 participant uncertain whether to include protein bars</p>	<p>E. 1 participant considered portion sizes but ultimately reported frequency</p> <p>F. 1 participant initially did not notice that cereal should be included</p>	<p>Similar issues to issue 12E regarding portion size confusion (issues 1C and 3F) were considered during the screener’s development, but not addressed. Additional instances of such issues, as in the case of issue</p>

	<p>C. 1 participant included non-sugary cereals</p> <p>D. 1 participant uncertain whether to include their preferred cereal brand (black bean-based)</p>			<p>12E, may have prompted changes to the screener.</p> <p>Issue 12F was unique and did not recur for other participants, and thus likely would not have been addressed during the screener’s development.</p>
<b>(13) Salty snacks</b>	<p>A. 3 participants initially did not notice that cracker should be included</p>	<p>B. 1 participant did not include crackers</p>	<p>C. 2 participants mentioned portion sizes, but ultimately reported frequency</p>	<p>Issue 13B was noted by the note-taker in error. However, the issue was considered and addressed (via issue 13A) in the screener’s development, by moving crackers to the front of the list of inclusion criteria for salty snacks.</p> <p>Similar issues to issue 13C regarding portion size confusion (issues 1C and 3F) were considered during the screener’s development, but not addressed. Additional instances of such issues, as in the case of issue 13C, may have prompted changes to the screener.</p>
<b>(14) White grains</b>	<p>A. 1 participant initially thought the question considered all grains, until seeing next question (whole grains)</p> <p>B. 1 participant uncertain where to include sourdough bread</p> <p>C. 1 participant initially included brown bread</p> <p>D. 1 participant initially did not notice that white pasta should be included; noticed only white bread and bagels</p>	<p>E. 1 participant included muffins in this category</p>	<p>F. 1 participant not confident in their response due to difficulty differentiating white versus whole wheat foods</p> <p>G. 2 participants noted difficulty averaging consumption over a 1-month period, as they do not consume these foods consistently</p>	<p>Issue 14E was considered and addressed in the screener’s development, by adding muffins to inclusion criteria for sugary snacks (12).</p> <p>Issue 14F and 14G would have required changes to the format and structure of the screener as a whole, and such recall and judgment issues likely would not have been addressed unless they pointed to a larger problem with the screener overall.</p>

<p><b>(15) Whole grains</b></p>	<p>A. 1 participant noted difficulty reporting consumption of white and whole grains separately</p> <p>B. 1 participant uncertain whether to include granola bars</p> <p>C. 1 participant uncertain whether to include rye bread as a whole grain or a white grain</p> <p>D. 1 participant included cauliflower rice</p> <p>E. 1 participant uncertain whether to include their preferred cereal brand (same issue as 12D)</p> <p>F. 1 participant uncertain if cereal should be included both as a whole grain and a white grain</p> <p>G. 1 participant initially reported the same bread in both this question and as a white grain</p>	<p>H. 1 participant considered portion size but this did not impact their answer</p>	<p>Similar issues to issue 15H regarding portion size confusion (issues 1C and 3F) were considered during the screener’s development, but not addressed. Additional instances of such issues, as in the case of issue 15H, may have prompted changes to the screener.</p>
<p><b>(16) Oils</b></p>	<p>A. 1 participant uncertain whether to include plant-based butter</p> <p>B. 1 participant did not consider margarine used on toast, only used in in cooking</p> <p>C. 1 participant did not consider oil used in salad dressing</p> <p>D. 1 respondent uncertain about “serving sizes” i.e., whether to report small amounts of oil in salad dressing or marinade</p>	<p>E. 1 participant initially included coconut oil before noticing it was listed in exclusion criteria</p>	<p>Issue 16E was unique and did not recur for other participants, and thus likely would not have been addressed during the screener’s development.</p>

### 6.5.3 Resources required

The informal analytic approach required less time, but required a note-taker, whereas the in-depth approach took more time and required transcription and coding software (**Table 8**). In the informal approach, data were ready to be coded immediately following the interview, as note-taking was conducted concurrently in 30-60 minutes per interview. The note-taker used their own judgment to note relevant errors and issues, while extraneous information was not collected. Coding therefore required 15 to 20 minutes to complete per interview, as the process involved little additional interpretation by the coder (TEW), who also conducted the interviews. Data analysis, which entailed copying coded data into a master document and compiling insights across interviews, was also relatively quick, requiring an estimated 10 to 15 minutes per interview. In total, the informal coding method required an estimated one hour and 25 minutes to two hours and 35 minutes per interview, including both the time required by the note-taker and the duration of the interview itself. The informal approach was implemented using Microsoft Word (Microsoft Corporation, Redmond, WA), which was free for use with a student license. However, the method required the involvement of a note-taker in addition to the interviewer, with implications for staff compensation.

In comparison, the framework analysis method was more time consuming and resource intensive. Transcription presented an additional step in the process, as data for each interview could not be analyzed until transcription was completed. The automated software used to generate transcripts (Otter.ai, Los Altos, CA) required approximately the duration of the audio file to process, though this can be completed in the background without additional labour for the researcher. Once transcripts were generated, they were then manually reviewed and corrected for errors. The researcher edited the transcripts while listening to the audio at an enhanced speed, but as pauses were needed to make edits, the review process ranged from 30 to 60 minutes. Coding in NVivo (QSR International, Burlington, MA) required approximately 25 to 35 minutes per interview before charting into the framework matrix, which required an additional 30 to 45 minutes per interview. The framework method therefore required an estimated two hours and 25 minutes to four hours and 20 minutes per interview, including the duration of the interview itself.

To conduct the framework analysis, the researcher used Microsoft Word (Microsoft Corporation, Redmond, WA), Microsoft Excel (Microsoft Corporation, Redmond, WA), NVivo (QSR International, Burlington, MA), and Otter.ai (Otter.ai, Los Altos, CA). While the former

three software programs were free for use with a student license, a pro subscription to Otter.ai (Otter.ai, Los Altos, CA) was used to transcribe pre-recorded audio files, at a cost of \$12.99 CAD for one month. Though it is possible to complete transcription, coding, and analysis manually using standard software programs, the transcription and coding software was used for the analysis as it saved the researcher significant time and effort. Furthermore, because interviews were recorded and transcribed for analysis, the interview could have been conducted without a note-taker present. However, a note-taker would be needed when recording is not possible, for example, if a participant does not consent to recording.

**Table 8: Comparison of resources required to conduct informal coding vs. framework analysis**

Required resources		Informal approach using notes and informal coding	In-depth approach using transcription & framework analysis
Time (estimated, per interview)	Interviewer	30-60 mins	30-60 mins
	Note-taker	30-60 mins	-
	Transcription	-	30-60 mins ( <i>generated automatically</i> )
	Transcription review and editing	-	30-60 mins
	Coding	15-20 mins	25-35 mins
	Analysis	10-15 mins	30-45 mins
	<b>TOTAL</b>	1 hour 25 mins-2 hours 35 mins	2 hour 25 mins-4 hours 20 mins
Software costs (with student license)	Microsoft Word	\$0	\$0
	Microsoft Excel	-	\$0
	Otter.ai	-	\$12.99 per month
	NVivo	-	\$0
	<b>TOTAL</b>	\$0	\$12.99 per month
Human resources costs	Interviewer	Required	Required
	Note-taker	Required	Not required
	<b>TOTAL</b>	2 people	1 person

## 6.6 Discussion

Dietary assessment is crucial to understanding the dietary risk factors that contribute to noncommunicable disease outcomes and evaluating the effectiveness of nutrition policies and

programs. It is therefore essential to ensure that instruments to measure dietary intake are valid, reliable, and acceptable to both researchers and respondents. Cognitive testing is a valuable tool for identifying and correcting problems within a survey or screener, including those used for dietary assessment, but cognitive testing data analysis methods are not well-documented or standardized. In the present study, we compared two approaches for the analysis of cognitive interview data and explored trade-offs between the two. Though the results of each method were slightly different, no new themes were identified, and other differences were minor or observed only for individual participants.

During the screener's development and evaluation, issues identified by the informal analysis were discussed and the team determined whether refinements were necessary. In some cases, refinements were not made because the issue was deemed to be minor or the changes required were counter to the guiding principles for the screener, namely, the aim to keep questions as simple as possible. While it is not possible to determine with certainty whether the additional issues identified using the in-depth analysis approach would have resulted in any refinements to the screener, given the lack of meaningful differences between the two analytic approaches, these are likely to have been minor.

For example, the issue related to lack of clarity about whether to include milk consumed in various forms was identified during the screener's development and changes made to improve clarity. The fact that the in-depth analysis identified additional instances of this issue suggests that the refinements were important. Confusion regarding reporting portion sizes was also discussed during the screener's development, but no modifications were made to address the issue, as participants are instructed to report frequency in both the preamble and each screener question. However, the additional instances of this issue identified via framework analysis might suggest that this issue required greater attention (e.g., modifying the preamble to emphasize that participants should report frequency, not quantity).

Because of time and budgetary constraints on the development of the CFG-2019 Healthy Food Choices Screener, the informal coding analysis focused primarily on issues with interpretation of the screener that resulted in identifiable response errors to inform the refinement of the screener. Consequently, issues that did not cause easily identifiable response errors (e.g., cases where participants asked for clarification about aspects of the screener or reported difficulty with recall or judgment) were sometimes overlooked either during note-taking or

coding and not captured in the analysis. However, issues related to recall and judgment identified by the framework analysis could not have been addressed without changes to the overall structure and format of the screener. The reporting period of one month was carefully selected by the screener's development team and advisors early in the screener's conception. One month is the typical period queried by screeners to give an indication of longer-term intake, while reducing errors that might occur when asking respondents to estimate intake over a longer period (e.g., a year) (8,11). Therefore, these relatively uncommon judgment and recall issues likely would not have been addressed unless they pointed to a larger, recurrent problem with the screener overall.

Likewise, individual instances identified in framework analysis in which participants asked for clarification about aspects of the screener, or individual issues of misreading likely would not have required modification to the screener as they did not recur for other participants. Nonetheless, even relatively uncommon or seemingly irrelevant issues may still be valuable to identify so that researchers can make informed decisions about whether or not particular issues should be addressed.

Cases of note-taking errors in the informal analysis likely occurred due to the nature of the note-taking process, which necessitates describing and interpreting participant's responses in real time, without the ability to pause or rewind the audio. Such errors were avoided when interviews were transcribed. However, in other cases, the involvement of a note-taker revealed insight from the screener that was overlooked in transcription. Such issues were based on the note-taker's interpretation, with respect to necessary refinements to the screener, rather than contained directly in the transcription text. Discrepancies in these cases likely occurred because the note-taker was knowledgeable about the purpose of the project and the screener's development and noted salient errors in real time. The benefit of involving additional researchers during data interpretation has been noted in qualitative research methods (35,36), including the framework method, to ensure researchers are cognizant of unexpected ideas and avoid coding in a literal, narrative manner (24).

In addition to the varying quality and quantity of results produced, there are trade-offs between informal and in-depth analytic approaches in terms of the time and resources they require. The selection of an appropriate approach will therefore depend on the scope of a given project. Notably, each method consists of two components: the data preparation method (note-



taking or transcription), and the data analysis method (informal or framework analysis). Though this comparative analysis considered the data preparation and analysis component for each method as an interrelated pair, the components each have individual advantages and limitations (**Table 9**) and may be used as appropriate to suit a project’s needs. For example, interview notes may be coded using the framework analysis method, or transcripts may be coded informally, to create a combined analysis approach that balances the resources available to a project with time and budgetary limitations as well as the tolerable level of risk in terms of issues that may be overlooked. Our findings suggest that note-taking was beneficial but also resulted in some errors, indicating that informal analysis of the transcripts in addition to the notes may have been beneficial. Transcription is somewhat burdensome but can be aided using artificial intelligence and facilitates review and clarification of interview data. Additionally, direct quotes from the transcripts can be incorporated when reporting results of a cognitive testing study, which may help to illustrate the findings and justify changes to a tool.

**Table 9: Advantages and limitations of the data preparation and analysis methods**

		<b>Advantages</b>	<b>Limitations</b>
<i>Data preparation</i>	<b>Note-taking</b>	<ul style="list-style-type: none"> <li>• Data ready to analyze immediately following interview</li> <li>• Note-taker provides a second source of data</li> </ul>	<ul style="list-style-type: none"> <li>• Potential for misinterpretation</li> <li>• Potential to overlook issues when taking notes in real-time</li> <li>• Requires an additional person</li> </ul>
	<b>Transcription</b>	<ul style="list-style-type: none"> <li>• Lower potential for misinterpretation</li> <li>• Reporting of results can incorporate direct quotes</li> </ul>	<ul style="list-style-type: none"> <li>• Time-consuming, data must be prepared before analysis</li> <li>• Requires non-standard software (optional)</li> </ul>
<i>Data analysis</i>	<b>Informal analysis</b>	<ul style="list-style-type: none"> <li>• Lower time investment</li> <li>• Can be conducted using standard software</li> </ul>	<ul style="list-style-type: none"> <li>• Informal coding approach may overlook some issues</li> </ul>
	<b>Framework analysis</b>	<ul style="list-style-type: none"> <li>• Organizes information for easy data management</li> <li>• Facilitates data analysis via a systematic procedure producing structured outputs of summarized data</li> </ul>	<ul style="list-style-type: none"> <li>• Time-consuming</li> <li>• Requires non-standard software (optional)</li> </ul>

The interviewer (TEW) led both approaches to analysis and was familiar with the codes and themes identified in the original analysis, as well as their implications for the screener. This familiarity likely influenced the lens through which the data were analysed and interpreted in the application of the in-depth approach. Issues identified via transcription and framework analysis may have differed if the researcher was analyzing the data for the first time. Additionally, the researcher's familiarity with the data may have reduced the amount of time needed for analysis and interpretation. However, the two approaches to analyses were implemented nearly a year apart, perhaps blunting the researcher's memory of the details of the data. Further, in-depth analysis of the interviews conducted in French was not possible, and it was also not possible to reproduce the initial iterative process of interviewing and refining the screener in the application of the in-depth approach. As such, the potential implications for the screener are somewhat speculative.

