Advancing the Use of Knowledge Synthesis to Inform Policy and Decision Making in Agri-food Public Health

by

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ABSTRACT

ADVANCING THE USE OF KNOWLEDGE SYNTHESIS TO INFORM POLICY AND DECISION MAKING IN AGRI-FOOD PUBLIC HEALTH

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The research described in this thesis aims to advance the use of knowledge synthesis to inform policy and decision making in the field of agri-food public health. The scoping review is a relatively new approach to reviewing the literature for which there is not yet a standard study definition or definitive procedure. A scoping review was conducted to map out the characteristics and range of methodological processes used in scoping reviews identified in the published and grey literature. The results of the scoping review were used to propose a methodological framework for conducting scoping reviews, providing guidance and specific examples relevant to the field of agri-food public health. The framework is intended to advance the approach and enhance the consistency with which they are undertaken and reported, and help bring greater awareness about the scoping review as a research synthesis approach among the agri-food public health community. A survey was conducted to investigate the extent to which policy and decision makers in Canada are aware of and have used evidence from systematic reviews and other knowledge syntheses, and to evaluate their perceptions on the utility of systematic reviews and three review-derived summary formats to inform policy, practice and planning. The survey results indicate that summary formats highlighting the key findings of systematic reviews in plain language and incorporating supportive contextual information may help to increase the
uptake of evidence from systematic reviews into policy and practice decisions. An empirical comparative study was undertaken to assess the potential implications of four methodological shortcuts on the outcomes of three completed systematic reviews-meta-analyses addressing agri-food public health topics. The study results highlighted the risk of missing relevant literature when methodological shortcuts are applied to expedite systematic reviews, and will better enable rapid reviews authors to determine the most appropriate approach to synthesis when time is limited.
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STATEMENT OF WORK

Mai Pham developed the study protocol, performed data cleaning, analyzed the data, interpreted the results, and generated the manuscript for each chapter.

Dr. Rajić, Dr. McEwen, Dr. Sargeant and Dr. Papadopoulos consulted on study design, data analysis and interpretation of results, and reviewed and commented on manuscript drafts. Editing assistance for the thesis in its entirety was received from Dr. McEwen, Dr. Rajić, Dr. Sargeant and Dr. Papadopoulos.

For the scoping review of scoping reviews (Chapter 2), Mai Pham implemented the search, removed duplicate bibliographic records, and procured articles in full-text. Title and abstract relevance screening was performed by Mai Pham, Judy Greig, Ian Young and Kathleen Gropp. Data characterization was performed by Mai Pham, Judy Greig and Kathleen Gropp.

For the survey of policy and decision makers in Canada (Chapter 4), Mai Pham recruited participants and conducted the follow-up interviews.

For the study evaluating the potential implications of rapid review shortcuts (Chapter 5), systematic review data were obtained from Oliver Bucher, Judy Greig, and Dr. Barbara Wilhelm. Relevance screening was performed by Shannon Harding and Lea Nogeira Borden. Mai Pham evaluated the impact of each shortcut and performed all meta-analyses in STATA.
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CHAPTER ONE

Introduction, Thesis Rationale, Literature Review, Thesis Objectives

Introduction

Science is meant to be a cumulative process in which individual research studies contribute to the overall body of knowledge on a topic (Chalmers et al., 2002; World Health Organization, 2004). Plans for new research should be informed by a systematic assessment of existing research evidence and should incorporate lessons from previous studies (Chalmers, 2005; Chalmers, 2001). A failure to do so may result in the unnecessary duplication of research, an inefficient use of the limited resources available for research, and missed opportunities for advancement of knowledge (Chalmers et al., 2002; World Health Organization, 2004). Knowledge syntheses are thus important scientific approaches as they use systematic and transparent processes to integrate the findings of individual studies within the larger body of research knowledge on the topic (Canadian Institutes of Health Research, 2008; Grimshaw et al., 2012). By providing an assessment of the current state of knowledge on a given topic or question, they can provide a reliable evidentiary base with which to inform future research, policy and practice decisions (World Health Organization, 2004; Canadian Institutes of Health Research, 2008).

Over the past few decades, knowledge synthesis methods have been widely adopted and further developed in various fields such as health, social science, education and psychology (Chalmers et al., 2002). However, the formal adoption of knowledge syntheses to address agri-food public health issues and topics did not widely occur until the mid-2000s (Young et al., 2014b). The field of agri-food public health comprises a wide range of multidisciplinary issues and topics at the interface of humans, animals and the environment. The research described in
this thesis aims to advance the use of knowledge synthesis to inform policy and decision making in agri-food public health. By employing examples from the field, it proposes a methodological framework for conducting scoping reviews, assesses the implications of applying methodological shortcuts to expedite systematic reviews, and evaluates the perceptions of policy and decision makers towards the utility of knowledge syntheses and review-derived formats for informing policy. The literature review that follows is intended to provide a brief introduction to the following areas: knowledge synthesis and its various approaches, the use of research evidence in policy and practice, and barriers to and initiatives to enhance the uptake of systematic reviews.

**Literature Review**

**Knowledge synthesis methods**

Knowledge synthesis refers to the integration of findings of individual studies within the larger body of research knowledge on the topic (Canadian Institutes of Health Research, 2008). It is an important process since it involves assessing the current state of knowledge on a given topic or question (Lomas, 2005). In doing so, knowledge syntheses can be used to identify what is known about a topic to prevent unnecessary repetition of research studies (Grimshaw et al., 2012), identify gaps in knowledge for future research (Mays et al., 2001; Tricco et al., 2013), and understand inconsistencies across studies (Grimshaw et al., 2012; Tricco et al., 2013). In contrast to traditional narrative reviews that often do not use structured methods to identify and assess relevant studies (Mulrow, 1987), knowledge syntheses are conducted using explicit and reproducible methodologies (Mays et al., 2001; Greenhalgh, 1997). Knowledge synthesis uses various methods or approaches, such as systematic reviews, meta-analyses, rapid reviews and scoping reviews.

Systematic reviews are widely regarded as the best source of synthesized research
evidence because they use rigorous and transparent methods to identify, appraise and synthesize all relevant research evidence on a specific and clearly defined question (Centre for Reviews and Dissemination, 2008). Procedures for carrying out the review are explicitly defined in advance in order to minimize bias and random errors (Higgins & Green, 2011; Cook et al., 1997). As a result, they provide a more transparent, robust, and reliable assessment of the state of knowledge on a topic than traditional, narrative reviews (Higgins & Green, 2011; Sargeant et al., 2006a). Systematic reviews can determine whether findings are consistent across studies, including the risk-of-bias and overall quality-of-evidence, and the extent to which results might be generalized across populations and other settings (Higgins & Green, 2011; Mulrow, 1994; Schünemann et al., 2006; Guyatt et al., 2008a; Guyatt et al., 2008b). When appropriate, systematic reviews may include a meta-analysis, which is a statistical method for pooling the quantitative results from individual studies to provide a more precise overall estimate of effect (Higgins & Green, 2011; Glass, 1976; Borenstein et al., 2009).

The rapid review is a streamlined approach to synthesizing research evidence when a short timeframe (e.g. less than six months) for completion of the review is required (Ganann et al., 2010; Harker & Kleijnen, 2012; Khangura et al., 2012). Although there is currently no standardized approach for conducting rapid reviews, they generally follow the same methodological process as traditional systematic reviews, but with one or more methodological shortcuts (Ganann et al., 2010; Harker & Kleijnen, 2012). Some of the streamlined methods that have been adopted in rapid reviews include: addressing a narrower research question (e.g. specific to a particular study population or setting); limiting the number of electronic databases searched; limiting or eliminating the search of the grey literature; defining narrower study eligibility criteria (e.g. study design, language, location, publication dates); screening and
reviewing by a single reviewer; limiting or eliminating risk-of-bias assessment, and eliminating meta-analyses (Ganann et al., 2010; Harker & Kleijnen, 2012; Cameron et al., 2007; Grant & Booth, 2009; Van De Velde et al., 2011). While the methodological shortcuts allow rapid reviews to be conducted in less time and with fewer resources, they also increase the likelihood of introducing bias into the review process and missing important information from grey literature (Ganann et al., 2010; Harker & Kleijnen, 2012).

The scoping review is an approach that aims to map the existing literature in a field of interest in terms of the volume, nature and characteristics of the primary research (Arksey & O'Malley, 2005). Consequently, scoping reviews provide a descriptive overview of the characteristics of research underpinning a broad topic with minimal critical appraisal of individual studies or quantitative synthesis of results across studies (Arksey & O'Malley, 2005; Brien et al., 2010). Scoping reviews can be of particular use when a topic has not yet been extensively reviewed or is of a complex or heterogeneous nature (Mays et al., 2001; Shankardass et al., 2012). They are commonly undertaken to: examine the extent, range and nature of research activity in a topic area; determine the value and potential scope and cost of undertaking a full systematic review; summarize and disseminate research findings; and identify research gaps in the existing literature (Arksey & O'Malley, 2005; Levac et al., 2010; Armstrong et al., 2011). Since the scoping review employs rigorous and transparent processes, it can be used as a standalone project or as a preliminary step to a systematic review (Arksey & O'Malley, 2005).

The knowledge syntheses described above are essential components of knowledge translation (KT) by helping to bridge the gap between research and decision making (Tricco et al., 2011). For target audiences outside the research community—such as policy makers, managers, practitioners and end-user groups—knowledge syntheses can bring together a
potentially large and scattered body of published research into a more concise and manageable format (Mays et al., 2001). Since few individual studies provide sufficient evidence to change practice or policy, knowledge syntheses should whenever possible form the basis for KT activities and products (Grimshaw et al., 2012).

**Use of research evidence in policy and practice**

Research evidence can be one of many inputs used by policy makers and managers in making decisions about policy and practice (Lavis et al., 2005; Mays et al., 2005; Rajić et al., 2013). Decision making is a complex and value-laden process in which other factors are also considered, such as beliefs, local applicability, resource availability, costs, and political context (Lavis et al., 2005; Mitton et al., 2007; Rajić & Young, 2013; Rycroft-Malone et al., 2004; Bowen et al., 2009). Integrating research knowledge into the decision making process helps to ensure that the best available knowledge is used to inform policy and practice decisions, as well as, enhancing the accountability and transparency of the process (Rajić & Young, 2013).

However, it is well recognized that research evidence is generally underutilized in policy and practice decision making across many sectors (World Health Organization, 2004; Rajić et al., 2013; Graham et al., 2006). Lack of time, user capacity to critical appraise evidence, support from management, interaction between researchers and policy makers, local applicability and data availability are frequently reported as barriers to evidence-informed decision making (Lavis et al., 2005; Bowen et al., 2009).

The research and decision making processes tend to exist in different sectors and there is no direct route linking the two (World Health Organization, 2004; Straus et al., 2009). The end-result is that research often has limited relevance to or impact on practice, planning or policy making (World Health Organization, 2004). Knowledge translation (KT) is a concept that aims
to address the gap between what is known from research and the implementation of this knowledge in policy and practice (Graham et al., 2006). More formally, KT is defined as “a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge” (Canadian Institutes of Health Research, 2008). The KT process involves collaborative and two-way interaction between researchers and knowledge end-users to enhance the uptake and application of relevant research evidence by end-users (Graham et al., 2006).

The knowledge-to-action cycle (Figure 1.1) is a conceptual framework that provides an approach for the KT process (Graham et al., 2006). The framework presents KT as an iterative, complex and dynamic process that can be divided conceptually into two main elements: knowledge creation and action (Straus et al., 2009). Knowledge creation comprises three phases: knowledge inquiry, knowledge synthesis and the development of knowledge tools or products. Primary research is the knowledge inquiry phase. The knowledge synthesis phase involves use of explicit and reproducible methods to integrate and combine existing knowledge from contributions generated by primary research. The final phase consists of developing tools or products that present synthesized knowledge in clear, concise and user-friendly formats. Knowledge is presumed to become more distilled and refined as it moves through the three phases and thus be more useful to end-users (Graham et al., 2006). The action cycle consists of seven phases that can influence the application of research knowledge by end-users. The seven phases can occur consecutively or simultaneously (Straus et al., 2009), and are characterized as: identifying a problem that needs addressing and using synthesis methods to identify relevant knowledge; adapting the identified knowledge to the local context; assessing barriers to using the knowledge; selecting, tailoring and implementing interventions to disseminate the knowledge;
monitoring use of knowledge after interventions have been launched; evaluating the outcomes of knowledge use; and determining strategies for ensuring sustained knowledge use (Graham et al., 2006).

**Barriers to and initiatives to enhance the uptake of systematic reviews**

Systematic reviews are widely considered to be more appropriate sources of synthesized evidence to inform decision making than the opinions of experts or the most recent or most highly-cited individual primary research studies (Tricco et al., 2011; Lavis et al., 2005). Despite the high quality of evidence that systematic reviews can provide in support of planning, practice or policy, they are infrequently used to make decisions (Tricco et al., 2011; Pope et al., 2006). One reason is the frequent failure of systematic reviews to provide the contextual information that end-users seek to determine the local applicability of the evidence (Lomas, 2005; Lavis et al., 2005). While systematic reviews can provide useful information about the effectiveness of an intervention, they often do not address issues related to intervention costs, public sensitivity, harms or risks, and ease of implementation (Lomas, 2005; Lavis et al., 2006). A second barrier to their uptake in decision making is the format in which the results of systematic reviews are typically disseminated. Systematic reviews are most commonly published in peer-reviewed journals; a format generally written for an academic audience, focused on methodological rigour and not readily accessible to the general public (Tricco et al., 2011). Policy and decision makers often do not possess sufficient understanding of research terminology and methodology to critically appraise published systematic reviews. Finally, due to the lengthy time required to complete a systematic review, this format may not best serve the need of decision makers for rapid advice on issues of urgent concern when an up-to-date systematic review does not already exist (Thomas et al., 2013; Watt et al., 2008).
Recent efforts sought to enhance the uptake of systematic reviews in decision making by making them more accessible and user-friendly (Tricco et al., 2011). Lavis et al. (Lavis et al., 2005) suggested that presenting systematic reviews using a graded-entry format (e.g. 1:3:25) (Canadian Foundation for Healthcare Improvement, 2010) is preferred over current approaches. The 1:3:25 format was designed to provide researchers with guidelines on communicating research findings to decision makers. It consists of one-page of take-home messages, three-pages of executive summary, and a 25-page full report written in a non-academic style (Canadian Foundation for Healthcare Improvement, 2010). Building on this format, Young et al. (2014) developed a guideline for summarizing systematic reviews in one- and three-page plain-language formats: a one-page summary of the key results and implications, and a three-page summary of the findings with supportive contextual information (e.g. cost, practicality, availability, public sensitivity, additional benefits or harms) (Young et al., 2014a). The multiple formats approach can address the needs of different decision makers and also serve as user-friendly “front ends” that can be more readily accessible to non-academic audiences than published systematic reviews (Lavis et al., 2005; Young et al., 2014a).

The Cochrane Collaboration, an international organization that prepares and maintains systematic reviews of the effects of healthcare interventions, has developed a “Summary of Findings” table format for presenting the findings for the most important outcomes of a review in a transparent and simple tabular format (Higgins & Green, 2011). The table was designed for a broader audience and is intended to provide a concise summary of the key information that is needed by someone making a decision (Guyatt et al., 2011). For each important outcome included in a “Summary of Findings” table, data are provided for the number of participants and studies addressing the outcome, the study design, an overall judgment of the quality of evidence
(high, moderate, low or very low), the typical burden of the outcome, and the absolute and relative effects of the intervention (Guyatt et al., 2011). The Collaboration has also developed standard requirements for writing plain language summaries for Cochrane reviews (Higgins & Green, 2011); these summaries are made freely available at the Cochrane Summaries website (http://summaries.cochrane.org/).

**Thesis Rationale and Objectives**

Agri-food public health refers to the cross-cutting and overlapping areas of veterinary public health, food safety and “One Health” (Rajić & Young, 2013; Sargeant et al., 2006b). One Health is a concept that recognizes that the health of humans, animals and the environment are extrinsically linked and that a collaborative approach between multiple disciplines is required to achieve optimal health for all (Kahn et al., 2014). Examples of agri-food public health issues include: antimicrobial use and antimicrobial resistance, emerging infectious diseases, and the prevention and management of hazards in the food chain (Rajić & Young, 2013). Policy makers and decision makers in agri-food public health need access to reliable information to help inform the decisions that affect public health and food safety. Knowledge syntheses—such as systematic reviews and meta-analysis—can provide them with the most trustworthy and concise information about the effectiveness of potential interventions, risk factors for disease or infection, and where knowledge gaps exist; the latter are useful for targeting further research (Young et al., 2014b; Sargeant et al., 2005). The first guidance on how to apply systematic review and meta-analysis methods in agri-food public health was published in 2005 (Sargeant et al., 2006a; Sargeant et al., 2005). Since then, systematic reviews and meta-analyses have been increasingly conducted in this area, and the application of other synthesis methods such as scoping reviews and rapid reviews has also begun (Young et al., 2014b). Enhanced uptake of these knowledge syntheses by
policy and decision makers is important in order to ensure that the best available evidence is used to inform agri-food public health practice, planning and policy.

The research described in this thesis aims to advance the use of knowledge synthesis in agri-food public health through four main objectives:

1. Gain a better understanding of the scoping review approach by mapping out the characteristics and range of methodological processes used in scoping reviews identified in the published and grey literature.
2. Propose a methodological framework for conducting scoping reviews to advance the approach and enhance the consistency with which they are undertaken and reported.
3. Investigate the extent to which policy and decision makers in Canada are aware of and have used evidence from systematic reviews and other knowledge syntheses, and evaluate their feedback on the utility of systematic reviews and three corresponding summary formats to inform policy, practice and planning.
4. Evaluate rapid review methods by assessing the impact of streamlining four systematic review processes on the number of included studies and the direction, magnitude and precision of summary estimates from meta-analysis.

This thesis is presented in a manuscript-based format. Chapter 2 describes a scoping review that provides an overview of the characteristics of scoping reviews in the literature. Chapter 3 proposes a methodological framework for conducting scoping reviews, with guidance and examples relevant to the field of agri-food public health. Chapter 4 describes a survey of policy and decision makers in Canada on the utility of knowledge syntheses and review-derived formats for informing decisions. Chapter 5 describes a comparative study of the implications of applying methodological shortcuts to expedite systematic reviews. Chapter 6 is a summary
discussion of the research, including its strengths and weaknesses, and presents the overall conclusions and recommendations arising from this thesis project.
Figure 1.1. The knowledge-to-action framework. The framework provides a conceptual model for the knowledge translation process. Adapted from “Lost in knowledge translation: Time for a map?” by I. Graham, 2006, *Journal of Continuing Education in the Health Professions*, 26(1), p. 19. Copyright 2006 by the Alliance for Continuing Medical Education, the Society for Medical Education, the Society for Academic Continuing Medical Education, and the Council on CME, Association for Hospital Medical Education. Adapted with permission.
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CHAPTER TWO

A scoping review of scoping reviews: advancing the approach and enhancing the consistency

This chapter has been published as:

1. Background

The scoping review has become an increasingly popular approach for synthesizing research evidence (Daudt et al., 2013; Davis et al., 2009; Levac et al., 2010). It aims to map the existing literature in a field of interest in terms of the volume, nature and characteristics of the primary research (Arksey & O’Malley, 2005). A scoping review of a body of literature can be of particular use when the topic has not yet been extensively reviewed or is of a complex or heterogeneous nature (Mays et al., 2001). They are commonly undertaken to: examine the extent, range and nature of research activity in a topic area; determine the value and potential scope and cost of undertaking a full systematic review; summarize and disseminate research findings; and identify research gaps in the existing literature (Levac et al., 2010; Arksey & O'Malley, 2005). As it provides a rigorous and transparent method for mapping areas of research, a scoping review can be used as a standalone project or as a preliminary step to a systematic review (Arksey & O'Malley, 2005).

Scoping reviews share a number of the same processes as systematic reviews as they both use rigorous and transparent methods to comprehensively identify and analyze all the relevant literature pertaining to a research question (DiCenso et al., 2010). The key differences between
the two review methods can be attributed to their differing purposes and aims. First, the purpose of a scoping review is to map the body of literature on a topic area (Arksey & O'Malley, 2005), while the purpose of a systematic review is to sum up the best available research on a specific question (Campbell Collaboration, 2013). Subsequently, a scoping review seeks to present an overview of a potentially large and diverse body of literature pertaining to a broad topic, whereas a systematic review attempts to collate empirical evidence from a relatively smaller number of studies pertaining to a focused research question (Arksey & O'Malley, 2005; Higgins & Green, 2011). Second, scoping reviews generally include a greater range of study designs and methodologies than systematic reviews addressing the effectiveness of interventions, which often focus on randomized controlled trials (Arksey & O'Malley, 2005). Third, scoping reviews aim to provide a descriptive overview of the reviewed material without critically appraising individual studies or synthesizing evidence from different studies (Arksey & O'Malley, 2005; Brien et al., 2010). In contrast, systematic reviews aim to provide a synthesis of evidence from studies assessed for risk of bias (Higgins & Green, 2011).

Scoping reviews are a relatively new approach for which there is not yet a universal study definition or definitive procedure (Daudt et al., 2013; Davis et al., 2009; Levac et al., 2010; Arksey & O'Malley, 2005; Anderson et al., 2008). In 2005, Arksey & O’Malley published the first methodological framework for conducting scoping reviews with the aims of clarifying when and how one might be undertaken. They proposed an iterative six-stage process: 1. identifying the research question; 2. identifying relevant studies; 3. study selection; 4. charting the data; 5. collating, summarizing and reporting the results; and 6. an optional consultation exercise (Arksey & O'Malley, 2005). Arksey & O’Malley intended for their framework to stimulate discussion about the value of scoping reviews and provide a starting point towards a methodological
framework. Since its publication, a few researchers have proposed enhancements to the Arksey & O’Malley framework based on their own experiences with it (Daudt et al., 2013; Levac et al., 2010; Brien et al., 2010) or a review of a selection of scoping reviews (Davis et al., 2009; Anderson et al., 2008).