Notably, as a frequency-based dietary screener, the CFG-2019 Healthy Food Choices screener uses the same root and response options for each question. Participant's responses and the potential cognitive errors they may contain were therefore similar across questions and the data could readily be coded and analyzed using the informal method. Furthermore, the screener was informed by prior screeners that had undergone validation (9,10,12,37,38) and benefited from feedback from expert advisors prior to the cognitive interviews (Williams et al., Chapter 5). During the informal approach, interview results were also discussed amongst the French and English research teams, and the screener refined iteratively based on input from numerous researchers between three rounds of testing. The in-depth framework method may have proved more valuable if applied to cognitive testing of a tool addressing a more novel construct or containing more variation or ambiguity, such as a survey including more variable response options; or a study using a less rigorous approach to the development of the tool. Additionally, it is possible that a different thematic analysis approach may have elicited different issues from the screener. The results of the present study pertain to framework analysis only, and the implications of other in-depth approaches were not explored.

Cognitive testing methods are commonly used in the development and evaluation of nutrition-related tools (10,12,18,19,33,39). Data analysis methods are considered to be the "least-developed" component of the cognitive testing process, as they are rarely well-documented or standardized, and tend to be highly variable between studies (21). Though variation is not in

itself problematic, the lack of documentation between studies makes it difficult to replicate the process of a particular investigation, or to compare the efficacy of different analysis methods (21). To our knowledge, this study is the first to directly compare cognitive interview data analysis methods applied to the same dataset, presenting a unique exploration of an under-developed aspect of cognitive testing. The comparison of trade-offs between methods (27,40), including the results gleaned from the present study, may help to guide the selection of cognitive testing data analysis methods for future nutrition research so investigators can balance the goals of their testing with the scope of the project and the resources available.

## **6.7 Conclusion**

In a comparison of methods for analyzing cognitive interview data, the note-taking and informal coding approach was quicker and easier to conduct. The in-depth transcription and framework analysis approach was more time-consuming and resource intensive but identified additional instances of errors and some minor considerations not noted using the informal approach. An informal analysis approach to the notes and transcripts may have achieved the optimal balance in terms of reducing missed issues and avoiding errors associated with relying on the notes alone. Nonetheless, the application of the in-depth approach appears unlikely to have meaningfully impacted the dietary screener considered here. However, for testing of tools that address novel or more ambiguous concepts, an in-depth approach, involving transcription and formal coding, may be beneficial to reduce the likelihood of misinterpretations or missed considerations. Overall, the trade-offs between less and more intensive data analysis approaches should be weighed considering the nature of the tool being tested and the associated cognitive interview data, the tolerance for error, and the resources and time available.

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## 6.8 References for Chapter 6

1. Micha R, Shulkin ML, Peñalvo JL, Khatibzadeh S, Singh GM, Rao M, et al. Etiologic effects and optimal intakes of foods and nutrients for risk of cardiovascular diseases and diabetes: Systematic reviews and meta-analyses from the nutrition and chronic diseases expert group (NutriCoDE). PLoS ONE. 2017 Apr 1;12(4).
2. Vajdi M, Farhangi MA. A systematic review of the association between dietary patterns and health-related quality of life. Health and Quality of Life Outcomes. 2020 Oct 12;18(1).
3. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet [Internet]. 2012;380:2095–128. Available from: [www.thelancet.com](http://www.thelancet.com)
4. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet [Internet]. 2012;380:2224–60. Available from: [www.thelancet.com](http://www.thelancet.com)
5. Afshin A, Sur PJ, Fay KA, Cornaby L, Ferrara G, Salama JS, et al. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet. 2019 May 11;393(10184):1958–72.
6. Herforth A, Arimond M, Álvarez-Sánchez C, Coates J, Christianson K, Muehlhoff E. A Global Review of Food-Based Dietary Guidelines. Vol. 10, Advances in Nutrition. Oxford University Press; 2019. p. 590–605.
7. Canada’s Food Guide [Internet]. Government of Canada. 2019 [cited 2022 Mar 12]. Available from: <https://food-guide.canada.ca/en/>
8. Thompson FE, Kirkpatrick SI, Subar AF, Reedy J, Schap TRE, Wilson MM, et al. The National Cancer Institute’s Dietary Assessment Primer: A Resource for Diet Research. J Acad Nutr Diet. 2015 Dec 1;115(12):1986–95.
9. Tangney CC, Rasmussen HE, Richards C, Li M, Appelhans BM. Evaluation of a brief sodium screener in two samples. Nutrients. 2019 Jan 1;11(1).
10. Centers for Disease Control and Prevention. Surveillance of Fruit and Vegetable Intake Using the Behavioral Risk Factor Surveillance System [Internet]. Atlanta, Ga; Available from: [https://www.cdc.gov/brfss/pdf/fruits\\_vegetables.pdf](https://www.cdc.gov/brfss/pdf/fruits_vegetables.pdf)
11. Dietary Assessment Primer [Internet]. National Cancer Institute. 2015 [cited 2022 Mar 6]. Available from: <https://dietassessmentprimer.cancer.gov/>

12. Colby S, Zhou W, Allison C, Mathews AE, Olfert MD, Morrell JS, et al. Development and validation of the short healthy eating index survey with a college population to assess dietary quality and intake. *Nutrients*. 2020 Sep 1;12(9):1–24.
13. Willis GB, Artino AR. What Do Our Respondents Think We’re Asking? Using Cognitive Interviewing to Improve Medical Education Surveys. *Journal of Graduate Medical Education*. 2013 Sep 1;5(3):353–6.
14. Willis GB, Miller K. Cross-cultural cognitive interviewing: Seeking comparability and enhancing understanding. Vol. 23, *Field Methods*. 2011. p. 331–41.
15. Foddy W. The in-depth testing of survey questions: A critical appraisal of methods. Vol. 30, *Quality & Quantity*. Kluwer Academic Publishers; 1996.
16. Willis GB. *Cognitive Interviewing*. SAGE Publications, Inc.; 2005.
17. Jabine TB, Straf ML, Tanur JM, Tourangeau R. *Cognitive Aspects of Survey Methodology: Building a Bridge Between Disciplines*. Cognitive Aspects of Survey Methodology. Washington, D.C.: National Academies Press; 1984.
18. Yaroch AL, Toozee J, Thompson FE, Blanck HM, Thompson OM, Colón-Ramos U, et al. Evaluation of Three Short Dietary Instruments to Assess Fruit and Vegetable Intake: The National Cancer Institute’s Food Attitudes and Behaviors Survey. *J Acad Nutr Diet*. 2012 Oct;12(10):1570–7.
19. Vaughn AE, Dearth-Wesley T, Tabak RG, Bryant M, Ward DS. Development of a Comprehensive Assessment of Food Parenting Practices: The Home Self-Administered Tool for Environmental Assessment of Activity and Diet Family Food Practices Survey. *J Acad Nutr Diet*. 2017 Feb 1;17(2):214–27.
20. Beatty PC, Willis GB. Research synthesis: The practice of cognitive interviewing. Vol. 71, *Public Opinion Quarterly*. 2007. p. 287–311.
21. Boeije H, Willis G. The cognitive interviewing reporting framework (CIRF): Towards the harmonization of cognitive testing reports. *Methodology*. 2013;9(3):87–95.
22. Collins D. Analysing and interpreting cognitive interview data: a qualitative approach. In: *Proceedings of the 6th Questionnaire Evaluation Standard for Testing Conference*. Ottawa: Statistics Canada; 2007. p. 64–73.
23. Miles Matthew B, Huberman A Michael, Saldaña Johnny. *Qualitative Data Analysis: A Methods Sourcebook*. 3rd ed. SAGE Publications, Inc.; 2014.
24. Gale NK, Heath G, Cameron E, Rashid S, Redwood S. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology*. 2013;13(1).
25. Ritchie J, Spencer L. Qualitative data analysis for applied policy research. In: Bryman A, Burgess RG, editors. *Analyzing Qualitative Data*. Routledge; 1994. p. 173–94.

26. Srivastava A, Thomson SB. Framework Analysis: A Qualitative Methodology for Applied Policy Research. *Journal of Administration and Governance* [Internet]. 2009 [cited 2022 Aug 20];4(2). Available from: <http://ssrn.com/abstract=2760705>
27. Zimmerman TP, Hull SG, McNutt S, Mittl B, Islam N, Guenther PM, et al. Challenges in converting an interviewer-administered food probe database to self-administration in the National Cancer Institute automated self-administered 24-hour recall (ASA24). *Journal of Food Composition and Analysis*. 2009 Dec;22(Suppl 1):S48–51.
28. Litwin H, Sapir E V. Perceived income adequacy among older adults in 12 countries: Findings from the survey of health, ageing, and retirement in Europe. *Gerontologist*. 2009 Jun;49(3):397–406.
29. Tourangeau R, Rips LJ, Rasinski K. *The Psychology of Survey Response*. New York, NY: Cambridge University Press; 2000.
30. Lenzner T, Neuert C, Otto W. *GESIS Survey Guidelines: Cognitive Pretesting*. Mannheim, Germany; 2016 Dec.
31. Collins D. Pretesting Survey Instruments: An Overview of Cognitive Methods [Internet]. Vol. 12, Research. 2003. Available from: <https://www.jstor.org/stable/4038871>
32. Bobrovitz N, Santana MJ, Kline T, Kortbeek J, Stelfox HT. The use of cognitive interviews to revise the Quality of Trauma Care Patient-Reported Experience Measure (QTAC-PREM). *Quality of Life Research*. 2015 Aug 21;24(8):1911–9.
33. Thompson C, Adams J, Vidgen HA. Progressing the development of a food literacy questionnaire using cognitive interviews. *Public Health Nutrition*. 2021;
34. Clarke V, Braun V. Thematic analysis. In: *Encyclopedia of Critical Psychology*. New York: Springer; 2014. p. 1947–52.
35. Church SP, Dunn M, Prokopy LS. Benefits to Qualitative Data Quality with Multiple Coders: Case Studies in Multi-coder Data Analysis. *Journal of Rural Social Sciences* [Internet]. 2019;34(1). Available from: <https://egrove.olemiss.edu/jrss>
36. O'Connor C, Joffe H. Intercoder Reliability in Qualitative Research: Debates and Practical Guidelines. *International Journal of Qualitative Methods*. 2020;19.
37. National Cancer Institute. Dietary Screener in the 2009 California Health Interview Survey (CHIS 2009) [Internet]. Bethesda, MD; 2019 [cited 2022 Aug 12]. Available from: <https://epi.grants.cancer.gov/diet/screeners/CHIS2009.pdf>
38. England CY, Thompson JL, Jago R, Cooper AR, Andrews RC. Development of a brief, reliable and valid diet assessment tool for impaired glucose tolerance and diabetes: The UK Diabetes and Diet Questionnaire. *Public Health Nutrition*. 2017 Feb 1;20(2):191–9.

39. Banna JC, Vera Becerra LE, Kaiser LL, Townsend MS. Using Qualitative Methods to Improve Questionnaires for Spanish Speakers: Assessing Face Validity of a Food Behavior Checklist. *J Am Diet Assoc.* 2010 Jan;110(1):80–90.
40. Dufour IF, Richard MC. Theorizing from secondary qualitative data: A comparison of two data analysis methods. *Cogent Education.* 2019 Jan 1;6(1).



## CHAPTER 7: General Discussion

### 7.1 Summary of key findings

Chapter 5 describes the development of the Canada's Food Guide-2019 (CFG-2019) Healthy Food Choices Screener. The screener was developed and evaluated through an iterative process that included three rounds of cognitive interviews in each language along with ongoing feedback from expert advisors, as well as formal face and content validity testing by a separate panel of experts.

Cognitive testing identified issues with initial drafts of the screener, which generally fell into one of four themes. *Lack of clarity about what to include or exclude* in responses to screener questions related to groupings of foods and forms of foods that can be consumed in different ways. Food groupings issues occurred when participants were uncertain which types of food should be reported in a question, either due to a lack of details or example foods provided in a question, or examples that were too specific, causing participants to think too narrowly about the category. These issues were addressed by adding detail to existing questions or adding new questions to the screener, as well as through formatting and ordering of questions. Issues with foods that can be consumed in multiple ways occurred when participants were uncertain whether certain foods should be reported only if consumed by a particular method (e.g., whether milk should be reported only if consumed as a beverage, or if it can be added to a bowl of cereal or used in a sauce). To address these issues, general terms were used to encompass all methods of consumption (e.g., "have" instead of "drink" milk).

*Keyword confusion* occurred when questions used keywords that were unclear or vague to respondents. For example, a participant in cognitive testing initially believed "sweetened cow's milk" referred to regular dairy milk, because it has naturally-occurring sugars. To address *keyword confusion* issues, more specific terms were used to describe the foods that should be included in each category (e.g., changing "sweetened cow's milk" to "chocolate milk or other flavoured milk").

*Readability* issues occurred when the structure of a question hindered participants' comprehension. For example, lengthy lists of examples caused participants to miss details of the question, consequently providing inaccurate responses. Including parentheses within a question to provide additional examples of particular food categories also hindered readability, as

participants felt the parentheses cued them to stop reading. Such problems were alleviated through formatting changes and by re-wording and simplifying phrasing, for example, by reducing the number or changing the order of example foods, or breaking a single question into multiple questions.

Finally, *response option errors* occurred when participants reported quantity rather than frequency of consumption in their answers. These issues appeared to be uncommon, and because the screener instructs participants to report frequency in both the preamble and each question, no changes were made to the screener.

Refinements to the screener were also informed by content and face validity testing, which was conducted concurrently with the cognitive interviews. 17 federal and provincial experts and health professionals assessed whether the questions reflected the recommendations and were easy to understand; overall, there was high agreement on this. Insights from face and content validity were often consistent with findings from cognitive interviews. However, in some cases, suggestions conflicted with cognitive interview findings and guiding principles for the screener (e.g., to prioritize simplicity and low cognitive load). For example, some participants suggested ordering questions in a manner consistent with the CFG-2019 guidance and including more detail, such as specifying more example foods noted in the guidance. The research team consulted with Health Canada in such cases and opted to keep the screener questions and ordering as simple and intuitive as possible for respondents.

The final version of the screener assesses overall alignment of dietary intake with the healthy food choices guidance in CFG-2019 and is available in English and French. It includes 16 questions assessing consumption of “healthy foods to eat each day” (fruit; vegetables; potatoes; animal-based protein foods; plant-based protein foods; yogurt, kefir, and cheese; unsweetened cow’s milk and plant-based beverages; whole-grain foods; and margarine and vegetable oils) as well as “foods to limit” (processed meat; fast food; sweetened cow’s milk and plant-based beverages; other sugary beverages; sugary snacks; salty snacks; and refined grains). The screener is intended for use with adults aged 18-65 years with marginal and higher health literacy skills.