In recent years, scoping reviews have become an increasingly adopted approach and have been published across a broad range of disciplines and fields of study (Anderson et al., 2008). To date, little has been published of the extent, nature and use of completed scoping reviews. One study that explored the nature of scoping reviews within the nursing literature found that the included reviews (N=24) varied widely in terms of intent, procedure and methodological rigour (Davis et al., 2009). Another study that examined twenty-four scoping reviews commissioned by a health research programme found that the nature and type of the reports were wide ranging, and reported that the value of scoping reviews is ‘increasingly limited by a lack of definition and clarity of purpose’ (Anderson et al., 2008). Given that these studies examined only a small number of scoping reviews from select fields, it is not known to what extent scoping reviews have been undertaken in other fields of research and whether these findings are representative of all scoping reviews as a whole. A review of scoping reviews across the literature can provide a better understanding of how the approach has been used and some of the limitations and challenges encountered by scoping review authors. This information would provide a basis for the development and adoption of a universal definition and methodological framework.

The purpose of this paper is to provide an overview of existing scoping reviews in the literature. The four specific objectives of this scoping review were to: 1) conduct a systematic search of the published and grey literature for scoping review papers, 2) map out the characteristics and range of methodologies used in the identified scoping reviews, 3) examine
reported challenges and limitations of the scoping review approach, and 4) propose recommendations for advancing the approach and enhancing the consistency with which they are undertaken and reported.

2. Methods

This scoping review began with the establishment of a research team consisting of individuals with expertise in epidemiology and research synthesis (Levac et al., 2010). The team advised on the broad research question to be addressed and the overall study protocol, including identification of search terms and selection of databases to search.

The methodology for this scoping review was based on the framework outlined by Arksey & O’Malley (2005) and ensuing recommendations made by Levac et al. (2010). The review included the following five key phases: 1) identifying the research question, 2) identifying relevant studies, 3) study selection, 4) charting the data, and 5) collating, summarizing and reporting the results. The optional ‘consultation exercise’ of the framework was not conducted. A detailed review protocol can be obtained from the primary author upon request.

2.1. Research question

This review was guided by the question, ‘What are the characteristics and range of methodologies used in scoping reviews in the literature?’ For the purposes of this study, a scoping review is defined as a type of research synthesis that aims to ‘map the literature on a particular topic or research area and provide an opportunity to identify key concepts; gaps in the research; and types and sources of evidence to inform practice, policymaking, and research’ (Daudt et al., 2013).
2.2. Data sources and search strategy

The initial search was implemented on June 17, 2011, in four electronic databases: MEDLINE/PubMed (biomedical sciences, 1946–present), SciVerse Scopus (multidisciplinary; 1823–present), CINAHL/EBSCO (nursing and allied health; 1981–present) and Current Contents Connect/ISI Web of Knowledge (multidisciplinary current awareness; 1998–present). The databases were selected to be comprehensive and to cover a broad range of disciplines. No limits on date, language, subject or type were placed on the database search. The search query consisted of terms considered by the authors to describe the scoping review and its methodology: scoping review, scoping study, scoping project, literature mapping, scoping exercise, scoping report, evidence mapping, systematic mapping and rapid review. The search query was tailored to the specific requirements of each database [see Appendix 2.1].

Applying the same search string that was used for the search in SciVerse Scopus (Elsevier), a web search was conducted in SciVerse Hub (Elsevier) to identify grey literature. The a priori decision was made to screen only the first 100 hits (as sorted by relevance by Scopus Hub) after considering the time required to screen each hit and because it was believed that further screening was unlikely to yield many more relevant articles (Stevinson & Lawlor, 2004). The following websites were also searched manually: the Health Services Delivery Research Programme of the National Institute for Health Research (http://www.netscc.ac.uk/hsdr/), the National Co-ordinating Centre for NHS Service Delivery and Organisation (http://php.york.ac.uk/inst/spru/pubs/main.php), NHS Evidence by the National Institute for Health and Clinical Excellence (http://evidence.nhs.uk/), the University of York Social Policy Research Unit (http://php.york.ac.uk/inst/spru/pubs/main.php), the United Kingdom’s Department of Health (http://www.dh.gov.uk/en/index.htm) and Google (www.google.com).
The reference lists of 10 randomly-selected relevant articles (Bassi et al., 2010; Churchill et al., 2011; Gagliardi et al., 2009; Hazel, 2005; Kushki et al., 2011; Meredith et al., 2009; Ravenek et al., 2010; Sawka et al., 2010; Spilsbury et al., 2011; Vissandjee et al., 2007) and 8 review articles on scoping reviews (Davis et al., 2009; Levac et al., 2010; Arksey & O'Malley, 2005; Anderson et al., 2008; Armstrong et al., 2011; Grant & Booth, 2009; Hetrick et al., 2010; Rumrill et al., 2010) were manually searched to identify any further scoping reviews not yet captured. A ‘snowball’ technique was also adopted in which citations within articles were searched if they appeared relevant to the review (Jaskiewicz & Tulenko, 2012; Hepplestone et al., 2011).

A follow-up search of the four bibliographic databases and grey literature sources was conducted on October 1, 2012 to identify any additional scoping reviews published after the initial search [see Appendix 2.1]. A search of Google with no date restrictions was also conducted at this time; only the first 100 hits (as sorted by relevance by Google) were screened.

2.3. Citation management

All citations were imported into the web-based bibliographic manager RefWorks 2.0 (RefWorks-COS, Bethesda, MD), and duplicate citations were removed manually with further duplicates removed when found later in the process. Citations were then imported into the web-based systematic review software DistillerSR (Evidence Partners Incorporated, Ottawa, ON) for subsequent title and abstract relevance screening and data characterization of full articles.

2.4. Eligibility criteria

A two-stage screening process was used to assess the relevance of studies identified in the search. Studies were eligible for inclusion if they broadly described the use of a scoping review methodology to identify and characterize the existing literature or evidence base on a
broad topic. Due to limited resources for translation, articles published in languages other than English, French or Spanish were excluded. Papers that described the scoping review process without conducting one and reviews of scoping reviews were excluded from the analysis, but their reference list was reviewed to identify additional scoping reviews. When the same data were reported in more than one publication (e.g., in a journal article and electronic report), only the article reporting the most complete data set was used.

2.5. Title and abstract relevance screening

For the first level of screening, only the title and abstract of citations were reviewed to preclude waste of resources in procuring articles that did not meet the minimum inclusion criteria. A title and abstract relevance screening form was developed by the authors and reviewed by the research team [See Appendix 2.2]. The form was pre-tested by 3 reviewers (MP, JG, IY) using 20 citations to evaluate reviewer agreement. The overall kappa of the pre-test was 0.948, where a kappa of greater than 0.8 is considered to represent a high level of agreement (Dohoo et al., 2012). As there were no significant disagreements among reviewers and the reviewers had no revisions to recommend, no changes were made to the form. The title and abstract of each citation were independently screened by two reviewers. Reviewers were not masked to author or journal name. Titles for which an abstract was not available were included for subsequent review of the full article in the data characterization phase. Reviewers met throughout the screening process to resolve conflicts and discuss any uncertainties related to study selection (Levac et al., 2010). The overall kappa was 0.90.

2.6. Data characterization

All citations deemed relevant after title and abstract screening were procured for subsequent review of the full-text article. For articles that could not be obtained through
institutional holdings available to the authors, attempts were made to contact the source author or journal for assistance in procuring the article. A form was developed by the authors to confirm relevance and to extract study characteristics such as: publication year, publication type, study sector, terminology, use of a published framework, quality assessment of individual studies, types of data sources included, number of reviewers, and reported challenges and limitations [see Appendix 2.3]. This form was reviewed by the research team and pre-tested by all reviewers (MP, AR, JG, IY, KG) before implementation, resulting in minor modifications to the form. The characteristics of each full-text article were extracted by two independent reviewers (MP and JG/KG). Studies excluded at this phase if they were found to not meet the eligibility criteria. Upon independently reviewing a batch of 20 to 30 articles, the reviewers met to resolve any conflicts and to help ensure consistency between reviewers and with the research question and purpose (Levac et al., 2010).

2.7. Data summary and synthesis

The data were compiled in a single spreadsheet and imported into Microsoft Excel 2010 (Microsoft Corporation, Redmond, WA) for validation and coding. Fields allowing string values were examined for implausible values. The data were then exported into STATA version 12 (StataCorp, College Station, TX) for analyses. Descriptive statistics were calculated to summarize the data. Frequencies and percentages were utilized to describe nominal data.

3. Results

3.1. Search and selection of scoping reviews

The original search conducted in June 2011 yielded 2528 potentially relevant citations. After deduplication and relevance screening, 238 citations met the eligibility criteria based on title and abstract and the corresponding full-text articles were procured for review. Four articles
could not be procured and were thus not included in the review (Bhavaraju, 1987; Centre for Reviews and Dissemination, 2004; Connell et al., 2006; Levy & Sanghvi, 1986). After data characterization of the full-text articles, 182 scoping reviews remained and were included in the analysis. The updated search in October 2012 produced 758 potentially relevant citations and resulted in another 162 scoping reviews being included. In total, 344 scoping reviews were included in the study [see Appendix 2.4]. The flow of articles through identification to final inclusion is represented in Figure 2.1.

Many citations were excluded upon screening at the title and abstract level as several terms used in the search algorithm also corresponded to other study designs. For example, the term ‘scoping study’ was also used to describe studies that assessed the chemical composition of samples (e.g. Banks & Banks, 2001; Forrest et al., 2011; Behrens et al., 1998), and preliminary mining studies (Butcher, 2002; Bhargava et al., 2008). ‘Scoping exercise’ also described studies that scoped an issue using questionnaires, focus groups, and/or interviews (e.g. Willis et al., 2011; Norwood & Skinner, 2012; Malloch & Burgess, 2007). ‘Rapid review’ was also used to describe the partial rescreening of negative cervical smears as a method of internal quality assurance (e.g. Faraker & Boxer, 1996; Frist, 1997; Shield & Cox, 1998). ‘Systematic mapping’ was also used in studies pertaining to topographic mapping (e.g. Liu et al., 2011; Noda & Fujikado, 1987; Gunnell, 1997) and mapping of biomolecular structures (e.g. Betz et al., 2006; Camargo et al., 1976; Descaries et al., 1982).