Results from cognitive testing of the screener were initially coded and analyzed informally, based on brief notes collected during the interviews. To assess the potential impact of a more systematic data analysis method, the recordings of the interviews in English were

subsequently transcribed and coded using the framework method. This comparative analysis of cognitive testing data analysis methods is presented in Chapter 6.

Most issues identified by the in-depth transcription and framework method were also identified using the original, informal approach, and no new themes were identified. In some cases, the in-depth approach identified additional instances of issues that were already identified by the informal approach. Such discrepancies would have had minimal impact on the screener in cases where the issue was already addressed in the original analysis (e.g., additional instances of a lack of clarity about whether to include milk consumed in various forms). However, the in-depth approach identified several additional instances of potential response errors that were not captured in the informal analysis. The issue of response errors was considered, but not addressed in the screener's development, and the additional instances of the issue might suggest that the issue required greater attention (e.g., by modifying the preamble to emphasize that participants should report frequency).

The in-depth method also identified several unique instances of misreading issues or uncertainty about inclusion and exclusion criteria that were overlooked in the informal analysis. Because these issues were relatively uncommon, it is unlikely that they would have entailed modifications to the screener.

Furthermore, the in-depth method identified some cases in which participants reported difficulty estimating their intake of a particular food over the period of a month, or expressed they were not entirely confident in their answer to a question. Addressing these issues would have required significant changes to the structure of the screener; however, the screener's format was selected early in the screener's development as a guiding principle. Therefore, it is unlikely that these relatively uncommon judgment and recall issues would have been addressed.

The comparison of methods also identified some cases in which issues identified by the informal method were not captured by the in-depth method. Some of these cases appear to be note-taker errors that were not discovered until transcripts were reviewed for the in-depth analysis. These issues were not addressed in the screener's development, and therefore did not impact the screener. In other cases, the informal analysis identified issues that were not immediately evident in the transcripts but were identified by the note-taker. Such issues were based on the note-taker's interpretation with respect to necessary refinements to the screener, and

likely occurred because the note-taker was knowledgeable about the screener's development and noted salient issues in real time.

Resource requirements and related trade-offs with respect to each method were also discussed. While the informal method was much quicker and simpler than the in-depth method, an additional staff member was required for note-taking, with implications for compensation. Comparatively, the framework method took much longer and used specialized software including NVivo (QSR International, Burlington, MA), and Otter.ai (Otter.ai, Los Altos, CA), the latter program costing \$12.99 CAD for one month. Overall, the informal method was less-resource intensive (but required employment of a note-taker) and identified most but not all issues with the screener, while the in-depth method was more-resource intensive but reduced likelihood of misinterpretation. However, there was a lack of meaningful differences in results between the two analytic approaches, and the potential impact for the CFG-2019 Healthy Food Choices Screener was minimal.

## **7.2 Overall limitations and strengths of the thesis**

Each manuscript in this thesis brings unique limitations related to their scope and methodology. The CFG-2019 Healthy Food Choices Screener described in Chapter 5 captures the main components of the healthy food choices guidance in CFG-2019. However, as a brief screener, it cannot comprehensively query all elements of the guidance. For example, though several questions are included to assess intake of processed foods, not all processed foods mentioned in the guidance (e.g., frozen entrées; syrups and jams; sauces, dressings, and gravies) were included in the screener (17). Further, as the screener was developed and evaluated for use with adults aged 18-65 years, and it is uncertain whether or how the screener could be administered to young children or older adults.

Regarding the appropriateness of the screener for use with diverse populations, variation in sociodemographic characteristics among cognitive testing participants was achieved, helping to ensure a broad range of perspectives were represented in the study. However, the sample was skewed toward women, no participants identified as non-binary, and few identified as Black or Indigenous.

A strength of the study was its methodical reporting of cognitive testing results, which was guided by the Cognitive Interview Reporting Framework (CIRF) proposed by Boeije and

Willis (16). As there is typically large variation in the application and reporting of cognitive testing procedures, the CIRF provides a checklist to guide researchers to report their work clearly and comprehensively, so that results and methods can be more easily compared across studies. By adhering to the CIRF, the cognitive testing of the CFG-2019 Healthy Food Choices Screener was described in a level of detail that is often missing in reports describing the development of dietary screeners or other nutrition-related tools (36,49,58,65).

The comparative analysis presented in Chapter 6 also poses several limitations. First, as I led both approaches to data analysis, I was already familiar with the codes and themes identified in the original, informal analysis as well as their implications for the screener when conducting the subsequent in-depth analysis. This knowledge likely influenced my analysis and interpretation of the data, and issues that were identified during the in-depth approach may have differed if I was analyzing the data for the first time.

Further, while the original, rapid coding approach allowed the research team to iteratively refine the screener and interview guide as new evidence was identified from initial rounds of testing, the alternative framework analysis could not reproduce this process. Additionally, data from interviews in French could not be included due to ethics restrictions. As a result, potential implications for the screener identified in the comparative analysis are speculative.

The comparative exercise was also limited by its source data, that is, the screener itself. As the screener uses the same root and response options for each question, participants' responses and the potential cognitive errors that may occur were similar across questions. Further, the screener's structure and content were informed by existing validated screeners (36,58,59,61,66) and advice from experts prior to cognitive interviews, perhaps resolving potential cognitive issues before they could arise in testing. The in-depth framework approach may therefore have been more valuable if applied to cognitive testing of a tool containing more variation in its structure or addressing a more novel construct.

To my knowledge, Chapter 6 presents the first study of its kind to directly compare cognitive testing data analysis methods within the same dataset. Such an experiment would typically not be a feasible use of time or resources for the funders of a screener or survey development project, so this project represents a unique opportunity to explore an under-developed aspect of cognitive testing.

The practice of cognitive testing in general also presents several limitations, including the potential for validity and reliability error. Regarding the former, cognitive testing may identify problems that would not exist when the survey is administered in the field or conversely, it may fail to identify issues that would exist in the field (13). Reliability errors may emerge when cognitive interviewing is conducted by different researchers who identify conflicting or inconsistent findings (13). All interviews in English were conducted by the same interviewer, as were interviews in French, to mitigate the potential for inconsistency. However, the note-taker varied between interviews. Because note-taking begins the process of data interpretation, using different note-takers between interviews may have had implications for the cognitive testing results using the informal analysis method. For example, certain issues may or may not have been identified by different note-takers.

The qualitative nature of cognitive testing also brings limitations. Though the method can identify the existence of an issue within a survey or screener, it cannot quantitatively measure improvement to the tool as revisions are made in response to insights developed through cognitive testing (14). However, the iterative approach to testing discussed in Chapter 5 allowed the research team to track improvements to respondent comprehension as changes were made to the screener.

Furthermore, cognitive interviewing may be difficult for participants with lower literacy levels, or simply those who are less articulate or have trouble verbalizing their thought processes, which could be a deterrent from participating in cognitive testing studies (14,53). Literacy aside, some cognitive processes are simply implicit and difficult to verbalize (53). To ensure the CFG-2019 Healthy Food Choices Screener would be well-understood by individuals with a range of literacy levels, recruitment for cognitive testing aimed to oversample participants with lower educational attainment, and just under half of the sample had less than post-secondary education (used as a proxy for lower literacy levels).

### **7.3 Reflections on positionality and reflexivity in the research process**

A researcher's background and social positionality inevitably influences the lens through which they view and construct the world, thus impacting the design and outcome of a research project (63). As such, it is impossible to divorce my own positionality from this thesis, and reflexivity therefore must be considered alongside these research findings.

As previously stated, I aimed to engage in reflexivity throughout the process of designing and conducting cognitive interviews and analyzing the resultant data. However, my positionality necessarily constitutes some limitations. Due to my own biases, expectations, and assumptions, as well as my position as a novice qualitative researcher, it is possible and in fact likely that I failed to recognize key opportunities for follow-up probing within interviews. Relatedly, the development of the CFG-2019 Healthy Food Choices Screener was my first experience with cognitive testing. If I were to conduct and analyze the interviews again, my approach would likely be somewhat different, and presumably, more sophisticated, because of the lessons learned from my first attempt. The secondary analysis of cognitive testing data presented in Chapter 6 afforded me the opportunity to put some of these lessons into practice. Notably, it is crucial to recognize that reflexivity is “fluid rather than static” (63,67), and my positionality between the two approaches to analysis may have shifted, with implications for the results of the comparative study. For example, my increased level of experience with cognitive testing methods compounded with my increased familiarity with the data during the comparative analysis presents an added variable between the two methods of analysis.

Further, the nature of cognitive interviewing and data analysis presents some challenges for the practice of reflexivity. For example, as noted in Chapter 4, during the secondary (in-depth) analysis, I attempted to code and paraphrase interview transcripts using the participant’s own words. However, this language was sometimes lost when results were compiled, as the data were homogenized for consistency and comparison across interviews to inform potential modifications to the screener.

Overall, no research can be conducted entirely free of the biases and assumptions held by the researcher. However, monitoring and critically reflecting on my positionality throughout the research process may help to account for its impact, thus enhancing the credibility of the findings of this thesis.

## **7.4 Implications for future research**

This thesis has several implications for future research. First, the CFG-2019 Healthy Food Choices Screener should be specifically tested amongst population subgroups that were not well-represented in the present study (Chapter 5), to assess whether interpretation of the questions and their face and content validity is consistent. Further, as the screener was developed

and evaluated for use among adults aged 18-65 years, there may be a need for adaptation of the current tool to assess alignment with CFG-2019 guidance among children under 18 years or older adults over 65 years. Past applications of dietary intake measures in national surveillance have used caregivers to assist reporting for children aged 6 to 11 years, or as proxy reporters for younger children aged 0-6 years (68–70). Administration of the CFG-2019 Healthy Food Choices Screener in this fashion could be evaluated in future research. It has been suggested that older children (10 years of age or older) may be able to accurately report their own dietary intake using frequency-based measures, and therefore the screener may be amenable to self-administration by children aged 10-17 years without substantial modification (70). However, evaluation for use within this age group is required. The screener could also be evaluated for use or adaptation amongst older adults, in relation to digital literacy skills required to complete the screener online.

The comparative analysis in Chapter 6 also presents several implications for future research. Chapter 6 compared an informal approach for cognitive testing data analysis using interview notes, to an in-depth approach using transcription and the framework method. However, there are many ways that cognitive testing data could be analyzed. Future research could determine the utility and trade-offs associated with other data analysis approaches, such as different thematic analysis approaches, or the use of formal coding schemes (45), representing a potential middle ground between the informal and the highly systematic framework method.

Additionally, the comparative analysis considered the data preparation (note taking or transcription) and analysis component (informal analysis or framework analysis) for each method as an interrelated pair. However, future research could determine the utility of each component individually, by directly comparing note taking vs. transcription using the same analysis method, or directly comparing informal vs. framework analysis applied either to interview notes or interview transcription.

The CFG-2019 Healthy Food Choices Screener was fairly homogenous in its structure and was based upon previously validated tools. The in-depth analysis method therefore may have been more valuable if applied to the testing of a tool containing more variation or evaluating a more novel construct than the CFG-2019 Healthy Food Choices Screener. A future study could repeat the comparison of informal vs. in-depth methods using data from a different survey tool,



to determine whether the lack of meaningful implications identified in the current study pertain to the method itself, or the tool being evaluated.

## **7.5 Conclusion**

The CFG-2019 Healthy Food Choices Screener allows for rapid assessment of the overall alignment of adults' dietary intake with the CFG-2019 healthy food choices guidance. Appropriate use of the screener can inform policies and programs to narrow the gap between current dietary intake and the guidance. During the screener's development, as described in Chapter 5, cognitive testing informed refinements to ensure that the screener could be understood consistently by respondents in the way researchers intend, to improve the screener's ability to accurately assess dietary intake relative to the guidance. Although the cognitive testing of the CFG-2019 Healthy Food Choices Screener was reported clearly and comprehensively, cognitive testing processes, and particularly data analysis methods, are often not well-described in the literature. The comparative analysis presented in Chapter 6 thus may help to aid selection of cognitive testing data analysis methods for future research, so investigators can balance the goals of their testing with the scope of the project to uncover sufficient results with minimal unnecessary burden in terms of cost, time, and resources. Altogether, this thesis presents a rigorously documented example of cognitive testing processes and contributes to a scarce body of literature on cognitive testing data analysis methods. Improving our understanding and practice of cognitive testing can help to ensure that dietary assessment and other survey tools are thoroughly evaluated for potential sources of cognitive error before being deployed in the field. The resulting tools will therefore be well-prepared to effectively measure dietary intake for surveillance, dietary interventions, policy work, and other activities promoting both human and planetary health.