3.2. General characteristics of included scoping reviews

The general characteristics of scoping reviews included in this study are reported in Table 2.1. All included reviews were published between 1999 and October 2012, with 68.9% (237/344) published after 2009. Most reviews did not report the length of time taken to conduct the review;
for the 12.8% (44/344) that did, the mean length was approximately 5.2 months with a range of 2
weeks to 20 months. Journal articles (64.8%; 223/344) and government or research station
reports (27.6%; 95/344) comprised the majority of documents included in the review. The
number of journal articles was slightly underrepresented as 10 were excluded as duplicates since
the same scoping review was also reported in greater detail in a report. The included reports
ranged greatly in length, from 4 pages (Healthcare Improvement Scotland, 2012) to over 300
pages (Wallace et al., 2006).

The included scoping reviews varied widely in terms of the terminology used to describe
the methodology. ‘Scoping review’ was the term most often used, reported in 61.6% (212/344)
of included studies. An explicit definition or description of what study authors meant by ‘scoping
review’ was reported in 63.1% (217/344) of articles. Most definitions centered around scoping
reviews as a type of literature that identifies and characterizes, or maps, the available research on
a broad topic. However, there was some divergence in how study authors characterized the
rigour of the scoping review methodology. The terms ‘systematic’, ‘rigorous’, ‘replicable’ and
‘transparent’ were frequently used to describe the methodology, and several authors described
scoping reviews to be comparable in rigour to systematic reviews (Gagliardi et al., 2009;
Ravenek et al., 2010; Feehan et al., 2011; Heller et al., 2011; Liu et al., 2010). In contrast, some
studies described the methodology as less rigorous or systematic than a systematic review
(Cameron et al., 2008; Campbell et al., 2011; Levac et al., 2009). Brien et al. (2010) commented
that scoping reviews were ‘often misinterpreted to be a less rigorous systematic review, when in
actual fact they are a different entity’.

Some reviews were conducted as stand-alone projects while others were undertaken as
parts of larger research projects. Study authors reported that a main purpose or objective for the
majority of articles (97.4%; 335/344) was to identify, characterize and summarize research evidence on a topic, including identification of research gaps. Only 6.4% (22/344) of included articles conducted the scoping review methodology to identify questions for a systematic review. As response options were not mutually exclusive, some reviews reported multiple purposes and/or objectives. A commissioning source was reported in 31.4% (108/344) of reviews; some reported that they were specifically commissioned to advise a funding body as to what further research should be undertaken in an area (E.g. Arksey et al., 2002; Baxter et al., 2008; Brearley et al., 2011; Carr-Hill et al., 2003; Crilly et al., 2010; Fotaki et al., 2005; Trivedi et al., 2009; Williams et al., 2008).

The majority of the included scoping reviews addressed a health topic, making up 74.1% (255/344) of reviews. The use of scoping reviews in software engineering—or ‘systematic mapping’ as termed in the sector—has increased in recent years with 92.7% (38/41) published after 2010. The topics examined in the included scoping reviews ranged greatly, spanning from data on multiplayer online role-playing games (MMORPGs) (Meredith et al., 2009), to factors that influence antibiotic prophylaxis administration (Gagliardi et al., 2009). The topics investigated were generally broad in nature, such as: ‘what is known about the diagnosis, treatment and management of obesity in older adults’ (Decaria et al., 2012). Some reviews that were conducted under short time frames (e.g. 1 month) addressed more specific questions such as: ‘what is the published evidence of an association between hospital volume and operative mortality for surgical repair (open and endovascular) of unruptured and ruptured abdominal aortic aneurysms?’ (Healthcare Improvement Scotland, 2011).
3.3. Methodological characteristics of included scoping reviews

The methodological characteristics of included scoping reviews are reported in Table 2. Approximately half of the reviews (50.6%; 174/344) reported using one or more methodological frameworks for carrying out the scoping review. Framework use varied greatly between reviews from different sectors, such as in 85.4% (35/41) of reviews from the software engineering sector and in 44.0% (89/202) of health sector reviews. Overall, the Arksey & O’Malley (2005) framework was the most frequently used, reported in 62.6% (109/174) of studies that reported using a framework. Among reviews from the software engineering sector that reported using a framework, frameworks by Kitchenham & Charters (2007) (40.0%; 14/35) and Petersen et al. (2008) (51.4%; 18/35) were most commonly employed. The use of a framework increased over time, from 31.6% (6/19) of reviews published from 2000–2004, to 42.5% (37/87) of reviews from 2005–2009, and to 55.3% (131/237) of reviews published from 2010 onward.

Following the search, 79.7% (174/344) of reviews used defined inclusion and exclusion criteria to screen out studies that were not relevant to the review question(s). Among these, only 6 reviews explicitly reported that criteria were redefined or amended on a post hoc basis during the review process (Marsella, 2009; Johnston et al., 2010; Crooks et al., 2010; Snyder et al., 2011; Victoor et al., 2012; While et al., 2005). The selection criteria in a few reviews were unclear due to ambiguous wording such as ‘real paper’ (Saraiva et al., 2012), ‘scientific papers’ (Victoor et al., 2012), and ‘culling low-interest articles’ (Catts et al., 2010). Compared to the study selection process, fewer details were generally reported about the data characterization (or charting) of individual studies. Nearly a quarter of reviews (23.8%; 82/344) did not report any detail as to how the included studies were characterized, and it was unclear in 33.4% (115/344) as to how many reviewers were involved.

The majority of included reviews (77.7%, 267/344) did not assess the methodological
quality of individual studies. A number of these studies reported that quality assessment was not conducted as it is not a priority in scoping reviews or part of the scoping review methodology. Two studies reported the use of publication in a peer-reviewed publication as a proxy for good quality (Baxter et al., 2008; Pita et al., 2011) and another reported using studies included in existing reviews or meta-analyses to ‘overcome’ the lack of quality assessment (MacDougall, 2011). Of the 22.4% (77/344) of articles that reported a critical appraisal step, the rigor with which it was conducted ranged from the reviewer’s subjective assessment using a scale of high, medium or low (Roland et al., 2006), to the use of published tools such as the Jadad scale (Jadad et al., 1996) for randomized control trials (Borkhoff et al., 2011; Deshpande et al., 2009).

The level of detail reported about the search strategy varied considerably across the reviews. Table 2.3 displays information about the search strategy reported in the included reviews by time. Overall, the detail of reporting for the search increased numerically over time. For example, 78.06% of reviews published after 2009 reported complete strings or a complete list of search terms, compared to 57.89% of reviews published between 2000 and 2004 and 67.82% of reviews published between 2005 and 2009.

Table 2.4 summarizes how some of the results of the included reviews were reported and ‘charted’. A flow diagram was used to display the flow of articles from the initial search to final selection in 35.8% of reviews (123/344). Characteristics of included studies were often displayed in tables (82.9%; 285/344); ranging from basic tables that described the key characteristics of each included study, to cross-tabulation heat maps that used colour-coding to highlight cell values. Study characteristics were also mapped graphically in 28.8% (99/344) of reviews, often in the form of histograms, scatterplots or pie charts. Reviews from the software engineering sector frequently used bubble charts to map the data (Figure 2.2 is an example of a bubble chart).
In summarizing the reviewed literature, 77.6% (267/344) of reviews noted gaps where little or no research had been conducted, and 77.9% (268/344) recommended topics or questions for future research.

Stakeholder consultation is an optional sixth-step in the Arksey & O’Malley (2005) framework and was reported in 39.8% (137/344) of reviews. This optional step was reported in 34.9% (38/109) of reviews that used the Arksey & O’Malley framework, compared with 42.13% (99/235) of reviews that did not. Stakeholders were most often consulted at the search phase to assist with keyword selection for the search strategy or help identify potential studies to include in the review (74.5%; 102/137). Stakeholders were less frequently involved in the interpretation of research findings (30.7%; 42/137) and in the provision of comments at the report writing stage (24.1%; 33/137). Ongoing interaction with stakeholders throughout the review process was reported in 25.9% (89/344) of all reviews. Comparing between sectors, the proportion of reviews that reported consulting with stakeholders was highest in the social sciences sector (71.4%; 10/14) and lowest in the software engineering sector (2.4%; 1/41).

3.4. Reported challenges and limitations

Limitations in the study approach were reported in 71.2% (245/344) of reviews. The most frequent limitation reported in the reviews was the possibility that the review may have missed some relevant studies (32.0%; 110/344). This limitation was frequently attributed to database selection (i.e. searching other databases may have identified additional relevant studies), exclusion of the grey literature from the search, time constraints, or the exclusion of studies published in a language other than English. In comparison to systematic reviews, one review noted that it was ‘unrealistic to retrieve and screen all the relevant literature’ in a scoping review due to its broader focus (Gentles et al., 2010), and a few noted that all relevant studies may not
have been identified as scoping reviews are not intended to be as exhaustive or comprehensive (Cameron et al., 2008; Levac et al., 2009; Boydell et al., 2012).

The balance between breadth and depth of analysis was a challenge reported in some reviews. Brien et al. (2010) and Cronin de Chavez et al. (2005) reported that it was not feasible to conduct a comprehensive synthesis of the literature given the large volume of articles identified in their reviews. Depth of analysis was also reported to be limited by the time available to conduct the review (Freeman et al., 2000; Gulliford et al., 2001; Templeton et al., 2006; Cahill et al., 2008; Bostock et al., 2009; Brodie et al., 2009).

The lack of critical appraisal of included studies was reported as a study limitation in 16.0% (55/344) of reviews. One review commented that this was the primary limitation of scoping reviews (Feehan et al., 2011), and others noted that without this step scoping reviews cannot identify gaps in the literature related to low quality of research (Brien et al., 2010; Hand & Letts, 2009). Additionally, two reviews reported that their results could not be used to make recommendations for policy or practice since they did not assess the quality of included studies (Churchill et al., 2011; Bostrom et al., 2011). Conversely, Njelesani et al. (2011) noted that ‘by not addressing the issues of quality appraisal, this study dealt with a greater range of study designs and methodologies than would have been included in a systematic review’, and McColl et al. (2009) commented that ‘the emphasis of a scoping study is on comprehensive coverage, rather than on a particular standard of evidence’.

4. Discussion

In this paper, we provided an overview of scoping reviews identified in the grey and published literature. Our search for scoping reviews in the published and grey literature aimed to be comprehensive while also balancing practicality and available resources. It was not within the
remit of this scoping review to assess the methodological quality of individual scoping reviews included in the analysis. Based on the characteristics, range of methodologies and reported challenges in the included scoping reviews, we have proposed some recommendations for advancing the scoping review approach and enhancing the consistency with which they are undertaken and reported.

4.1. Overview of included scoping reviews

Our results corroborate that scoping reviews are a relatively new approach that has gained momentum as a distinct research activity in recent years. The identified reviews varied in terms of terminology, purpose, methodological rigor, and level of detail of reporting, therefore, there appears to be a lack of clarity or agreement around the appropriate methodology for scoping reviews. In a scoping review that reviewed twenty-four scoping reviews from the nursing literature, Davis et al. (2009) also reported that the included scoping reviews varied widely in terms of intent, procedural and methodological rigour. Given that scoping reviews are a relatively new methodology for which there is not yet a universal study definition, definitive procedure or reporting guidelines, the variability with which scoping reviews have been conducted and reported to date is not surprising. However, efforts have been made by scoping review authors such as Arksey & O’Malley (2005), Anderson et al. (2008), Davis et al. (2009), Brien et al. (2010), Levac et al. (2010) and Daudt et al. (2013) to guide other researchers in undertaking and reporting scoping reviews, as well as clarifying, enhancing and standardizing the methodology. Their efforts seem to be having some impact given the increase in the number of scoping reviews disseminated in the published and grey literature, the growth in the use of a methodological framework, and the greater amount of detail and consistency with which scoping review processes have been reported.
4.2. Recommendations

Levac et al. (2010) remarked that discrepancies in nomenclature between ‘scoping reviews’, ‘scoping studies’, ‘scoping literature reviews’, ‘scoping exercises’ and so on lead to confusion, and consequently used the term ‘scoping study’ for consistency with the Arksey & O’Malley framework. We agree that there is a need for consistency in terminology, however argue that the term ‘scoping review’ should be adopted in favour of ‘scoping study’ or the other terms that have been used to describe the method. Our review has found that ‘scoping review’ is the most commonly used term in the literature to denote the methodology, and that a number of the other terms (i.e. scoping study, scoping exercise, systematic mapping) have been used to describe a variety of primary research study designs. Furthermore, we find that the word ‘review’ more explicitly indicates that the term is referring to a type of literature review, compared with ‘study’ or ‘exercise’.

As scoping reviews share many of the same processes with the more commonly known systematic review, many of the included reviews compared and contrasted the two methods. We concur with Brien et al. (2010) that scoping reviews are often misinterpreted as a less rigorous version of a systematic review, when in fact they are a ‘different entity’ with a different set of purposes and objectives. We contend that researchers adopting a systematic review approach but with concessions in rigor to shorten the timescale, refer to the process as a ‘rapid review’.

Scoping reviews are one method among many available to reviewing the literature (Arksey & O'Malley, 2005), and researchers need to consider their research question or study purpose when deciding which review approach is most appropriate. Additionally, given that some of the included reviews took over one year to complete, we agree that it would be wrong to necessarily assume that scoping reviews represent a quick alternative to a systematic review (Arksey & O'Malley, 2005).
There is an ongoing deliberation in the literature regarding the need for quality assessment of included studies in the scoping review process. While Arksey & O’Malley stated that ‘quality assessment does not form part of the scoping [review] remit’, they also acknowledged this to be a limitation of the method. This may explain why quality assessment was infrequently performed in the included reviews, and why it was reported as a study limitation among a number of these reviews. In their follow-up recommendations to the Arksey & O’Malley framework, Levac et al. (2010) did not take a position on the matter but recommended that the debate on the need for quality assessment continue. However, a recent paper by Daudt et al. (2013) asserts that it is a necessary component of scoping reviews and should be performed using validated tools. We argue that scoping reviews should include all relevant literature regardless of methodological quality, given that their intent is to present an overview of the existing literature in a field of interest without synthesizing evidence from different studies (Arksey & O'Malley, 2005). In doing so, scoping reviews can provide a more complete overview of all the research activity related to a topic. However, we also recognize that some form of quality assessment of all included studies would enable the identification of gaps in the evidence base—and not just where research is lacking—and a better determination of the feasibility of a systematic review. The debate on the need for quality assessment should consider the challenges in assessing quality among the wide range of study designs and large volume of literature that can be included in scoping reviews (Levac et al., 2010).

The lack of consistency among the included reviews was not surprising given the lack of a universal definition or purpose for scoping reviews (Daudt et al., 2013; Davis et al., 2009; Levac et al., 2010; Anderson et al., 2008). The most commonly cited definition scoping reviews may be the one set forth by Mays et al. (2001) and used by Arksey & O’Malley: ‘scoping studies
aim to map *rapidly* the key concepts underpinning a research area and the main sources and types of evidence available, and can be undertaken as standalone projects in their own right, especially where an area is complex or has not been reviewed extensively before.’ However, we believe that a recently proposed definition by Daudt *et al.* (2013) is more straightforward and fitting of the method: ‘scoping studies aim to map the literature on a particular topic or research area and provide an opportunity to identify key concepts; gaps in the research; and types and sources of evidence to inform practice, policymaking, and research.’ While we would replace the term ‘scoping studies’ with ‘scoping reviews’, we endorse the Daudt *et al.* definition because it clearly articulates that scoping reviews are a type of literature review and removes the emphasis away from being ‘rapid’ process.

It has been suggested that the optimal scoping review is ‘one that demonstrates procedural and methodological rigour in its application’ (Davis *et al.*, 2009). We found that some scoping reviews were not reported in sufficient detail to be able to demonstrate ‘rigour in its application’. When there is a lack of clarity or transparency relating to methodology, it is difficult to distinguish poor reporting from poor design. We agree that it is crucial for scoping review authors to clearly report the processes and procedures undertaken—as well as any limitations of the approach—to ensure that readers have sufficient information to determine the value of findings and recommendations (Davis *et al.*, 2009; Arksey & O'Malley, 2005). The development of reporting guidelines for scoping reviews would help to ensure the quality and transparency of those undertaken in the future (Brien *et al.*, 2010). Given that reporting guidelines do not currently exist for scoping reviews (Brien *et al.*, 2010), researchers conducting scoping reviews may want to consider using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (http://prisma-statement.org/) as a guide, where
applicable.

4.3. Strengths & limitations of this scoping review

This scoping review used rigorous and transparent methods throughout the entire process. It was guided by a protocol reviewed by a research team with expertise in knowledge synthesis and scoping reviews. To ensure a broad search of the literature, the search strategy included: four electronic bibliographic databases, the reference list of eighteen different articles, two internet search engines, the websites of relevant organizations, and the snowball technique. The relevance screening and data characterization forms were pre-tested by all reviewers and revised as needed prior to implementation. Each citation and article was reviewed by two independent reviewers who met in regular intervals to resolve conflicts. Our use of a bibliographic manager (RefWorks) in combination with systematic review software (DistillerSR) ensured that all citations and articles were properly accounted for during the process. Furthermore, an updated search was performed in October 2012 to enhance the timeliness of this review.

This review may not have identified all scoping reviews in the published and grey literature despite attempts to be as comprehensive as possible. Our search algorithm included nine different terms previously used to describe the scoping process, however other terms may also exist. Although our search included two multidisciplinary databases (i.e. Scopus, Current Contents) and Google, the overall search strategy may have been biased towards health and sciences. Searching other bibliographic databases may have yielded additional published scoping reviews. While our review included any article published in English, French or Spanish, our search was conducted using only English terms. We may have missed some scoping reviews in the grey literature as only the first 100 hits from each web search were screened for inclusion. Furthermore, we did not contact any researchers or experts for additional scoping reviews we
may have missed.

Other reviewers may have included a slightly different set of reviews than those included in this present review. We adopted Arksey & O’Malley’s definition for scoping reviews at the outset of the study, and found that their simple definition was generally useful in guiding study selection. However, we encountered some challenges during study selection with reviews that also reported processes or definitions more typically associated with narrative, rapid or systematic reviews. We found that some reviews blurred the line between narrative and scoping reviews, between scoping and rapid reviews, and between scoping and systematic reviews. Our challenges echoed the questions: ‘where does one end and the other start?’ (Arksey & O’Malley, 2005) and ‘who decides whether a particular piece of work is a scoping [review] or not?’ (Anderson et al., 2008). For this review, the pair of reviewers used their judgement to determine whether each review as a whole sufficiently met our study definition of a scoping review. On another note, characterization and interpretation of the included reviews were also subject to reviewer bias.

5. Conclusions

This scoping review of scoping reviews characterized and described the nature of scoping reviews in the published and grey literature. Scoping reviews are a relatively new approach to reviewing the literature which has increased in popularity in recent years. As the purpose, methodological process, terminology and reporting of scoping reviews have been highly variable, there is a need for their methodological standardization to maximize the utility and relevance of their findings. We agree that the establishment of a common definition and purpose for scoping reviews is an important step towards enhancing the consistency with which they are conducted (Levac et al., 2010); this would provide a common platform from which debates
regarding the methodology can ensue, and the basis for future methodological frameworks and reporting guidelines. We hope that the results of our study can contribute to the ongoing collective work of a number of researchers to further clarifying and enhancing the scoping review methodology.
Figure 2.1. PRISMA flowchart of study selection process.
Figure 2.2. Bubble plot of scoping reviews published by year and sector. The size of a bubble is proportional to the number of scoping reviews published in the year and sector corresponding to the bubble coordinates.
Table 2.1. General characteristics of included scoping reviews (n=344).

<table>
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<tr>
<th>Characteristic</th>
<th>Number (n=344)</th>
<th>Percentage (%)</th>
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<td>2005-2009</td>
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<td>2010-October 2012</td>
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<td>Thesis dissertation</td>
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<td>Conducted quality assessment</td>
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<td>Manual searching of select journals</td>
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<td>Search in Internet search engines or specific websites</td>
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<td>Performed an updated search</td>
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<td>Screening of full text articles by ≥2 reviewers</td>
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<td>Formal qualitative analysis</td>
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<tr>
<td>Meta-analysis</td>
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Table 2.3. Search strategy details reported in included reviews, by year

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<th>2000-2004 (n=19)</th>
<th>2005-2009 (n=87)</th>
<th>2010-Oct 2012 (n=237)</th>
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<td>Updated search</td>
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<td>Data sources</td>
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<td>91.56%</td>
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<td>In appendix</td>
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<td>37.93%</td>
<td>28.69%</td>
<td>31.10%</td>
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<tr>
<td>Reporting of results in the included scoping reviews</td>
<td>Number (n=344)</td>
<td>Percentage (%)</td>
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<tr>
<td>-----------------------------------------------------</td>
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<td><strong>Depiction of flow of articles from search to final selection</strong></td>
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<td>71.8</td>
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<td><strong>Charting of included studies</strong></td>
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<td>77.9</td>
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<td>Inform design or scope of future research</td>
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<td>3.2</td>
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<tr>
<td>Policy implications or recommendations for policy or practice</td>
<td>63</td>
<td>18.3</td>
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References


46


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Healthcare Improvement Scotland. 2012. In Patients With Severe Medically Refractory Gastroparesis (Such as Those Requiring Nutritional Support), How Effective and Cost Effective is Gastric Electrical Stimulation (EnterraTM device) In Reducing Symptoms, Reducing Requirement for Nutritional Support or Hospitalisation and Improving Quality of Life, When Compared with Medical or Alternative Surgical Management? Healthcare Improvement Scotland, Edingburgh.

Healthcare Improvement Scotland. 2011. What is the Published Evidence of an Association Between Hospital Volume and Operative Mortality for Surgical Repair (Open and Endovascular) of Unruptured and Ruptured Abdominal Aortic Aneurysms? Healthcare Improvement Scotland, Edinburgh.