## References for Chapters 1-4 and 7

1. Micha R, Shulkin ML, Peñalvo JL, Khatibzadeh S, Singh GM, Rao M, et al. Etiologic effects and optimal intakes of foods and nutrients for risk of cardiovascular diseases and diabetes: Systematic reviews and meta-analyses from the nutrition and chronic diseases expert group (NutriCoDE). *PLoS ONE*. 2017 Apr 1;12(4).
2. Vajdi M, Farhangi MA. A systematic review of the association between dietary patterns and health-related quality of life. *Health and Quality of Life Outcomes*. 2020 Oct 12;18(1).
3. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* [Internet]. 2012;380:2095–128. Available from: [www.thelancet.com](http://www.thelancet.com)
4. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* [Internet]. 2012;380:2224–60. Available from: [www.thelancet.com](http://www.thelancet.com)
5. Afshin A, Sur PJ, Fay KA, Cornaby L, Ferrara G, Salama JS, et al. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*. 2019 May 11;393(10184):1958–72.
6. World Cancer Research Fund/American Institute for Cancer Research. *Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective*. Washington DC; 2007.
7. WHO. *Diet, nutrition and the prevention of chronic diseases: report of the joint WHO/FAO expert consultation*. Geneva: WHO; 2002.
8. Hewawitharana SC, Thompson FE, Loria CM, Strauss W, Nagaraja J, Ritchie L, et al. Comparison of the NHANES dietary screener questionnaire to the Automated Self-Administered 24-Hour Recall for Children in the Healthy Communities Study. *Nutrition Journal*. 2018 Nov 27;17(1).
9. *Dietary Assessment Primer* [Internet]. National Cancer Institute. 2015 [cited 2022 Mar 6]. Available from: <https://dietassessmentprimer.cancer.gov/>

10. Frongillo EA, Baranowski T, Subar AF, Tooze JA, Kirkpatrick SI. Establishing Validity and Cross-Context Equivalence of Measures and Indicators. *J Acad Nutr Diet.* 2019 Nov 1;119(11):1817–30.
11. Kirkpatrick SI, Baranowski T, Subar AF, Tooze JA, Frongillo EA. Best Practices for Conducting and Interpreting Studies to Validate Self-Report Dietary Assessment Methods. *J Acad Nutr Diet.* 2019 Nov 1;119(11):1801–16.
12. Willis GB, Artino AR. What Do Our Respondents Think We’re Asking? Using Cognitive Interviewing to Improve Medical Education Surveys. *Journal of Graduate Medical Education.* 2013 Sep 1;5(3):353–6.
13. Beatty PC, Willis GB. Research synthesis: The practice of cognitive interviewing. Vol. 71, *Public Opinion Quarterly.* 2007. p. 287–311.
14. Collins D. Pretesting Survey Instruments: An Overview of Cognitive Methods [Internet]. Vol. 12, *Research.* 2003. Available from: <https://www.jstor.org/stable/4038871>
15. Jabine TB, Straf ML, Tanur JM, Tourangeau R. *Cognitive Aspects of Survey Methodology: Building a Bridge Between Disciplines.* Cognitive Aspects of Survey Methodology. Washington, D.C.: National Academies Press; 1984.
16. Boeije H, Willis G. The cognitive interviewing reporting framework (CIRF): Towards the harmonization of cognitive testing reports. *Methodology.* 2013;9(3):87–95.
17. Canada’s Food Guide [Internet]. Government of Canada. 2019 [cited 2022 Mar 12]. Available from: <https://food-guide.canada.ca/en/>
18. Gale NK, Heath G, Cameron E, Rashid S, Redwood S. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology.* 2013;13(1).
19. Ritchie J, Spencer L. Qualitative data analysis for applied policy research. In: Bryman A, Burgess RG, editors. *Analyzing Qualitative Data.* Routledge; 1994. p. 173–94.
20. Srivastava A, Thomson SB. Framework Analysis: A Qualitative Methodology for Applied Policy Research. *Journal of Administration and Governance* [Internet]. 2009 [cited 2022 Aug 20];4(2). Available from: <http://ssrn.com/abstract=2760705>
21. Whitmee S, Haines A, Beyrer C, Boltz F, Capon AG, de Souza Dias BF, et al. Safeguarding human health in the Anthropocene epoch: Report of the Rockefeller Foundation-Lancet Commission on planetary health. *The Lancet.* 2015 Nov 14;386(10007):1973–2028.

22. Friel S, Barosh LJ, Lawrence M. Towards healthy and sustainable food consumption: An Australian case study. *Public Health Nutrition*. 2014;17(5):1156–66.
23. Willet W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, et al. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*. 2019;393(10170).
24. Herforth A, Arimond M, Álvarez-Sánchez C, Coates J, Christianson K, Muehlhoff E. A Global Review of Food-Based Dietary Guidelines. Vol. 10, *Advances in Nutrition*. Oxford University Press; 2019. p. 590–605.
25. Preparation and use of food-based dietary guidelines. Report of a joint FAO/WHO consultation. Geneva: World Health Organization; 1998. (WHO technical report series ; 880).
26. History of Canada’s Food Guides from 1942 to 2007 [Internet]. 2019 Jan [cited 2022 Mar 6]. Available from: <https://www.canada.ca/en/health-canada/services/canada-food-guide/about/history-food-guide.html>
27. Kirkpatrick SI, Vanderlee L, Dias GM, Hanning RM. Can dietary guidelines support the transformation of food systems to foster human and planetary health? *UNSCN Nutrition*. 2019;(44):122–8.
28. Vanderlee L, McCrory C, Hammond D. Awareness and Knowledge of Recommendations from Canada’s Food Guide. *Canadian Journal of Dietetic Practice and Research*. 2015;76(3).
29. Garriguet D. Canadians’ eating habits. *Health Reports* [Internet]. 2007;18(2):17–32. Available from: <http://www.statcan.ca/english/>
30. Fahlman MM, McCaughy N, Martin J, Shen B. Racial and Socioeconomic Disparities in Nutrition Behaviors: Targeted Interventions Needed. *Journal of Nutrition Education and Behavior*. 2010 Jan;42(1):10–6.
31. Kirkpatrick SI, Tarasuk V. Food Insecurity Is Associated with Nutrient Inadequacies among Canadian Adults and Adolescents. *The Journal of Nutrition* [Internet]. 2008;138:604–12. Available from: <https://academic.oup.com/jn/article/138/3/604/4670266>
32. Health Canada. Canada’s Dietary Guidelines for Health Professionals and Policy Makers [Internet]. Ottawa; 2019 [cited 2022 Mar 13]. Available from: <https://food-guide.canada.ca/en/guidelines/>

33. Brassard D, Munene LAE, St-Pierre S, Guenther PM, Kirkpatrick SI, Slater J, et al. Development of the Healthy Eating Food Index (HEFI)-2019 measuring adherence to Canada's Food Guide 2019 recommendations on healthy food choices. *Applied Physiology, Nutrition and Metabolism*. 2022;47(5):595–610.
34. Brassard D, Munene LAE, St-Pierre S, Gonzalez A, Guenther PM, Jessri M, et al. Evaluation of the Healthy Eating Food Index (HEFI)-2019 measuring adherence to Canada's Food Guide 2019 recommendations on healthy food choices. *Applied Physiology, Nutrition and Metabolism*. 2022;47(5):582–94.
35. Kirkpatrick SI, Guenther PM, Subar AF, Krebs-Smith SM, Herrick KA, Freedman LS, et al. Using Short-Term Dietary Intake Data to Address Research Questions Related to Usual Dietary Intake among Populations and Subpopulations: Assumptions, Statistical Techniques, and Considerations. *J Acad Nutr Diet*. 2022 Jul 1;122(7):1246–62.
36. Colby S, Zhou W, Allison C, Mathews AE, Olfert MD, Morrell JS, et al. Development and validation of the short healthy eating index survey with a college population to assess dietary quality and intake. *Nutrients*. 2020 Sep 1;12(9):1–24.
37. Gabe KT, Jaime PC. Development and testing of a scale to evaluate diet according to the recommendations of the Dietary Guidelines for the Brazilian Population. *Public Health Nutrition*. 2019 Feb 12;22(5):785–96.
38. de Rijk MG, Slotegraaf AI, Brouwer-Brolsma EM, Perenboom CWM, Feskens EJM, de Vries JHM. Development and evaluation of a diet quality screener to assess adherence to the Dutch food-based dietary guidelines. *Br J Nutr*. 2021 Nov;15:1–11.
39. Surveillance of Fruit and Vegetable Intake Using the Behavioral Risk Factor Surveillance System [Internet]. Available from: [https://www.cdc.gov/brfss/pdf/fruits\\_vegetables.pdf](https://www.cdc.gov/brfss/pdf/fruits_vegetables.pdf)
40. Dietary Screener Questionnaire [Internet]. National Health and Nutrition Examination Survey (NHANES). National Cancer Institute; 2009 [cited 2022 Mar 13]. Available from: <https://epi.grants.cancer.gov/diet/shortreg/instruments/dsq-in-nhanes-09-10-self-administered-english-version.pdf>
41. Health Canada. Canadian Community Health Survey, Cycle 2.2, Nutrition Focus - Food and Nutrition Surveillance - Health Canada [Internet]. 2017 [cited 2022 Aug 17]. Available from: <https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/health-nutrition-surveys/canadian-community-health-survey-cchs/canadian-community-health-survey-cycle-2-2-nutrition-focus-food-nutrition-surveillance-health-canada.html>

42. The Dietary Screener in the 2009 California Health Interview Survey [Internet]. Epidemiology and Genomics Research Program. National Cancer Institute; 2019. Available from: <https://epi.grants.cancer.gov/diet/screeners/files>
43. Willis GB, Miller K. Cross-cultural cognitive interviewing: Seeking comparability and enhancing understanding. Vol. 23, *Field Methods*. 2011. p. 331–41.
44. Foddy W. The in-depth testing of survey questions: A critical appraisal of methods. Vol. 30, *Quality & Quantity*. Kluwer Academic Publishers; 1996.
45. Willis GB. *Cognitive Interviewing*. SAGE Publications, Inc.; 2005.
46. Gower A, Dibbs R. Cognitive Research: Designing a Respondent-Friendly Questionnaire for the 1991 Census. In: Presented at the Fifth Annual Research Conference (ARC V). United States Bureau of the Census; 1989.
47. Gower A, Zylstra P. The Use of Qualitative Methods in the Design of a Business Survey Questionnaire. In: *Proceeding of the International Conference on Measurement Errors in Surveys*. Tuscon, Arizona; 1990.
48. Statistics Canada. Survey on Mental Health and Stressful Events (SMHSE) [Internet]. Government of Canada. 2022. Available from: <https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5341>
49. Yaroch AL, Tooze J, Thompson FE, Blanck HM, Thompson OM, Colón-Ramos U, et al. Evaluation of Three Short Dietary Instruments to Assess Fruit and Vegetable Intake: The National Cancer Institute’s Food Attitudes and Behaviors Survey. *J Acad Nutr Diet*. 2012 Oct;112(10):1570–7.
50. Goodman S, Leos-Toro C, Hammond D. Methods to Assess Cannabis Consumption in Population Surveys: Results of Cognitive Interviewing. *Qualitative Health Research*. 2019 Aug 1;29(10):1474–82.
51. Willis G, Boeije H. Reflections on the cognitive interviewing reporting framework: Efficacy, expectations, and promise for the future. *Methodology*. 2013;9(3):123–8.
52. Collins D. Analysing and interpreting cognitive interview data: a qualitative approach. In: *Proceedings of the 6th Questionnaire Evaluation Standard for Testing Conference*. Ottawa: Statistics Canada; 2007. p. 64–73.
53. Tourangeau R, Rips LJ, Rasinski K. *The Psychology of Survey Response*. New York, NY: Cambridge University Press; 2000.

54. Lenzner T, Neuert C, Otto W. GESIS Survey Guidelines: Cognitive Pretesting. Mannheim, Germany; 2016 Dec.
55. Thompson C, Adams J, Vidgen HA. Progressing the development of a food literacy questionnaire using cognitive interviews. *Public Health Nutrition*. 2021;
56. Conron KJ, Scout, Austin SB. Everyone has a right to, like, check their box: Findings on a measure of gender identity from a cognitive testing study with adolescents. *Journal of LGBT Health Research*. 2008;4(1):1–9.
57. Egger-Rainer A. Enhancing validity through cognitive interviewing. A methodological example using the Epilepsy Monitoring Unit Comfort Questionnaire. *Journal of Advanced Nursing*. 2019 Jan 1;75(1):224–33.
58. Centers for Disease Control and Prevention. Surveillance of Fruit and Vegetable Intake Using the Behavioral Risk Factor Surveillance System [Internet]. Atlanta, Ga; Available from: [https://www.cdc.gov/brfss/pdf/fruits\\_vegetables.pdf](https://www.cdc.gov/brfss/pdf/fruits_vegetables.pdf)
59. England CY, Thompson JL, Jago R, Cooper AR, Andrews RC. Development of a brief, reliable and valid diet assessment tool for impaired glucose tolerance and diabetes: The UK Diabetes and Diet Questionnaire. *Public Health Nutrition*. 2017 Feb 1;20(2):191–9.
60. Thompson FE, Kirkpatrick SI, Subar AF, Reedy J, Schap TRE, Wilson MM, et al. The National Cancer Institute’s Dietary Assessment Primer: A Resource for Diet Research. *J Acad Nutr Diet*. 2015 Dec 1;115(12):1986–95.
61. Tangney CC, Rasmussen HE, Richards C, Li M, Appelhans BM. Evaluation of a brief sodium screener in two samples. *Nutrients*. 2019 Jan 1;11(1).
62. Litwin H, Sapir E v. Perceived income adequacy among older adults in 12 countries: Findings from the survey of health, ageing, and retirement in Europe. *Gerontologist*. 2009 Jun;49(3):397–406.
63. Berger R. Now I see it, now I don’t: researcher’s position and reflexivity in qualitative research. *Qualitative Research*. 2015 Apr 15;15(2):219–34.
64. Dodgson JE. Reflexivity in Qualitative Research. *Journal of Human Lactation*. 2019 May 1;35(2):220–2.
65. Vaughn AE, Dearth-Wesley T, Tabak RG, Bryant M, Ward DS. Development of a Comprehensive Assessment of Food Parenting Practices: The Home Self-Administered Tool for Environmental Assessment of Activity and Diet Family Food Practices Survey. *J Acad Nutr Diet*. 2017 Feb 1;117(2):214–27.

66. National Cancer Institute. Dietary Screener in the 2009 California Health Interview Survey (CHIS 2009) [Internet]. Bethesda, MD; 2019 [cited 2022 Aug 12]. Available from: <https://epi.grants.cancer.gov/diet/screeners/CHIS2009.pdf>
67. Eppley K. Review Essay: Defying Insider-Outsider Categorization: One Researcher's Fluid and Complicated Positioning on the Insider-Outsider Continuum. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*. 2006;7(3).
68. Health Canada. Canadian Community Health Survey. Cycle 2.2, Nutrition (2004): A guide to accessing and interpreting the data. [Internet]. Ottawa; 2006 [cited 2022 Aug 19]. Available from: [https://www.hc-sc.gc.ca/fn-an/alt\\_formats/hpfb-dgpsa/pdf/surveill/cchs-guide-escc-eng.pdf](https://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/surveill/cchs-guide-escc-eng.pdf)
69. Health Canada. Reference Guide to Understanding and Using the Data 2015 Canadian Community Health Survey—Nutrition. [Internet]. Ottawa; 2017. Available from: [https://www.canada.ca/content/dam/hc-sc/documents/services/food-nutrition/food-nutrition-surveillance/ReferenceGuide2015CCHS-Nutr\\_Eng\\_Final\\_06192017.pdf](https://www.canada.ca/content/dam/hc-sc/documents/services/food-nutrition/food-nutrition-surveillance/ReferenceGuide2015CCHS-Nutr_Eng_Final_06192017.pdf)
70. Livingstone MBE, Robson PJ, Wallace JMW. Issues in dietary intake assessment of children and adolescents. *British Journal of Nutrition*. 2004 Oct;92(S2):S213–22.



# Appendices

## **Appendix A: Supplementary materials for Chapter 4**

This appendix includes supplementary materials for Chapter 4: *Methods*.