CHAPTER THREE

Framework for enhancing the consistency and advancing the conduct of scoping reviews: guidance and examples for application in agri-food public health

Background

Scoping reviews are a relatively new, but increasingly popular approach to synthesizing research evidence (Pham et al., 2014). The approach aims to identify the existing literature on a broad topic or research area in order to identify key concepts, gaps in the research, and types and sources of evidence to inform practice, policymaking, and research (Arksey & O'Malley, 2005; Daudt et al., 2013). Following similar principles to systematic reviews, the scoping review uses rigorous and transparent methods to comprehensively identify and describe all the relevant literature pertaining to a research question. Thus, a scoping review can be used as a standalone project or as a preliminary step to one or more systematic reviews (Arksey & O'Malley, 2005). Topics not yet extensively reviewed and those that are complex or multidimensional in nature are particularly well-suited to a scoping review (Mays et al., 2001).

The scoping review can thus provide a useful approach to mapping the evidence underpinning the broad and complex issues that are common to the field of agri-food public health. Agri-food public health refers to the cross-cutting and overlapping areas of veterinary public health, food safety and “One Health” (Rajić & Young, 2013; Sargeant et al., 2006). While the conduct of scoping reviews has gained momentum in fields such as health, social sciences and software engineering, few scoping reviews addressing agri-food public health topics have been published. In a review of 344 scoping reviews published from 1999–2012, only four (1.2%) addressed an agri-food public health topic (Pham et al., 2014). The development of a scoping review framework tailored to this area may help to bring greater awareness about the approach
and encourage more widespread use.

Arksey & O’Malley (2005) published the first methodological framework for conducting scoping reviews based on their experiences of reviewing the literature on caregiver services for people with mental health issues. They proposed an iterative six-stage process as a starting point to help develop appropriate methods for conducting scoping reviews: 1. identifying the research question; 2. identifying relevant studies; 3. study selection; 4. charting the data; 5. collating, summarizing and reporting the results; and 6. Incorporating an optional stakeholder consultation exercise. Other researchers have since proposed enhancements to this framework based on their own experiences conducting scoping reviews (Daudt et al., 2013; Levac et al., 2010; Brien et al., 2010) or through analysis of published scoping reviews (Davis et al., 2009; Anderson et al., 2008). The need to further clarify and enhance the methodology was demonstrated in a review that found wide variability in the purpose, methodological process, terminology and detail of reporting of scoping reviews published from 1999–2012 (Pham et al., 2014).

In this paper, we describe a methodological framework for conducting scoping reviews that integrates and builds on the previous collective work. This framework is intended as a step-by-step guide through each stage of the scoping review process; providing guidance and specific examples relevant to the field of agri-food public health where possible. The framework is intended to further the methodological standardization of scoping reviews, and help bring greater awareness about the scoping review as a research synthesis approach among the agri-food public health community.

What is a scoping review?

The scoping review is a relatively new research synthesis method for which a universal study definition or definitive procedure has not yet been established (Arksey & O'Malley, 2005;
Daudt et al., 2013; Levac et al., 2010; Davis et al., 2009; Anderson et al., 2008). In general, scoping reviews aim to map the existing literature on a broad topic of interest to describe the volume, nature and characteristics of the primary research (Arksey & O'Malley, 2005). They are commonly undertaken to: examine the extent, range and nature of research activity in a topic area; identify research gaps in the existing literature; and, determine the value and potential scope and cost of undertaking one or more follow-up systematic reviews related to the topic (Arksey & O'Malley, 2005; Levac et al., 2010). In recent years, the scoping review has become an increasingly adopted approach and examples have been published across a broad range of disciplines and fields of study (Anderson et al., 2008).

The scoping review is one approach among many available for review of the literature (Arksey & O'Malley, 2005), and researchers need to consider their research question and review objectives when deciding which method—or combination of methods—is most appropriate. The narrative review has been the traditional method for summarizing literature and is often undertaken by experts in a field to provide an examination of recent or current literature (Grant & Booth, 2009). Narrative reviews often do not use structured and transparent methods to identify and assess relevant studies (Mulrow, 1987; Sargeant & O’Connor, 2014) and may be prone to selective inclusion of studies that support the authors’ views (Egger et al., 2005; Waddell et al., 2009). Alternatively, synthesis methods such as scoping and systematic reviews use rigorous and transparent methods to comprehensively identify and characterize all the relevant literature pertaining to a research question (DiCenso et al., 2010). Systematic reviews differ from scoping reviews in that they aim to identify, analyze and evaluate the risk of bias from all studies meeting pre-defined eligibility criteria to answer a narrowly-defined research question (Higgins & Green, 2011). Scoping reviews, however, aim to provide a descriptive
overview of the characteristics of research underpinning a broad topic with minimal critical appraisal of individual studies or quantitative synthesis of results across studies (Arksey & O'Malley, 2005; Brien et al., 2010). There are also “rapid reviews” that use traditional systematic review methods, but with concessions (e.g. limited literature search, single reviewer) in order to synthesize evidence within a shorter timeframe (Ganann et al., 2010).

**Proposed framework**

This framework builds on the Arksey & O’Malley (2005) framework and ensuing recommendations by Levac et al. (2010). The purpose of the framework is to provide a transparent and objective strategy for conducting scoping reviews that mirrors the rigour of the systematic review process. Thus, we add to previous work in this area by incorporating data gathered from a scoping review of scoping reviews identified in the published and grey literature from 1999 to 2012 (reported in Chapter 2) (Pham et al., 2014) and from our experiences in conducting scoping reviews on a range of agri-food public health topics (Illic et al., 2012; Tusevljak et al., 2012; Wilhelm et al., 2011; Wilhelm et al., 2012; Farrar, 2009; Bernardo et al., 2013; Coe et al., 2014; Greig et al., 2014; Mascarenhas et al., 2013; Wilhelm et al., 2015). These scoping reviews may be used to provide further examples and details on the conduct, analysis and write up of a scoping review. Although this framework has been tailored to agri-food public health, its application can readily be adapted to other sectors. Figure 3.1 provides an overview of the scoping review stages discussed below.

**Stage 1: Identifying the review question and developing the review protocol**

1.1. *The review team*

A scoping review requires a multidisciplinary team with both methodological and content expertise to make appropriate decisions regarding the scope, objectives and conduct of the
review (e.g. search strategy, synthesis methods) (Levac et al., 2010). For example, the scoping review by Ilic et al. (2012) on microbial hazards in leafy green vegetables had a review team that included individuals with expertise in microbiology, produce production and processing, food safety, epidemiology, research synthesis methods and library science. Access to a librarian, information specialist or someone with extensive literature search experience is essential to the review team to ensure the design and execution of a comprehensive search (Arksey & O'Malley, 2005).

1.2. Defining the review objectives, question and its scope

Clearly articulating the main objectives of the review is important for defining the review question and ensuring that appropriate steps are taken to achieve them. The research question establishes the scope, key definitions and eligibility criteria for subsequent stages of the scoping review process (Levac et al., 2010). Compared to a focused systematic review question, a scoping review question is typically broad in nature to generate a breadth of coverage (Arksey & O'Malley, 2005). Even so, its components should still be well defined and follow the PICO approach (Populations, Interventions, Comparisons, Outcomes) (Higgins & Green, 2011)(where applicable) to provide direction, clarity and focus to the review (Levac et al., 2010). For example, Ilic et al. (2012) conducted a scoping review based on the broad question: what are the prevalence, risk factors and intervention research themes for 16 microbial hazards in leafy green vegetables? Their review question also included explicit definitions for ‘prevalence’, ‘risk factor’, ‘intervention’, ‘microbial hazards’ and ‘leafy green vegetables’.

A poorly defined review question may encumber the development of the search strategy, result in the search capturing an excessively large number of studies to review, and fail to provide a clear direction for study selection and characterization. Clearly defining the review
question and its scope may be difficult at the outset if the size and nature of the relevant literature is unclear (Badger et al., 2000). We recommend that review teams do some preliminary searches of the literature and consult with topic experts to gain insight into the nature and disparities of the relevant research literature. This will help to refine the review question and its scope prior to commencing the review. The best time to set parameters for the review is at the outset (Badger et al., 2000); changing the scope or eligibility criteria after the review has begun may require backtracking and repeating some steps to ensure that all screening is conducted using the same criteria. If this should occur after the review has commenced, any changes should be documented and justified as protocol deviations.

1.3. Review protocol

As with any other study design, a scoping review should have a detailed protocol that clearly articulates the question to be addressed and the methodological steps involved. The protocol is intended to guide the conduct of the whole review but also helps to reduce the impact of review authors’ biases, enhance reviewing consistency when a team of reviewers is involved (Badger et al., 2000), promote transparency of methods and processes, allow for peer review of the planned methods (Light & Pillemier, 1984), and provide a record of conduct so the scoping review may be updated or reproduced. The protocol can also reduce the potential for duplication if it is published or posted publicly ahead of the review.

Key components of the scoping review protocol include:

1. List of individuals on the review team and their roles
2. Scoping review title
3. Brief background and rationale for the scoping review
4. Scoping review question, objectives for the review and key definitions
5. List of eligibility (inclusion/exclusion) criteria for studies to be included in the review

6. Strategy for identifying relevant studies (i.e. the search strategy)

7. Strategy for managing bibliographic citations identified in the search

8. Strategy for identifying relevant studies for the review (including a draft of the relevance screening form)

9. Strategy for characterizing included studies (including a draft of the study characterization form)

10. Brief description of the data analysis plan

11. Dissemination plan for the scoping review results

12. Timeline for the scoping review.

The protocol should be reviewed by the review team and potential stakeholders prior to initiating the scoping review. Throughout the review process, revisions may be made to the protocol as the authors become more familiar with the size and nature of the literature under review. In contrast to a systematic review, the process of conducting a scoping review may be more iterative to ensure a comprehensive coverage of the literature (Arksey & O'Malley, 2005). Any deviations from the protocol should be documented and properly justified.

1.4. Scoping review title

The title should include the topic and population group (e.g. broilers) addressed in the review and the term ‘scoping review’ to denote the study approach. We recommend the use of ‘scoping review’ over other terminology (e.g. scoping study, scoping literature review, literature mapping) because it has been the most commonly used term for the approach in the literature (Pham et al., 2014) and it clearly indicates a type of literature review.
1.5. Eligibility criteria

A list of eligibility criteria for studies to be included in the review helps to ensure clarity and consistency in the study selection process (Arksey & O'Malley, 2005). Criteria are defined at the outset of the review based on specifics of the review question and its scope. Additional criteria may also be defined *a posteriori* based on greater familiarity with the topic matter as the review progresses (Levac *et al.*, 2010), but may require repeating previous steps in the review to ensure that eligibility criteria are applied consistently. Depending on the review question, eligibility criteria will consist of definitions and inclusion/exclusion parameters for populations (e.g. species, age), locations (e.g. North America), settings (e.g. processing plants, farms), interventions or risk factors (e.g. vaccination, occupation), and outcomes (e.g. prevalence, incidence). In contrast to a systematic review, a scoping review will define broader eligibility criteria for study design (e.g. all primary research) or include all study designs (including secondary and tertiary research). For example, in a scoping review of the role of wildlife in the transmission of bacterial pathogens and antimicrobial resistance to the food chain (Greig *et al.*, 2014), criteria for eligibility in the review included: primary research studies, published ≥1990, written in English or French, wildlife species relevant to North America, and a list of 10 selected bacterial pathogens or AMR in any bacteria.

1.6. Timeline

In our experience, scoping reviews typically take 4–10 months to complete, depending on the scope of the review question, the volume of literature available on the review topic, the expertise of the review team, and the resources and personnel available to conduct the review. A pair of reviewers is needed to screen each abstract for relevance (stage 3) and to extract the characteristics of each relevant full text study (stage 4). When estimating the number of hours
that may be required of reviewers, we have found that a typical reviewer will screen an average of 50 abstracts per hour (accounting for the time needed to resolve disagreements between reviewers) and spend an average of 45 minutes per full text paper for data characterization (including conflict resolution). Adding additional personnel to the team can reduce the time frame needed to conduct a scoping review without sacrificing rigour and breadth of coverage. For example, additional pairs of reviewers will expedite the screening and study characterization phases, and having a separate team member obtain the full text articles means that article procurement can take place as the title and abstract screening phase progresses. Setting deadlines for each stage of the review can help ensure that a scoping review is completed within a given timeframe.

**Stage 2: Searching for relevant studies**

For reviews addressing agri-food public health topics, locating all relevant information sources is not always easy and there is a risk of missing relevant information that may influence the output of the final review (Glanville *et al.*, 2014). The search strategy for a scoping review should be driven by the review question and we recommend that it be developed in consultation with a librarian, information specialist or someone with extensive experience conducting synthesis research. The search process for a scoping review is similar to that of a systematic review, but broader in scope due to the nature of scoping review questions. The overall search strategy should be comprehensive to ensure that as many relevant studies as possible are captured while keeping the total output of the search as low as possible. When a search is limited in scope due to time, resources or other constraints, authors should justify their decisions and report these as potential limitations of their study (Levac *et al.*, 2010). The search strategy is made up of two main parts: the search algorithm(s) and sources to search.
2.1. Search algorithm

The search algorithm for a scoping review may be relatively simple, or may need to be more complex to achieve breadth of coverage while resulting in the fewest number of extraneous citations. For any scoping review question, the first step in developing the search algorithm is to break the question into its component parts (e.g. target population(s), setting(s), intervention(s), etc.). Then for each component part, identify search terms related to that topic, taking into consideration potential synonyms (e.g. feces and stool), alternate spellings (e.g. feces and faeces) and word variations (e.g. feces and fecal). Grouping search terms within the same category with the Boolean operator “OR” will find citations that contain any of the terms (e.g. feces OR faeces OR fecal OR stool). Combining each category of terms with the Boolean operator “AND” will result in a search algorithm that will find citations that contain at least one search term from each category. Filters or limits such as publication date, document type and language may be placed on the search algorithm to contain the breadth of the output.

Developing the search algorithm for a scoping review is an iterative process involving trial and error. When testing initial search algorithms in a database, we suggest quickly scanning the abstracts of the first 20–40 bibliographic citations that are retrieved for relevancy to the review question and for potential additional or alternate search terms. For citations completely irrelevant to the review question, try to determine why they are being captured by the search and if possible, modify the search algorithm to not capture them. When testing the final search algorithm, we suggest examining the output of the search for 15-25 references known to be relevant to the review topic and known to be indexed by the database. These references may be identified by the review team through preliminary searches of the topic, and/or by experts that are part of the review team or the stakeholder committee. An algorithm that captures most or all of the references on the list provides some confirmation as to its comprehensiveness. The
algorithm will also have to be tailored to each bibliographic database as every database and/or platform may have different rules for advanced searching.

Table 3.1 provides an example of a search algorithm from a scoping review on the use of search queries and social media for disease surveillance (Bernardo et al., 2013). The search algorithm consisted of three broad categories of terms related to: 1) social media and internet-based tools, 2) disease and 3) surveillance. This simple search algorithm was sufficient for an area of research that was relatively new and small. In cases where the research area is very large, it may be necessary to divide the review question into smaller parts with a search algorithm for each. This was the case in a scoping review that aimed to characterize the published research investigating selected zoonotic bacteria and aquaculture therapeutic topics (antimicrobial resistance, antimicrobial drug use and residues, dye use) in wild and farmed aquatic species and seafood (Tuševljak et al., 2012). Five categories of search terms were identified for the review: 1) 21 aquatic species and seafood ‘population’ terms, 2) 11 bacteria terms, 3) 21 general antimicrobial terms, 4) 55 specific antimicrobial terms, and 5) 4 therapeutic dye terms. Due to the large number of search terms, the search algorithm was split into four separate search strings: i) (population terms) AND (bacteria terms), ii) (population terms) AND (general antimicrobial terms), iii) (population terms) AND (specific antimicrobial terms), and iv) (population terms) AND (dye terms). Each search string was implemented separately, and the results were then combined into a single database where duplicate citations were removed.

2.2. Sources to search

Agri-food public health research may be disseminated in a variety of formats, including publication in academic journals, research reports, theses or dissertations, books, monographs and conference proceedings. For the search to achieve a comprehensive coverage of the research
on an agri-food public topic, a scoping review search should include multiple overlapping sources. We recommend that the search be first implemented in bibliographic databases, followed by a grey literature search, and then a search verification strategy detailed below.

Searches of bibliographic databases

Agri-food public health research may be published in journals from a wide range of disciplines, including veterinary sciences, agriculture, public health, food safety and processing, epidemiology, human medicine, environmental health, and basic science. Scoping reviews addressing agri-food public health topics will require searching multiple bibliographic databases as none are likely to index all literature relevant to a review question (Murphy, 2007). Knowledge of the subject and journal coverage of bibliographic databases is important in deciding which and how many databases to search to ensure a comprehensive search of a topic (Grindlay et al., 2012). In addition to maximizing the inclusion of potentially relevant literature, searching across multiple databases compensates for imperfect search recall (i.e. record is indexed in a database, but not retrieved by the search algorithm), delays in adding citations, missing citations, and errors in a record (Grindlay et al., 2012). Examples of bibliographic databases that index journals publishing agri-food public health research are provided in Table 3.2.

Grey literature search

Not all completed studies are subsequently published in indexed journals and books; in agri-food public health, many completed studies may only be released as government or research station reports (Wilhelm et al., 2011). The term ‘grey literature’ is used to refer to research literature that has not undergone a peer-review process for publication in journals and books, and is generally not indexed in bibliographic databases (Higgins & Green, 2011; Eysenbach et al.,
Scoping reviews should include a search of the grey literature to ensure a comprehensive overview of the body of research on the review topic. Unfortunately, there is no simple and reliable way to identify and obtain data from studies that have been completed but never published in indexed sources (Higgins & Green, 2011), and the approach to grey literature searching may differ based on the topic of the scoping review. Furthermore, there is no standard and recommended approach for searching the grey literature at this time (Mahood et al., 2013).

A variety of sources can be searched for grey literature. Institutions, associations and organizations that conduct or fund research may publish reports of completed studies on their websites; a manual search through the website of groups with interests related to the review question may be useful in identifying relevant unpublished studies. Glanville et al. (2014) compiled a list of websites and resources that can be searched for research related to agri-food public health (Glanville et al., 2014). Unpublished literature may also be identified through searches of online repositories (e.g. Depository Services Program e-Collection; http://www.publications.gc.ca/site/eng/search/eCollection.html), grey literature databases (e.g. OpenGrey, http://www.opengrey.eu/), and Web search engines (e.g. Google Scholar, https://scholar.google.com/; Microsoft Academic Search, http://academic.research.microsoft.com/). These platforms may require a simplified search algorithm if they do not accommodate the more complex search algorithms developed for bibliographic databases (Mahood et al., 2013). Searches in Web search engines may produce very large yields, and thus it may be necessary to impose limits on the search or screening of the output given available time and resources (Mahood et al., 2013). A pragmatic approach for handling searches from Web search engines is to start by screening the first 100 hits sorted by the search engine algorithm for potential relevance to the review question. If any new potentially
relevant studies (published or unpublished) are identified in the first 100 hits, then the subsequent block of 100 hits should also be screened until no new studies are identified. While this approach has not been validated, it offers a transparent way to operationalize searches in web search engines.

Search verification

To assess the completeness of the search and identify any missed citations, we recommend hand-searching key journals and screening the reference lists of relevant primary and review articles. In our experience, screening the reference lists of literature reviews (10 or more, depending on the breadth and complexity of the topic) that span the topic area has been useful in identifying research not captured in the electronic search. If searching these additional sources does not identify many new potentially relevant studies, the search strategy may be considered to be reasonably comprehensive. **Table 3.3** lists summary details of other sources that can be searched for potentially relevant research.

### 2.3. Citation management and deduplication

All bibliographic citations identified through the search strategy should be compiled into a single reference management program, such as RefWorks (ProQuest LLC, Ann Arbor; MI) or EndNote® (Thomson Reuters, Philadelphia, PA). When citations are imported into a reference management program, they are assigned a unique reference identification number which can be used to track each citation through the review process. Multiple copies of the same citation will result from searching more than one data source; reference management programs have functionalities to identify and remove duplicate citations. As the ability of these programs to identify duplicate citations is not perfect, we recommend that the remaining citations be examined manually for duplicates as well. The study selection phase can begin when only unique
Stage 3: Identification of relevant studies

A comprehensive search strategy will often have low precision and capture many bibliographic citations that are not relevant to the review topic (Higgins & Green, 2011). Consequently, a two-step process is typically undertaken to identify relevant studies for inclusion in scoping reviews, following a process similar to systematic reviews: 1) screening of titles and abstracts to remove citations that are clearly irrelevant to the review topic, and then 2) screening of full text articles to confirm relevance.

3.1. Data collection forms

We recommend that data collection forms be used for the study selection and data characterization phases of the review. Data collection forms ensure that all phases of the review are conducted in a transparent and replicable manner and that there is a record of decision for each citation. Data collection forms can be paper or electronic, and stand-alone or part of a sophisticated automated system. Table 3.4 provides a list of options for data collection and management in scoping reviews with their associated advantages and potential limitations. We recommend the use of web-based applications for data collection as they allow automated workflow for the screening and study characterization phases of the review, and facilitate use of virtual teams as reviewers can work in real-time anywhere an internet connection is available.