The following materials are included in this appendix:

1. Recruitment materials for cognitive interviews
2. Information letter and informed consent form
3. Cognitive testing interview guide

# 1. Recruitment materials for cognitive interviews

## *Social media recruitment poster*

 UNIVERSITY OF  
**WATERLOO** | SCHOOL OF PUBLIC HEALTH  
AND HEALTH SYSTEMS

## Interested in a research study on eating patterns?

We are looking for adults (ages 18-65 years) who live in Canada and are able to communicate in English to participate in a 45-60 min online interview

Participants will:

- Complete brief online questions about their eating patterns
- Tell us their thoughts about these questions
- Receive a \$20 Interac transfer for their time



Visit <http://bit.ly/uwfoodstudy> to complete the eligibility survey.

For more information, please contact  


This study has been reviewed by and has received ethics clearance through a University of Waterloo Research Ethics Committee. ORE # 42994

*Email recruitment script*

SUBJECT: Adults aged 18-65 years needed for a study on eating patterns with a \$20 thank you

Hello,

We are contacting you on behalf of the University of Waterloo. A research team at the University of Waterloo is creating a short set of questions to find out about Canadians' eating patterns. The purpose of this study is to learn how well these questions work and if they are easy to understand and answer.

To participate in this study, you must:

1. Be between 18 and 65 years of age
2. Be living in Canada
3. Be comfortable completing the questions and an interview in English

What is needed from you?

- 45- to 60-minutes of your time for an online or telephone interview. You will be asked to read through a set of questions and to walk through your thought process in answering the questions. As a thank you for your time, you will receive a \$20 Interac transfer immediately after the interview.

Participation in this study is voluntary. If you would like to participate, please visit this (link) to complete a quick survey.

This study has been reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#42994).

If you have any other comments or questions, please contact Joy Hutchinson or Dr. Sharon Kirkpatrick using the contact details below.

Thank you for your time,

**Joy Hutchinson**

Student Investigator, School of Public Health and Health Systems, University of Waterloo

Email: [REDACTED]

**Dr. Sharon Kirkpatrick**

Principal Investigator, School of Public Health and Health Systems, University of Waterloo

Email: [REDACTED]

## 2. Information letter and informed consent

### *Information letter*



**Study title:** Cognitive testing of a screener to assess the alignment of adults' eating patterns with the 2019 Canada's Food Guide

**Study investigators:** Dr. Sharon Kirkpatrick & Joy Hutchinson

You are invited to participate in a study to evaluate a screener designed to assess how well the eating patterns of Canadian adults align with the 2019 Canada's Food Guide. The results from this study will inform the final development of this screener, which will be used for research and in public health and clinical settings. This study is being conducted as part of Joy Hutchinson's PhD thesis under the supervision of Dr. Sharon Kirkpatrick. Funding for this study has been provided by Health Canada.

### **What does this study involve?**

You will participate in a 45- to 60-minute online interview. With your permission, the interview will be audio-recorded. You will be asked to review the screener and then to 'think-aloud' about how you answered questions about your usual eating patterns. This will help us determine if any wording or concepts within the screener are unclear or confusing. The student investigator or a research assistant will conduct the interview, and another research assistant will take notes to record your responses. To remind you, you provided information about your characteristics when you completed the online eligibility screener for this study; the information you provided will be used in combination with the perspectives you share in your interview to help us understand how well the eating patterns screener works for adults with different characteristics.

### **Participation and remuneration**

Participation in this study is voluntary and will take approximately 45 to 60 minutes of your time. You will receive a \$20 honorarium in the form of an Interac transfer following the interview. This amount received is taxable. It is your responsibility to report this amount for income tax purposes.

You may decline to answer any questions presented during the study if you so wish. Further, you may decide to discontinue the interview at any time, including part way through the interview by

advising the researcher and you may do so without any penalty. If you decide to stop the interview, we will ask you how you would like us to handle the data collected up to that point whether that is by returning it to you, destroying it, or using the data collected up to that point. You can request your data be removed from the study within 7 days of completing the interview; it is not possible to withdraw your data once responses have been synthesized to generate the final screener.

### **Personal benefits of the study**

There are no specific personal benefits to participation in this study. This research will be used to inform the development of a screener that will be used by public health practitioners, researchers, and clinicians to understand Canadians' eating patterns in relation to dietary guidance.

### **Risks to participation in the study**

There are no known or anticipated risks from participating in this study.

### **Confidentiality**

If you choose to participate, your participation will be confidential. All data will be summarized, and no individual will be identifiable from the summarized results. A summary of the findings will be shared with Health Canada and may be published. You will not be identifiable in the published findings.

When information is transmitted over the internet, privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). University of Waterloo researchers will not collect or use internet protocol (IP) addresses or other information that could link your participation to your computer or electronic device without first informing you.

With your consent, the interview will be audio-recorded. You will be asked to keep your camera on through the interview. If bandwidth requires turning off the camera, the interview will be continued. The recording will be stored on password-protected computers in a secure drive that can only be accessed by the student investigator, her supervisor, and research assistants. The recording will be used only for the purpose of this study. All other data will also be stored on password-protected computers accessible only to the study team. The data will be maintained for a minimum of 7 years and destroyed according to University of Waterloo policy.

### **Questions and research ethics clearance**

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE #42994). If you have questions, please contact the Office of Research Ethics at 1-519-888-4567, ext. 36005 or ore-ceo@uwaterloo.ca.

For all other questions about the study, please contact the student investigator Joy Hutchinson or principal investigator Dr. Sharon Kirkpatrick, using the information provided below. If you would like to receive a copy of the results of this study, please contact either investigator.

Thank you for your interest in our research and for your assistance with this project.

### **Contact information**

Student Investigator: Joy Hutchinson, School of Public Health and Health Systems, University of Waterloo [REDACTED]

Principal Investigator: Dr. Sharon Kirkpatrick, School of Public Health and Health Systems, University of Waterloo [REDACTED]

Research Assistant: Tabitha Williams, School of Public Health and Health Systems, University of Waterloo [REDACTED]

Research Assistant: Ailish Westaway, School of Public Health and Health Systems, University of Waterloo [REDACTED]

### **Consent**

Please review the information below prior to your interview and we will review it with you at the beginning of the interview. You will then be asked if you consent (verbally).

- I have read the information presented in the information letter about a study being conducted by Dr. Sharon Kirkpatrick and Joy Hutchinson of the School of Public Health and Health Systems at the University of Waterloo.
- I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.
- I am aware that I may withdraw from the study at any time and may withdraw my data within 7 days of completing the interview without penalty by advising the researchers of this decision.
- I understand that my participation in this study involves one online interview, requiring approximately 45 to 60 minutes in duration. I understand that I can refrain from answering any of the questions during the interview.
- I understand that I may decline to answer any questions presented during the study if I wish.
- I understand that I can decide to stop at any time, even part-way through the interview for whatever reason.
- I am aware that my identity will remain confidential.
- I am aware that I may allow my interview to be audio-recorded to ensure an accurate recording of my responses
- I am aware that I will be asked to keep my camera on through the interview. If bandwidth requires turning off the camera, the interview will be continued.

- I understand that there are no risks anticipated to me as a participant in this study.
- By providing my consent, I am not waiving my legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.
- This study has been reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#42994).

### ***Verbal consent script***

[Letter of information and consent form to be shared in advance]

Hello. I'm \_\_\_\_\_. I am part of the research team evaluating a screener designed to assess how well the eating patterns of Canadian adults' align with the 2019 Canada's Food Guide. I am working within the School of Public Health and Health Systems at the University of Waterloo in Waterloo, Ontario. This interview is part of a thesis study conducted under the supervision of Dr. Sharon Kirkpatrick from the School of Public Health and Health Systems at the University of Waterloo.

Thank you for your interest in this research project.

Have you had time to read over the letter of information and the consent form?

*[If yes, proceed with the script. If no, read through the letter of information and the consent form with the participant]*

Great, then I would like to take a few minutes to review the main points from the letter of information and consent form before we continue.

*[Go over the main points including risks, how we will handle their data & what the study entails]*

Confirm the following with the participant:

- You have read the information and consent letter and have had the opportunity to ask any questions related to this study, to receive satisfactory answers to your questions, and any additional details you wanted.
- Your participation in this study is voluntary and involves one online interview, approximately 45-60 minutes in duration. You have the right to withdraw at any time without penalty.
- You can ask to remove your data from the study within 7 days of completing the interview without penalty, after which it is not possible to withdraw your data because responses will have been synthesized to generate the final screener.
- You may decline to answer any questions presented during the study if you so wish.
- You can decide to stop at any time, even part-way through the interview for whatever reason. If you decide to stop the interview, we will ask you how you would like us to handle the data collected up to that point whether returning it to you, destroying it or using the data collected up to that point.
- Your identity will remain confidential.
- You may allow your interview to be audio-recorded to ensure an accurate recording of your responses.
- You will be asked to keep your camera on through the interview. If bandwidth requires turning off the camera, the interview will be continued.



- There are no risks anticipated to you as a participant in this study.
- By providing consent, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.
- This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#42994).

Do you have any questions or would you like me to review any of the study details again?

*[If yes, answer question/repeat details. If no, ask consent questions and record answers in the consent log]*

With full knowledge of all foregoing, do you agree of your own free will to participate in this study?

Do you agree to have your interview audio-recorded?

*[If they consent, continue with the interview. If they do not consent, thank them for their time. If they consent to participate but not to have their audio recorded, continue without recording]*

### 3. Cognitive testing interview guide

#### Purpose

Cognitive pre-testing will be conducted to ensure the items in the screener are meaningful to and understandable by the target population, in order to minimize misunderstanding and prevent measurement error. An interviewer will review the screener with the participant to assess interpretation of items. Speak-aloud and verbal probing methods will be used, prompting participants to walk through their responses to describe their perceptions and understanding of the proposed questions. Structural, grammatical, and content changes may be made based on participant feedback to improve clarity and appropriateness of the screening tool.

#### Interview Guide

Greet the participant and establish rapport

*[Introduce yourself. Thank the participant for joining online. Ease anxiety participant may have about the interview by establishing some rapport.]*

“On the call with us today is *[note-taker name]* who will be making notes to help me remember what you are telling me.”

*[Note taker turns on camera and introduces herself. Their camera should be left off for the rest of the session.]*

“If possible, we would like to ask you to keep your camera on during the interview.”

Introduction and consent

“The purpose of this project is to find out how you and other study participants respond to and understand a screener we have developed about Canadians’ eating patterns. We are hoping to gain information about your thought processes when reading and responding to the screener. This is to make sure the screener allows us to gather the information we’re looking for about eating patterns. Although you will be answering questions about the food you eat, the purpose of this interview is to evaluate our screener, not you or your eating patterns.”

“Do you have any questions? Can you please confirm that you understand the purpose of this project?”

*[Participant confirms. Or, if they express that they do not understand, answer their questions and re-state the purpose if necessary].*

“Now we will review the consent form that you have already received via email.”

*[Review information form and informed consent information. Allow participant to read through and answer any questions that they have]*

*[Participant provides verbal consent. Or, if consent not provided, end interview]*

“Thank you for that. In case we experience any problems with our connections during the interview, are you able to provide me with a phone number where I can reach you? We will delete your phone number immediately after the interview”

*[Participant provides phone number.]*

## Survey

“Now, we would like you to complete the screener, which you can access via the link I’ve sent you in the chat. It will take approximately 5 to 10 minutes to complete. Let me know if you have any trouble accessing the screener. Please let me know when you’ve finished. You may turn off your video while you complete the screener.”

*[Participant completes the screener while remaining on the call. Participant and interviewer may both turn off their video during this time.]*

## Interview

“Thank you for completing the screener. Before we get started with the interview portion, I would like to reassure you there are no right or wrong answers. We are looking for your reactions to the screener so we can improve it and make sure it is understandable to a wide range of adults.”

“I will be asking you about how you understood the questions you responded to. Sometimes, it will seem like we are asking you about the same things over and over again. Please be patient with us—we want to get as much detail as possible about ways that we can improve the screener. For some of the questions, I will ask you how you came up with your answer. Again, this is not because we do not believe you, but because we want to understand how you think through your answer to a question. This will help us to determine if others are interpreting the questions how we intended and if we need to make changes to the screener to improve it.”

“Ok, let’s get started. I’m going to show you some questions you would have seen while completing the screener.”

*[NOTE: The interviewer will use a semi-structured interview protocol, using the following types of probes, as appropriate to the questionnaire items and interview responses.]*

#### Preamble

Screener question	Probes	Probing type/purpose
These questions are about foods and beverages you ate or drank in the <u>past month</u> , that is, the past 30 days. When answering, please include meals and snacks consumed at home, at work or school, in restaurants, and anyplace else.	Before we get into the screener questions, can you describe the purpose of this screener in your own words, based on this brief blurb?	Comprehension/paraphrasing
	Are there any words or ideas in this paragraph that were difficult to understand?	Comprehension

#### Screener

Screener Question	Probes	Probing type/purpose
1. Over the <u>past month</u> , how often did you eat fresh, frozen, canned, or dried fruit?	What was your response to this question?	To guide further probing

<p><b>Do not include</b> fruit juices and drinks.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Never</li> <li><input type="checkbox"/> 1 time in the past month</li> <li><input type="checkbox"/> 2-3 times in the past month</li> <li><input type="checkbox"/> 1-2 times per week</li> <li><input type="checkbox"/> 3-4 times per week</li> <li><input type="checkbox"/> 5-6 times per week</li> <li><input type="checkbox"/> 1 time per day</li> <li><input type="checkbox"/> 2-3 times per day</li> <li><input type="checkbox"/> 4-5 times per day</li> <li><input type="checkbox"/> 6 or more times per day</li> </ul>	Can you walk me through how you arrived at that number?	Think-aloud
	<p>How sure or unsure (or confident) are you that the number you provided is accurate?</p> <p>How do you know this number is accurate?</p>	Confidence judgment/recall
	Are there any words or ideas in this question that were difficult to understand?	Comprehension
	<p>What kinds of fruits did you consider when answering this question? Which foods did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [food] in this category?</i></p>	Sorting/Face & content validity
<p>2. Over the <u>past month</u>, how often did you eat potatoes, including baked, boiled, or mashed potatoes, or sweet potatoes?</p>	What was your response to this question?	To guide further probing
	Can you walk me through how you arrived at that number?	Think-aloud

<p><b>Do not include</b> french fries, poutine, home fries, or hash browns.</p> <p><input type="checkbox"/> Never  <input type="checkbox"/> 1 time in the past month  <input type="checkbox"/> 2-3 times in the past month  <input type="checkbox"/> 1-2 times per week  <input type="checkbox"/> 3-4 times per week  <input type="checkbox"/> 5-6 times per week  <input type="checkbox"/> 1 time per day  <input type="checkbox"/> 2-3 times per day  <input type="checkbox"/> 4-5 times per day  <input type="checkbox"/> 6 or more times per day</p>	<p>How sure or unsure (or confident) are you that the number you provided is accurate?</p> <p>How do you know this number is accurate?</p>	Confidence judgment/recall
	<p>Are there any words or ideas in this question that were difficult to understand?</p>	Comprehension
	<p>What kinds of foods did you consider when answering this question? Which foods did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [food] in this category?</i></p>	Sorting/Face & content validity
<p>3. Over the <u>past month</u>, how often did you eat fresh, cooked, frozen, or canned vegetables?</p> <p><b>Do not include</b> potatoes, french fries, poutine, or other deep-fried vegetables, and vegetable juices and drinks.</p> <p><input type="checkbox"/> Never  <input type="checkbox"/> 1 time in the past month</p>	<p>What was your response to this question?</p>	To guide further probing
	<p>Can you walk me through how you arrived at that number?</p>	Think-aloud
	<p>How sure or unsure (or confident) are you that the number you provided is accurate?</p>	Confidence judgment/recall

<input type="checkbox"/> 2-3 times in the past month <input type="checkbox"/> 1-2 times per week <input type="checkbox"/> 3-4 times per week <input type="checkbox"/> 5-6 times per week <input type="checkbox"/> 1 time per day <input type="checkbox"/> 2-3 times per day <input type="checkbox"/> 4-5 times per day <input type="checkbox"/> 6 or more times per day	How do you know this number is accurate?	
	Are there any words or ideas in this question that were difficult to understand?	Comprehension
	What kinds of foods did you consider when answering this question? Which foods did you include, and which did you exclude?  <i>Follow up, if applicable: Would your response change if you included [food] in this category?</i>	Sorting/Face & content validity
4. Over the <u>past month</u> , how often did you eat fast food, such as burgers, french fries, poutine, pizza, submarine sandwiches, fried chicken, burritos, or tacos?  <input type="checkbox"/> Never <input type="checkbox"/> 1 time in the past month <input type="checkbox"/> 2-3 times in the past month <input type="checkbox"/> 1-2 times per week <input type="checkbox"/> 3-4 times per week <input type="checkbox"/> 5-6 times per week <input type="checkbox"/> 1 time per day <input type="checkbox"/> 2-3 times per day	What was your response to this question?	To guide further probing
	Can you walk me through how you arrived at that number?	Think-aloud
	How sure or unsure (or confident) are you that the number you provided is accurate?  How do you know this number is accurate?	Confidence judgment/recall

<input type="checkbox"/> 4-5 times per day <input type="checkbox"/> 6 or more times per day	Are there any words or ideas in this question that were difficult to understand?	Comprehension
	What kinds of foods did you consider when answering this question? Which foods did you include, and which did you exclude?  <i>Follow up, if applicable: Would your response change if you included [food] in this category?</i>	Sorting/Face & content validity
5. Over the <u>past month</u> , how often did you eat hot dogs, sausages, beef jerky, bacon, ham or other deli or luncheon meats?  <b>Do not include</b> fast food, canned fish, canned poultry, and packaged veggie burgers and plant-based meats.  <input type="checkbox"/> Never <input type="checkbox"/> 1 time in the past month <input type="checkbox"/> 2-3 times in the past month <input type="checkbox"/> 1-2 times per week <input type="checkbox"/> 3-4 times per week <input type="checkbox"/> 5-6 times per week <input type="checkbox"/> 1 time per day	What was your response to this question?	To guide further probing
	Can you walk me through how you arrived at that number?	Think-aloud
	How sure or unsure (or confident) are you that the number you provided is accurate?  How do you know this number is accurate?	Confidence judgment/recall
	Are there any words or ideas in this question that were difficult to understand?	Comprehension



<input type="checkbox"/> 2-3 times per day <input type="checkbox"/> 4-5 times per day <input type="checkbox"/> 6 or more times per day	<p>What kinds of foods did you consider when answering this question? Which foods did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [food] in this category?</i></p>	Sorting/Face & content validity
<p>6. Over the <u>past month</u>, how often did you eat eggs, beef, pork, wild meat, poultry, fish, or shellfish? Include canned fish and canned poultry.</p> <p><b>Do not include</b> fast food, hot dogs, sausages, beef jerky, bacon, ham, and other deli or luncheon meats.</p> <input type="checkbox"/> Never <input type="checkbox"/> 1 time in the past month <input type="checkbox"/> 2-3 times in the past month <input type="checkbox"/> 1-2 times per week <input type="checkbox"/> 3-4 times per week <input type="checkbox"/> 5-6 times per week <input type="checkbox"/> 1 time per day <input type="checkbox"/> 2-3 times per day <input type="checkbox"/> 4-5 times per day <input type="checkbox"/> 6 or more times per day	What was your response to this question?	To guide further probing
	Can you walk me through how you arrived at that number?	Think-aloud
	<p>How sure or unsure (or confident) are you that the number you provided is accurate?</p> <p>How do you know this number is accurate?</p>	Confidence judgment/recall
	Are there any words or ideas in this question that were difficult to understand?	Comprehension
	What kinds of foods did you consider when answering this question? Which foods did you include, and which did you exclude?	Sorting/Face & content validity

	<i>Follow up, if applicable: Would your response change if you included [beverage] in this category?</i>	
<p>7. Over the <u>past month</u>, how often did you eat nuts, seeds, tofu, beans and lentils, peanut butter or other nut butters, or other plant-based sources of protein?</p> <p><b>Do not include</b> green beans and packaged veggie burgers and plant-based meats.</p> <p><input type="checkbox"/> Never  <input type="checkbox"/> 1 time in the past month  <input type="checkbox"/> 2-3 times in the past month  <input type="checkbox"/> 1-2 times per week  <input type="checkbox"/> 3-4 times per week  <input type="checkbox"/> 5-6 times per week  <input type="checkbox"/> 1 time per day  <input type="checkbox"/> 2-3 times per day  <input type="checkbox"/> 4-5 times per day  <input type="checkbox"/> 6 or more times per day</p>	What was your response to this question?	To guide further probing
	Can you walk me through how you arrived at that number?	Think-aloud
	How sure or unsure (or confident) are you that the number you provided is accurate?	Confidence judgment/recall
	How do you know this number is accurate?	
	Are there any words or ideas in this question that were difficult to understand?	Comprehension
<p>What kinds of beverages did you consider when answering this question? Which beverages did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [beverage] in this category?</i></p> <p><i>Probe types of nuts, if applicable.</i></p>	Sorting/Face & content validity	

<p>8. Over the <u>past month</u>, how often did you consume yogurt, kefir, and cheese?</p> <p> <input type="checkbox"/> Never  <input type="checkbox"/> 1 time in the past month  <input type="checkbox"/> 2-3 times in the past month  <input type="checkbox"/> 1-2 times per week  <input type="checkbox"/> 3-4 times per week  <input type="checkbox"/> 5-6 times per week  <input type="checkbox"/> 1 time per day  <input type="checkbox"/> 2-3 times per day  <input type="checkbox"/> 4-5 times per day  <input type="checkbox"/> 6 or more times per day </p>	<p>What was your response to this question?</p>	<p>To guide further probing</p>
	<p>Can you walk me through how you arrived at that number?</p>	<p>Think-aloud</p>
	<p>How sure or unsure (or confident) are you that the number you provided is accurate?</p> <p>How do you know this number is accurate?</p>	<p>Confidence judgment/recall</p>
	<p>Are there any words or ideas in this question that were difficult to understand?</p>	<p>Comprehension</p>
	<p>What kinds of foods did you consider when answering this question? Which foods did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [food] in this category?</i></p> <p><i>Probe low-fat/low-sodium cheese, kefir, yogurt</i></p>	<p>Sorting/Face &amp; content validity</p>

<p>9. Over the <u>past month</u>, how often did you have <b>unsweetened</b> cows' milk or <b>unsweetened</b> plant-based beverages (e.g., soy, almond, oat milk)?</p> <p><b>Do not include</b> small amounts in coffee or tea, or chocolate and other sweetened milk.</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1 time in the past month</p> <p><input type="checkbox"/> 2-3 times in the past month</p> <p><input type="checkbox"/> 1-2 times per week</p> <p><input type="checkbox"/> 3-4 times per week</p> <p><input type="checkbox"/> 5-6 times per week</p> <p><input type="checkbox"/> 1 time per day</p> <p><input type="checkbox"/> 2-3 times per day</p> <p><input type="checkbox"/> 4-5 times per day</p> <p><input type="checkbox"/> 6 or more times per day</p>	<p>What was your response to this question?</p>	<p>To guide further probing</p>
	<p>Can you walk me through how you arrived at that number?</p>	<p>Think-aloud</p>
	<p>How sure or unsure (or confident) are you that the number you provided is accurate?</p> <p>How do you know this number is accurate?</p>	<p>Confidence judgment/recall</p>
	<p>Are there any words or ideas in this question that were difficult to understand?</p>	<p>Comprehension</p>
	<p>What kinds of beverages did you consider when answering this question? Which beverages did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [beverage] in this category?</i></p>	<p>Sorting/Face &amp; content validity</p>

<p>10. Over the <u>past month</u>, how often did you have <b>sweetened</b> cows' milk or <b>sweetened</b> plant-based beverages (e.g., soy, almond, oat milk)?</p> <p><b>Do not include</b> small amounts in coffee or tea or diet/artificially-sweetened or sugar-free beverages.</p> <p><input type="checkbox"/> Never  <input type="checkbox"/> 1 time in the past month  <input type="checkbox"/> 2-3 times in the past month  <input type="checkbox"/> 1-2 times per week  <input type="checkbox"/> 3-4 times per week  <input type="checkbox"/> 5-6 times per week  <input type="checkbox"/> 1 time per day  <input type="checkbox"/> 2-3 times per day  <input type="checkbox"/> 4-5 times per day  <input type="checkbox"/> 6 or more times per day</p>	What was your response to this question?	To guide further probing
	Can you walk me through how you came up with your answer?	Think-aloud
	How do you know your answer is accurate?	Confidence judgment/recall
	Are there any words or ideas in this question that were difficult to understand?	Comprehension
	<p>What kinds of beverages did you consider when answering this question? Which beverages did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [beverage] in this category?</i></p>	Sorting/Face & content validity
<p>11. Over the <u>past month</u>, how often did you drink fruit juice or fruit-flavoured drinks, soda or pop, <b>sweetened</b> sports or energy drinks, <b>sweetened</b> hot or iced coffee or tea, or <b>sweetened</b> waters?</p> <p><b>Do not include</b> diet/artificially-sweetened and sugar-free beverages, such as diet soda.</p>	What was your response to this question?	To guide further probing
	Can you walk me through how you arrived at that number?	Think-aloud
	How sure or unsure (or confident) are you that the number you provided is accurate?	Confidence judgment/recall

<input type="checkbox"/> Never <input type="checkbox"/> 1 time in the past month <input type="checkbox"/> 2-3 times in the past month <input type="checkbox"/> 1-2 times per week <input type="checkbox"/> 3-4 times per week <input type="checkbox"/> 5-6 times per week <input type="checkbox"/> 1 time per day <input type="checkbox"/> 2-3 times per day <input type="checkbox"/> 4-5 times per day <input type="checkbox"/> 6 or more times per day	How do you know this number is accurate?	
	Are there any words or ideas in this question that were difficult to understand?	Comprehension
	<p>What kinds of beverages did you consider when answering this question? Which beverages did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [beverage] in this category?</i></p>	Sorting/Face & content validity
<p>12. Over the <u>past month</u>, how often did you eat cookies, cakes, muffins, pastries, granola bars, protein bars, ice cream, candy, chocolate, or sugary breakfast cereals?</p> <input type="checkbox"/> Never <input type="checkbox"/> 1 time in the past month <input type="checkbox"/> 2-3 times in the past month <input type="checkbox"/> 1-2 times per week <input type="checkbox"/> 3-4 times per week <input type="checkbox"/> 5-6 times per week <input type="checkbox"/> 1 time per day <input type="checkbox"/> 2-3 times per day <input type="checkbox"/> 4-5 times per day	What was your response to this question?	To guide further probing
	Can you walk me through how you arrived at that number?	Think-aloud
	<p>How sure or unsure (or confident) are you that the number you provided is accurate?</p> <p>How do you know this number is accurate?</p>	Confidence judgment/recall

<input type="checkbox"/> 6 or more times per day	<p>Are there any words or ideas in this question that were difficult to understand?</p>	Comprehension
	<p>What kinds of foods did you consider when answering this question? Which foods did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [food] in this category?</i></p> <p><i>Probe sugary breakfast cereals, if applicable.</i></p>	Sorting/ Face & content validity
<p>13. Over the <u>past month</u>, how often did you eat crackers, chips, pretzels, popcorn, or other salty snacks?</p> <p> <input type="checkbox"/> Never  <input type="checkbox"/> 1 time in the past month  <input type="checkbox"/> 2-3 times in the past month  <input type="checkbox"/> 1-2 times per week  <input type="checkbox"/> 3-4 times per week  <input type="checkbox"/> 5-6 times per week  <input type="checkbox"/> 1 time per day  <input type="checkbox"/> 2-3 times per day  <input type="checkbox"/> 4-5 times per day  <input type="checkbox"/> 6 or more times per day </p>	<p>What was your response to this question?</p>	To guide further probing
	<p>Can you walk me through how you arrived at that number?</p>	Think-aloud
	<p>How sure or unsure (or confident) are you that the number you provided is accurate?</p> <p>How do you know this number is accurate?</p>	Confidence judgment/recall

	Are there any words or ideas in this question that were difficult to understand?	Comprehension
	<p>What kinds of foods did you consider when answering this question? Which foods did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [food] in this category?</i></p>	Sorting/ Face & content validity
<p>14. Over the <u>past month</u>, how often did you eat <b>white</b> breads, bagels, rice, pasta, noodles, or other refined grains, such as breakfast cereals?</p> <p><b>Do not include</b> whole wheat and whole grain foods.</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1 time in the past month</p> <p><input type="checkbox"/> 2-3 times in the past month</p> <p><input type="checkbox"/> 1-2 times per week</p> <p><input type="checkbox"/> 3-4 times per week</p> <p><input type="checkbox"/> 5-6 times per week</p> <p><input type="checkbox"/> 1 time per day</p> <p><input type="checkbox"/> 2-3 times per day</p> <p><input type="checkbox"/> 4-5 times per day</p> <p><input type="checkbox"/> 6 or more times per day</p>	What was your response to this question?	To guide further probing
	Can you walk me through how you arrived at that number?	Think-aloud
	<p>How sure or unsure (or confident) are you that the number you provided is accurate?</p> <p>How do you know this number is accurate?</p>	Confidence judgment/recall
	Are there any words or ideas in this question that were difficult to understand?	Comprehension



	<p>What kinds of foods did you consider when answering this question? Which foods did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [food] in this category?</i></p>	<p>Sorting/Face &amp; content validity</p>
<p>15. Over the <u>past month</u>, how often did you eat <b>whole wheat or whole grain</b> breads, bagels, pasta, noodles, quinoa, oats, breakfast cereals, brown or wild rice, or other whole wheat or whole grain foods?</p> <p><b>Do not include</b> white breads, bagels, pasta, noodles, or rice, or refined breakfast cereals.</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1 time in the past month</p> <p><input type="checkbox"/> 2-3 times in the past month</p> <p><input type="checkbox"/> 1-2 times per week</p> <p><input type="checkbox"/> 3-4 times per week</p> <p><input type="checkbox"/> 5-6 times per week</p> <p><input type="checkbox"/> 1 time per day</p> <p><input type="checkbox"/> 2-3 times per day</p> <p><input type="checkbox"/> 4-5 times per day</p> <p><input type="checkbox"/> 6 or more times per day</p>	<p>What was your response to this question?</p>	<p>To guide further probing</p>
	<p>Can you walk me through how you arrived at that number?</p>	<p>Think-aloud</p>
	<p>How sure or unsure (or confident) are you that the number you provided is accurate?</p> <p>How do you know this number is accurate?</p>	<p>Confidence judgment/recall</p>
	<p>Are there any words or ideas in this question that were difficult to understand?</p>	<p>Comprehension</p>
	<p>What kinds of foods did you consider when answering this question? Which foods did you include, and which did you exclude?</p>	<p>Sorting/Face &amp; content validity</p>

	<i>Follow up, if applicable:</i> Would your response change if you included <i>[food]</i> in this category?	
	Does the <b>bold</b> font help to clarify that we are asking only about whole wheat and whole grain foods?	
<p>16. Over the <u>past month</u>, how often did you have vegetable oils or soft margarines?</p> <p>Do <b>not</b> include lard, hard margarines, coconut oil, palm oil, and butter.</p> <p><input type="checkbox"/> Never  <input type="checkbox"/> 1 time in the past month  <input type="checkbox"/> 2-3 times in the past month  <input type="checkbox"/> 1-2 times per week  <input type="checkbox"/> 3-4 times per week  <input type="checkbox"/> 5-6 times per week  <input type="checkbox"/> 1 time per day  <input type="checkbox"/> 2-3 times per day  <input type="checkbox"/> 4-5 times per day  <input type="checkbox"/> 6 or more times per day</p>	What was your response to this question?	To guide further probing
	Can you walk me through how you arrived at that number?	Think-aloud
	How sure or unsure (or confident) are you that the number you provided is accurate?	Confidence judgment/recall
	How do you know this number is accurate?	
	Are there any words or ideas in this question that were difficult to understand?	Comprehension

	<p>What kinds of foods (oils/margarines/fats) did you consider when answering this question? Which foods did you include, and which did you exclude?</p> <p><i>Follow up, if applicable: Would your response change if you included [food] in this category?</i></p>	<p>Sorting/Face &amp; content validity</p>
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General comments and concerns

“Ok, now I just have a few final questions for you before we finish up.”

Question	Follow-up probes	Probing type/purpose
Did you feel pressure to answer the questions a certain way?	[If applicable] Can I ask what made you feel that way?	Addressing social desirability bias
Did you ever find yourself reporting the same information in multiple places while responding to the screener?	[If yes] What was it that you felt we asked you about more than once?	Repeated reporting – identify redundancies
Did you have any difficulty or issues with any aspect of the screener that I haven’t asked you about?	[Follow-up if necessary.]	General probing to identify other concerns

Interview wrap-up

“Thank you for participating in this study and taking the time to talk with me today. We will be providing you with a \$20 honorarium via Interac transfer as a thank you for your time and participation. This will be sent within the next hour, using the email address you provided. Please do not hesitate to follow-up with the research team if you have any questions or concerns.”

*[Interviewer says goodbye and ends call.]*

Interviewer debrief form

- a. In general, how did the respondent act toward you during the interview?
  - a. Not at all attentive

- b. Somewhat attentive
- c. Very attentive

- b. How much difficulty do you think the respondent had in understanding most of the questions?
  - a. A lot of difficulty
  - b. Some difficulty
  - c. No difficulty

Supplementary guide: Responses to participants' questions

Participants may have questions about the questionnaire or the process throughout the interview. Here are some possible questions and responses.

Possible Question/Situation	Possible Response
"What am I supposed to be doing?"	"I am interested in what you are thinking as you read and answer this screener."
Participant is having difficulty with the think-aloud technique.	<p>"Tell me what you are thinking."</p> <p>"What thoughts are going through your mind right now? You do not have to filter them, tell me your thoughts exactly as they are passing through your head"</p>
Participant is doing well with think-aloud technique.	"That's great. Thinking out loud like this is just what I need."

	“Good. Your comments help me understand what you’re thinking about.”
Asks you direct questions about why a question is being asked or the purpose of the questionnaire.	<p>“The purpose of this study is to see how you and other similar participants experience this screener. For example, we want to assess whether you are understanding them how we hoped you would or if we need to make changes before we test this screener further.”</p> <p>Please continue to express any questions you have while you are completing the screener. It will be helpful to know what questions you have about the screener.”</p>

#### Sources reviewed to inform this interview guide

1. Beatty PC, Willis GB. Research synthesis: The practice of cognitive interviewing. *Public opinion quarterly*. 2007 Jan 1;71(2):287-311.
2. Collins D. Pretesting survey instruments: an overview of cognitive methods. *Quality of life research*. 2003 May;12(3):229-38.
3. Foddy W. The in-depth testing of survey questions: A critical appraisal of methods. *Quality and Quantity*. 1996 Nov;30(4):361-70.
4. Strauss, Anselm, and Juliet Corbin. 1990. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: Sage.
5. Lenzner T, Neuert C, Otto W. Cognitive pretesting. *GESIS Survey Guidelines*. 2016:3.
6. Tourangeau R, Rips LJ, Rasinski K. *The Psychology of Survey Response*. New York, NY: Cambridge University Press; 2000.
7. Willis GB, Artino Jr AR. What do our respondents think we're asking? Using cognitive interviewing to improve medical education surveys. *Journal of graduate medical education*. 2013 Sep;5(3):353.
8. Willis GB, Miller K. Cross-cultural cognitive interviewing: Seeking comparability and enhancing understanding. *Field methods*. 2011 Nov;23(4):331-41.

## **Appendix B: Supplementary materials for Chapter 5**

This appendix includes supplementary materials for Chapter 5: *Development of the Canada's Food Guide-2019 Healthy Food Choices Screener to assess alignment of adults' dietary intake with the healthy food choices guidance*

The following materials are included in this appendix:

1. Expert advisors who provided input on the development and evaluation of the Canada's Food Guide-2019 Healthy Food Choices Screener
2. Initial questions in the Canada's Food Guide-2019 Healthy Food Choices Screener to assess alignment of adults' intake with the Canada Food Guide-2019 healthy food choices guidance
3. Final screener in English and French

## **1. Expert advisors who provided input on the development and evaluation of the Canada's Food Guide-2019 Healthy Food Choices Screener**

- Meghan Day, British Columbia Ministry of Health
- Kevin Dodd, U.S. National Cancer Institute
- Patricia Guenther, University of Utah
- Jess Haines, University of Guelph
- Mahsa Jessri, University of British Columbia
- Mary L'Abbé, University of Toronto
- Benoît Lamarche, Université Laval
- Simone Lemieux, Université Laval
- Maria Laura Louzada, University of São Paulo
- Dana Lee Olstad, University of Calgary
- Rachel Prowse, Memorial University
- Janis Randall Simpson, University of Guelph
- Jill Reedy, U.S. National Cancer Institute
- Hassan Vatanparast, University of Saskatchewan
- Jennifer Vena, Alberta Health Services



## 2. Initial questions in the Canada's Food Guide-2019 Healthy Food Choices Screener to assess alignment of adults' intake with the Canada Food Guide-2019 healthy food choices guidance

*La version Française suit*

These questions are about foods and beverages you ate or drank in the past month. When answering, please include meals and snacks consumed at home, at work or school, in restaurants, and anyplace else.

1. Over the past month, how often did you consume fresh, frozen, and canned fruit? *Do not include fruit juices or drinks.*
  - Never
  - 1 time in the past month
  - 2-3 times in the past month
  - 1-2 times per week
  - 3-4 times per week
  - 5-6 times per week
  - 1 time per day
  - 2-3 times per day
  - 4-5 times per day
  - 6 or more times per day
  
2. Over the past month, how often did you consume cooked, raw, frozen, and canned vegetables? *Do not include deep-fried vegetables or vegetable juices or drinks.*
  - Never
  - 1 time in the past month
  - 2-3 times in the past month
  - 1-2 times per week
  - 3-4 times per week
  - 5-6 times per week
  - 1 time per day
  - 2-3 times per day
  - 4-5 times per day
  - 6 or more times per day
  
3. Over the past month, how often did you consume deep-fried foods and ready-to-heat or ready-to-eat dishes? Include frozen, canned, and packaged meat-based and vegetarian/vegan dishes, such as soups, pre-made pasta and rice dishes, and plant-based

meats. *Do not include hot dogs, sausages, ham, corned beef, beef jerky or other deli or luncheon meats.*

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

4. Over the past month, how often did you consume hot dogs, sausages, ham, corned beef, beef jerky, and other deli or luncheon meats? *Do not include canned fish or canned poultry or packaged plant-based meats.*

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

5. Over the past month, how often did you consume lean red meat or pork, wild game, poultry, fish, shellfish, and eggs? Include canned fish and canned poultry. *Do not include hot dogs, sausages, ham, corned beef, beef jerky, or other deli or luncheon meats.*

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

6. Over the past month, how often did you consume nuts (including nut butters), seeds, tofu, beans (e.g., chickpeas, hummus, lentils, black beans), and other plant-based sources of protein? *Do **not** include green beans or ready-to-heat foods, such as pre-made veggie burgers and packaged plant-based meats.*
- Never
  - 1 time in the past month
  - 2-3 times in the past month
  - 1-2 times per week
  - 3-4 times per week
  - 5-6 times per week
  - 1 time per day
  - 2-3 times per day
  - 4-5 times per day
  - 6 or more times per day
7. Over the past month, how often did you drink milk and unsweetened plant-based beverages (e.g., soy, almond, and oat milk)? *Do **not** include small amounts in coffee or tea, or chocolate and other flavoured milk.*
- Never
  - 1 time in the past month
  - 2-3 times in the past month
  - 1-2 times per week
  - 3-4 times per week
  - 5-6 times per week
  - 1 time per day
  - 2-3 times per day
  - 4-5 times per day
  - 6 or more times per day
8. Over the past month, how often did you consume yogurt, kefir, and cheese?
- Never
  - 1 time in the past month
  - 2-3 times in the past month
  - 1-2 times per week
  - 3-4 times per week
  - 5-6 times per week
  - 1 time per day
  - 2-3 times per day
  - 4-5 times per day

6 or more times per day

9. Over the past month, how often did you drink flavoured milk, sweetened plant-based beverages (e.g., soy, almond, and oat milk), and sweetened coffee or tea (including bottled)? *Do not include diet or sugar-free beverages.*

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

10. Over the past month, how often did you drink soda or pop containing sugar, fruit juice and fruit-flavoured drinks, sweetened sports drinks, and sweetened waters? *Do not include diet or sugar-free beverages, such as diet soda and plain water.*

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

11. Over the past month, how often did you consume sugary breakfast cereals, cookies, cakes, pastries, granola bars, ice cream, candy, and chocolate?

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day

- 4-5 times per day
- 6 or more times per day

12. Over the past month, how often did you consume chips, pretzels, popcorn, crackers, and other salty snacks?

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

13. Over the past month, how often did you consume white breads, bagels, rice, pasta, and noodles? *Do **not** include whole wheat or whole grain foods.*

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

14. Over the past month, how often did you consume whole wheat or whole grain breads, rice, pasta, noodles, and cereals? *Do **not** include white breads, rice, pasta, noodles, or cereals.*

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day

- 4-5 times per day
- 6 or more times per day

15. Over the past month, how often did you cook with or add vegetable oils (e.g., canola, olive, sunflower) or soft margarines to your foods? *Do **not** include coconut oil, palm oil, or butter.*

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

Ces questions portent sur les aliments et les boissons que vous avez consommés au cours du **dernier mois**, c'est-à-dire au cours des 30 derniers jours. Lorsque vous répondez, veuillez inclure dans vos réponses les repas et les collations consommés à la maison, au travail, à l'école, au restaurant et à tout autre endroit.

1. Au cours du dernier mois, à quelle fréquence avez-vous consommé des fruits frais, congelés ou en conserve? **N'incluez pas** les jus et les boissons de fruits.
  - Jamais
  - 1 fois au cours du dernier mois
  - 2 - 3 fois au cours du dernier mois
  - 1 - 2 fois par semaine
  - 3 - 4 fois par semaine
  - 5 - 6 fois par semaine
  - 1 fois par jour
  - 2 - 3 fois par jour
  - 4 - 5 fois par jour
  - Au moins 6 fois par jour
  
2. Au cours du dernier mois, à quelle fréquence avez-vous consommé des légumes cuits, crus, congelés ou en conserve? **N'incluez pas** les légumes frits, les jus de légumes et les boissons de légumes.
  - Jamais
  - 1 fois au cours du dernier mois
  - 2 - 3 fois au cours du dernier mois
  - 1 - 2 fois par semaine
  - 3 - 4 fois par semaine
  - 5 - 6 fois par semaine
  - 1 fois par jour
  - 2 - 3 fois par jour
  - 4 - 5 fois par jour
  - Au moins 6 fois par jour
  
3. Au cours du dernier mois, à quelle fréquence avez-vous consommé des aliments frits et des plats prêts à réchauffer ou prêts à manger?  
Incluez les plats congelés, en conserve et emballés à base de viande et les plats végétariens/végétaliens, tels que les soupes, les plats de pâtes et de riz préparés, et les viandes à base de produits d'origine végétale. **N'incluez pas** les hot-dogs, les saucisses, le jambon, le bœuf salé, le bœuf séché et d'autres viandes de charcuterie ou froides.
  - Jamais
  - 1 fois au cours du dernier mois

- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour

4. Au cours du dernier mois, à quelle fréquence avez-vous consommé des hot-dogs, des saucisses, du jambon, du bœuf salé, du bœuf séché et d'autres viandes de charcuterie ou froides? *N'incluez pas le poisson en conserve, la volaille en conserve et les viandes à base de produits d'origine végétale emballées.*

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour

5. Au cours du dernier mois, à quelle fréquence avez-vous consommé de la viande rouge maigre, du porc maigre, du gibier, de la volaille, du poisson, des crustacés et des œufs? Incluez le poisson en conserve et la volaille en conserve. *N'incluez pas les hot-dogs, les saucisses, le jambon, bœuf salé, le bœuf séché ou d'autres viandes de charcuterie ou froides.*

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour



6. Au cours du dernier mois, à quelle fréquence avez-vous consommé des noix (y compris des beurres de noix), des graines, du tofu, des légumineuses (par exemple, des pois chiches, du houmous, des lentilles, des haricots noirs) et d'autres sources de protéines d'origine végétale? *N'incluez pas les haricots verts ou les aliments prêts à réchauffer, comme les hamburgers végétariens prépréparés et les viandes à base de produits d'origine végétale emballés.*
- Jamais
  - 1 fois au cours du dernier mois
  - 2 - 3 fois au cours du dernier mois
  - 1 - 2 fois par semaine
  - 3 - 4 fois par semaine
  - 5 - 6 fois par semaine
  - 1 fois par jour
  - 2 - 3 fois par jour
  - 4 - 5 fois par jour
  - Au moins 6 fois par jour
7. Au cours du dernier mois, à quelle fréquence avez-vous bu du lait et des boissons d'origine végétale non sucrées (par exemple, du lait de soja, aux amandes et d'avoine)? *N'incluez pas les petites quantités dans le café ou le thé, ni le lait au chocolat et autres laits aromatisés.*
- Jamais
  - 1 fois au cours du dernier mois
  - 2 - 3 fois au cours du dernier mois
  - 1 - 2 fois par semaine
  - 3 - 4 fois par semaine
  - 5 - 6 fois par semaine
  - 1 fois par jour
  - 2 - 3 fois par jour
  - 4 - 5 fois par jour
  - Au moins 6 fois par jour
8. Au cours du dernier mois, à quelle fréquence avez-vous consommé du yogourt, du kéfir et du fromage?
- Jamais
  - 1 fois au cours du dernier mois
  - 2 - 3 fois au cours du dernier mois
  - 1 - 2 fois par semaine
  - 3 - 4 fois par semaine
  - 5 - 6 fois par semaine

- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour

9. Au cours du dernier mois, à quelle fréquence avez-vous bu du lait aromatisé, des boissons d'origine végétale sucrées (par exemple, du lait de soja, aux amandes et d'avoine) et du café ou thé sucré (y compris en bouteille)? *N'incluez pas les boissons diètes ou sans sucre.*

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour

10. Au cours du dernier mois, à quelle fréquence avez-vous bu des boissons gazeuses contenant du sucre, des jus de fruits et des boissons aromatisées aux fruits, des boissons sportives sucrées et des eaux sucrées? *N'incluez pas les boissons diètes ou sans sucre, comme les boissons gazeuses diètes et l'eau plate.*

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour

11. Au cours du dernier mois, à quelle fréquence avez-vous consommé des céréales sucrées pour le déjeuner, des biscuits, des gâteaux, des pâtisseries, des barres tendres, de la crème glacée, des bonbons et du chocolat?

- Jamais
- 1 fois au cours du dernier mois

- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour

12. Au cours du dernier mois, à quelle fréquence avez-vous consommé des croustilles, des bretzels, du maïs soufflé, des craquelins et autres collations salées?

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour

13. Au cours du dernier mois, à quelle fréquence avez-vous consommé des pâtes, des nouilles, du pain, des bagels et du riz **blancs**? *N'incluez pas les aliments à base de blé entier ou de grains entiers.*

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour

14. Au cours du dernier mois, à quelle fréquence avez-vous consommé du pain, du riz, des pâtes, des nouilles et des céréales **de blé entier ou de grains entiers**? *N'incluez pas le pain blanc, le riz blanc, les pâtes et les nouilles blanches et les céréales raffinées.*

- Jamais

- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour

15. Au cours du dernier mois, combien de fois avez-vous cuisiné avec des huiles végétales (par exemple, de canola, d'olive, de tournesol) ou des margarines molles ou en avez-vous ajoutées à vos aliments? *N'incluez pas l'huile de coco, l'huile de palme ou le beurre.*

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- Au moins 6 fois par jour

### 3. Final Screener

#### Canada's Food Guide-2019 Healthy Food Choices Screener – English

These questions are about foods and beverages you ate or drank in the past month, that is, the past 30 days. When answering, please include meals and snacks consumed at home, at work or school, in restaurants, and anyplace else.

1. Over the past month, how often did you eat fresh, frozen, canned, or dried fruit?

**Do not include** fruit juices and drinks.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

2. Over the past month, how often did you eat potatoes, including baked, boiled, or mashed potatoes, or sweet potatoes?

**Do not include** french fries, poutine, home fries, or hash browns.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

3. Over the past month, how often did you eat fresh, cooked, frozen, or canned vegetables?

**Do not include** potatoes, french fries, poutine, or other deep-fried vegetables, or vegetable juices and drinks.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

4. Over the past month, how often did you eat food from fast food restaurants, such as burgers, french fries, poutine, pizza, submarine sandwiches, fried chicken, burritos, or tacos?

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

5. Over the past month, how often did you eat hot dogs, sausages, beef jerky, bacon, ham or other deli or luncheon meats?

**Do not include** fast food, canned fish, canned poultry, or packaged veggie burgers and plant-based meats.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

6. Over the past month, how often did you eat eggs, beef, pork, wild meat, chicken or other poultry, fish, shellfish, or other animal-based sources of protein? Include canned fish and canned poultry.

**Do not include** fast food, hot dogs, sausages, beef jerky, bacon, ham, or other deli or luncheon meats.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

7. Over the past month, how often did you eat nuts, seeds, tofu, beans and lentils, peanut butter or other nut butters, or other plant-based sources of protein?

**Do not include** green beans or packaged veggie burgers and plant-based meats.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

8. Over the past month, how often did you eat yogurt, kefir, or cheese?

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day



9. Over the past month, how often did you have **white** cows' milk or **unsweetened** plant-based beverages (e.g., soy, almond, or oat milk)?

**Do not include** small amounts in coffee or tea, or chocolate and other sweetened milk.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

10. Over the past month, how often did you have chocolate milk or other **flavoured** milk or **sweetened** plant-based beverages (e.g., soy, almond, or oat milk)?

**Do not include** small amounts in coffee or tea, or diet/artificially-sweetened or sugar-free beverages.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

11. Over the past month, how often did you drink fruit juice, fruit-flavoured drinks, soda or pop, **sweetened** sports or energy drinks, **sweetened** hot or iced coffee or tea, or **sweetened** waters?

**Do not include** diet/artificially-sweetened or sugar-free beverages, such as diet soda.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

12. Over the past month, how often did you eat cookies, cakes, muffins, pastries, granola bars, protein bars, ice cream, candy, chocolate, sugary breakfast cereals, or other sugary foods?

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

13. Over the past month, how often did you eat crackers, chips, pretzels, popcorn, or other salty snacks?

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

14. Over the past month, how often did you eat **white** breads, bagels, rice, pasta, noodles, or other refined grains, such as breakfast cereals?

**Do not include** whole wheat or whole grain foods.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

15. Over the past month, how often did you eat **whole wheat or whole grain** breads, bagels, pasta, noodles, quinoa, oats, brown or wild rice, breakfast cereals, or other whole wheat or whole grain foods?

**Do not include** white breads, bagels, pasta, noodles, rice, or refined breakfast cereals.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

16. Over the past month, how often did you have margarine or vegetable oils (e.g., olive, canola, or sunflower oil)?

**Do not include** lard, coconut oil, palm oil, or butter.

- Never
- 1 time in the past month
- 2-3 times in the past month
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

## Canada's Food Guide-2019 Healthy Food Choices Screener – Français

Ces questions portent sur les aliments et les boissons que vous avez consommés **au cours du dernier mois**, c'est-à-dire au cours des 30 derniers jours. Lorsque vous répondez, veuillez inclure dans vos réponses **tous** les repas et **toutes** les collations consommés à la maison, au travail, à l'école, au restaurant et à tout autre endroit.

1. Au cours du dernier mois, à quelle fréquence avez-vous consommé des fruits frais, congelés, en conserve ou séchés?

**N'incluez pas** les jus de fruits et les boissons aux fruits.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

2. Au cours du dernier mois, à quelle fréquence avez-vous consommé des pommes de terre, y compris des pommes de terre au four, bouillies ou en purée, ou des patates douces?

**N'incluez pas** les frites, les frites maison, la poutine, les pommes de terre rissolées et les galettes de pommes de terre (hash browns).

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

3. Au cours du dernier mois, à quelle fréquence avez-vous consommé des légumes crus, cuits, congelés ou en conserve?

N'incluez pas les pommes de terre, les frites ou autres légumes frits, la poutine, les jus de légumes et les boissons de légumes.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

4. Au cours du dernier mois, à quelle fréquence avez-vous consommé de la nourriture provenant d'un restaurant de type fast-food, comme des hamburgers, des frites, de la poutine, de la pizza, des sous-marins, du poulet frit, des burritos ou des tacos?

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

5. Au cours du dernier mois, à quelle fréquence avez-vous consommé des hot-dogs, des saucisses, du bœuf séché (beef jerky), du bacon, du jambon ou autres viandes de charcuterie ou froides?

**N'incluez pas** le fast-food, le poisson en conserve, le poulet ou autre volaille en conserve, les hamburgers végétariens préparés du commerce et les simili-viandes d'origine végétale préparées du commerce.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

6. Au cours du dernier mois, à quelle fréquence avez-vous consommé des œufs, du bœuf, du porc, du gibier, du poulet ou autre volaille, du poisson, des fruits de mer ou d'autres sources de protéines d'origine animale? Incluez le poisson en conserve et le poulet ou autre volaille en conserve.

**N'incluez pas** le fast-food, les hot-dogs, les saucisses, le bœuf séché, le bacon, le jambon et autres viandes de charcuterie ou froides.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

7. Au cours du dernier mois, à quelle fréquence avez-vous consommé des arachides, des noix, des graines, du tofu, des lentilles ou autres légumineuses, du beurre d'arachides ou autres beurres de noix, ou d'autres sources de protéines d'origine végétale?

**N'incluez pas** les haricots verts et les hamburgers végétariens prépréparés du commerce et les simili-viandes d'origine végétale prépréparées du commerce.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

8. Au cours du dernier mois, à quelle fréquence avez-vous consommé du yogourt, du kéfir ou du fromage?

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour



9. Au cours du dernier mois, à quelle fréquence avez-vous consommé du lait de vache ou des boissons d'origine végétale **non sucrées** (par exemple, du lait de soya, du lait aux amandes, du lait d'avoine) ?

**N'incluez pas** les petites quantités dans le café ou le thé, le lait au chocolat et autres laits aromatisés sucrés.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

10. Au cours du dernier mois, à quelle fréquence avez-vous consommé du lait au chocolat ou autres laits **aromatisés sucrés** ou des boissons d'origine végétale **sucrées** (par exemple, du lait de soya, du lait aux amandes, du lait d'avoine).

**N'incluez pas** les petites quantités dans le café ou le thé, les boissons diètes, les boissons sucrées avec des édulcorants et les boissons sans sucre.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

11. Au cours du dernier mois, à quelle fréquence avez-vous consommé des jus de fruits, des boissons aromatisées aux fruits, des boissons gazeuses **contenant du sucre**, des boissons sportives **sucrées**, des boissons énergisantes **sucrées**, des cafés sucrés ou thés **sucrés**, chauds ou glacés, ou des eaux **sucrées**?

**N'incluez pas** les boissons diètes, les boissons sucrées avec des édulcorants et les boissons sans sucre, comme les boissons gazeuses diètes.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

12. Au cours du dernier mois, à quelle fréquence avez-vous consommé des biscuits, des gâteaux, des muffins, des pâtisseries, des barres tendres, des barres protéinées, de la crème glacée, des bonbons, du chocolat, des céréales à déjeuner sucrées ou d'autres aliments sucrés?

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

13. Au cours du dernier mois, à quelle fréquence avez-vous consommé des craquelins, des croustilles, des bretzels, du maïs soufflé ou autres collations salées?

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

14. Au cours du dernier mois, à quelle fréquence avez-vous consommé du pain **blanc**, des bagels **blancs**, du riz **blanc**, des pâtes et des nouilles **blanches** ou d'autres grains **raffinés**, comme les céréales à déjeuner raffinées ?

**N'incluez pas** les aliments à base de blé entier ou de grains entiers.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

15. Au cours du dernier mois, à quelle fréquence avez-vous consommé du pain, des bagels, des pâtes, des nouilles, du quinoa, du gruau, du riz brun ou sauvage, des céréales à déjeuner ou tout autre **aliment fait de blé entier ou de grains entiers**?

**N'incluez pas** le pain blanc, les bagels blancs, les pâtes ou les nouilles blanches, le riz blanc et les céréales à déjeuner raffinées.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour

16. Au cours du dernier mois, à quelle fréquence avez-vous consommé de la margarine ou des huiles végétales (par exemple, l'huile d'olive, l'huile de canola, l'huile de tournesol)?

**N'incluez pas** le saindoux, l'huile de coco, l'huile de palme et le beurre.

- Jamais
- 1 fois au cours du dernier mois
- 2 - 3 fois au cours du dernier mois
- 1 - 2 fois par semaine
- 3 - 4 fois par semaine
- 5 - 6 fois par semaine
- 1 fois par jour
- 2 - 3 fois par jour
- 4 - 5 fois par jour
- 6 fois ou plus par jour