3.2. Title and abstract relevance screening

The search will capture a number of bibliographic citations that are clearly not relevant to the review topic. Screening the title and abstract of each record is a relatively fast and easy way to identify these citations and exclude them from the review. To ensure rigour and consistency,
the screening form should be pre-tested prior to implementation. The form should include one to three clear and concise screening questions that are easy to answer and based on the review question. The form should be pre-tested by all reviewers on a minimum of 30–50 citations to ensure clarity of the questions and consistency of responses among reviewers. Cohen’s kappa statistic can be calculated to determine the level of inter-rater agreement (Cohen, 1960); a kappa of greater than 0.8 may be interpreted as ‘almost perfect agreement’ (Dohoo et al., 2012). It is important to note that kappa is affected by prevalence and thus a pre-test with very few relevant studies may yield a low kappa despite a high percentage of agreement between reviewers (Kraemer, 1979); a lower cut-point should be considered in these situations. A high kappa score provides sound rationale for screening to proceed; if kappa is low, reasons for disagreements should be discussed and the pre-test should continue using 30-50 additional citations until a sufficient level of agreement is achieved. Based on the results of the pre-test and feedback from reviewers, the screening questions, response options and eligibility criteria may need to be refined prior to beginning screening to ensure consistent application of the screening form.

At least two reviewers should independently screen each title and abstract for study eligibility in the review (Levac et al., 2009). Studies have shown that there is a higher risk of excluding relevant citations when only one reviewer is used for title and abstract screening (Doust et al., 2005; Edwards et al., 2002). Reviewers should meet regularly throughout the screening process (e.g. every 150–250 citations) to resolve discrepancies and discuss any issues related to study selection. Discrepancies between reviewers may be resolved by consensus, or through a third independent reviewer (Levac et al., 2009). The use of a screening form and at least two independent reviewers will help to minimize potential reviewer bias, ensure consistency and rigour, and minimize human error. We recommend that reviewers err on the side
of inclusion during this level of screening since some citations may not include an abstract, and titles and abstracts may not be representative of the full article (Arksey & O'Malley, 2005). Final study eligibility decisions can be made upon review of the full text.

3.3. Article procurement

The full text should be retrieved for all studies meeting eligibility criteria after title and abstract relevance screening. Procurement should be done or supervised by someone with experience or training in locating journal articles, or in consultation with a librarian or information specialist to ensure a higher rate of retrieval. While most articles will be readily accessible through institutional holdings and subscriptions and, to a lesser extent, Open Access, at least a small proportion will need to be ordered through a library and could take some time to be located. When time is limited or to ensure that the review is completed within a specified timeline, we agree with previous recommendations to set a deadline by which articles need to be procured for inclusion in the review (Arksey & O'Malley, 2005; Badger et al., 2000).

3.5. Full text screening

We agree with Levac et al’s (2010) recommendation that at least two reviewers independently review the full text articles for eligibility in the review as this helps to minimize potential reviewer bias, ensure consistency and rigour, and minimize human error. The questions used to confirm the relevance of full text articles are typically the same as those used in the initial title and abstract screening form. For efficiency, we recommend combining this confirmation of relevance step with the study characterization phase (Stage 4) of the review.

3.6. Unit of interest

In a scoping review, individual studies are the unit of interest. Thus, scoping review
authors and reviewers should be aware that some studies may be published in more than one
journal article, or be initially released as a report, conference proceedings or dissertation, and
then published in a journal. Multiple reports of the same study can be linked together and
counted as one study (Higgins & Green, 2011), or review authors may decide that only the most
recent or peer-reviewed version is eligible for inclusion. It is important to specify how duplicate
reports will be dealt with in the protocol.

**Stage 4: Study characterization**

4.1. Study characterization form

Study characterization—referred to as “data charting” in the Arksey & O’Malley
framework—involves extracting key elements from the full text studies (Arksey & O'Malley,
2005; Levac et al., 2009). It is analogous to data extraction in systematic reviews, but is less
detailed and does not include a risk of bias assessment as the purpose is to provide an overview
of the reviewed literature rather than extracting and combining the results from different studies
(Arksey & O'Malley, 2005). As a result, information such as outcome data (e.g. number of
positive samples, bacterial counts) and data for assessing risk of bias (e.g. blinding,
randomization, or missing participants) are generally not collected at this stage. While an
abstract may capture many of the study characteristics of interest to a scoping review, our review
(Pham et al., 2014) found that less than 3% of included scoping reviews (10/344) reported
extracting data from abstracts alone. To ensure accurate characterization of included studies,
information should be extracted from full text articles since an abstract may not be representative
of the full article (Arksey & O'Malley, 2005) and not all reports of research include an abstract.
Furthermore, this also provides an opportunity to re-evaluate the relevance of each study to the
review based on additional data reported in the full text, and to exclude those that do not meet
eligibility criteria.

Study characterization should be performed using a standardized form to extract information from each study that will help to answer the review question(s) (Levac et al., 2009). The form should seek to capture general and some specific information about the study identified \textit{a priori} for descriptive charting of the literature. Typical items of interest include: year of publication, author, study location, study design, study population, sample size, intervention/exposure/risk factor information, and key outcome measures (Arksey & O'Malley, 2005). Scoping reviews often include a large number of studies, thus care should be taken to keep the characterization form short and concise, only focussing on the information needed to describe the breadth of literature underpinning the topic. The study characterization form may include questions that are not applicable to all studies, thus skip logic or conditional branching can be incorporated to efficiently guide reviewers through the relevant questions of the form. Electronic interfaces listed in Table 3.4 make it easy to create such forms and decrease the risk of reviewers answering the wrong question or missing a pertinent question.

The preceding stages of the review should improve the review team’s familiarity with the nature and extent of the relevant literature compared to at the outset of the review. To take advantage of this, we recommend that pre-testing of the study characterization form be undertaken after the study selection phase. The form should be pre-tested by all reviewers on a minimum of 5–10 full text articles that represent the variety of relevant studies captured; this will help to clarify questions or criteria not apparent at the outset of the review and to improve the consistency of data characterization (Badger et al., 2000). The form should be refined as needed based on the results of the pre-test and feedback from reviewers.

Levac et al. (2010) recommend that data from the first 5–10 studies be extracted by two
independent reviewers to determine whether the approach is consistent with the review question and purpose, and that further studies may be extracted by one reviewer. We support this recommendation only when time and resources do not allow for two independent reviewers to review each article. Data extraction for systematic reviews by one reviewer has been found to generate more errors than by two reviewers (Buscemi et al., 2006). Therefore, we recommend that data characterization be conducted by two independent reviewers to minimize potential reviewer bias, ensure rigour of the process and detect human error (e.g. missed information, incorrect transcribing). Reviewers should meet throughout the study characterization process (e.g. every twenty to thirty papers) to resolve discrepancies and discuss any issues related to study characterization.

4.2. Risk of bias assessment

There is an ongoing deliberation in the literature regarding the need for risk of bias assessment (or critical appraisal) of individual studies in the scoping review process. To date, risk of bias assessment has not been widely conducted in scoping reviews; of 344 scoping reviews published from 1999 to 2012, 22% (77/344) included some form of assessment of individual studies (Pham et al., 2014). In their framework, Arksey & O’Malley (2005) stated that ‘quality assessment does not form part of the scoping [review] remit’, but they acknowledged that its omission is a limitation of the process. Risk of bias assessment is challenging in scoping reviews due to the wide range of study designs that may be included (Levac et al., 2009) and lack of a validated approach for scoping reviews. At this time, we have reserved risk of bias assessment for systematic reviews, and do not consider it to be a part of the scoping review process.
Stage 5: Collating, analyzing and reporting the results

5.1. Collating the data

All information extracted from individual studies should be compiled into a single dataset for validation and coding. Data collected electronically can be readily imported into a spreadsheet or statistical program. Recording of data on paper will require later transcription to an electronic database.

5.2. Analyzing the data

The first step in the analysis is to generate univariate descriptive statistics for each variable extracted in the data charting phase. For categorical or discrete variables, this comprises tabulating frequencies for each category in the variable. For continuous variables, this comprises determining the range (i.e. minimum and maximum) and the central tendency of the values (e.g. mean, median). This descriptive numerical analysis provides a general overview of the characteristics of the reviewed literature, such as the overall number of included studies, types of study designs, years of publication, types of interventions or exposures, types of outcome measures, and characteristics of the study populations (Arksey & O'Malley, 2005; Levac et al., 2009). Once frequencies have been tabulated for each discrete or categorical variable, cross-tabulations can be conducted to determine the relationship between different variables (e.g. type of study by year).

The second step of the analysis should involve some form of narrative synthesis, or in some cases, a qualitative thematic analysis or framework analysis (Arksey & O'Malley, 2005; Brien et al., 2010; Levac et al., 2009). In most cases, a narrative synthesis combined with a descriptive analysis as described above will be sufficient; however, some issues may benefit from a more sophisticated qualitative analysis that involves categorizing the study characteristics
into common themes (and sub-themes). For example, a scoping review that assessed the current state of knowledge regarding the use of social media for disease surveillance (Bernardo et al., 2013) included a thematic analysis to determine the important characteristics, considerations and challenges regarding the use of social media in this context. Thematic analysis is a type of qualitative analysis in which the data are analyzed to identify common or recurrent themes (Green & Thorogood, 2004). In scoping reviews, themes are interpretative ideas or concepts that describe or explain characteristics of included studies. The initial list of themes is developed during protocol and tool development and can be refined by examining the data supporting each theme and by considering similarities and differences between themes (Braun & Clarke, 2006; Patton, 1990). The list is then reviewed and refined until a list of clear and distinct themes that accurately reflect the meaning of the dataset as a whole is generated (Braun & Clarke, 2006). Framework analysis builds on thematic analysis by summarizing and classifying themes within a thematic framework; diagrams and tables are commonly used to illustrate the relationships between themes (Green & Thorogood, 2004).

The third step in the analysis involves considering the implications of the findings for policy, practice and/or future research (Levac et al., 2009). The direction taken in this step is driven by the purpose and objectives of the scoping review. For scoping reviews aiming to describe the existing research on a topic, the analysis should include identifying gaps in the body of literature where insufficient research has been conducted, areas where further research should be focused, and design considerations for future research. For scoping reviews conducted as a preliminary step to one or more systematic reviews, the analysis should include identifying areas where further synthesis is feasible (i.e. where there is a sufficient number of studies that are homogeneous in terms of population, interventions, design and outcome measures) and
determining the potential scope and costs of undertaking one or more prioritized systematic reviews (i.e. based on the number of relevant studies) (Arksey & O'Malley, 2005). A framework-based analysis (Dixon-Woods, 2011) may be useful for scoping reviews seeking to address the potential implications for policy or practice.

5.3. Reporting the results

5.3.1. Reporting guidelines

Presenting the results of a scoping review in a clear and consistent matter will better enable policy makers, practitioners, researchers and other end users to make effective use of the findings (Arksey & O'Malley, 2005; Levac et al., 2010). At present, reporting guidelines for scoping reviews have not been developed (Brien et al., 2010). Given that scoping and systematic reviews share some processes, scoping review authors should consider using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (http://prisma-statement.org/) as a guide. The PRISMA Statement consists of a 27-item checklist and flow diagram template for reporting systematic reviews and meta-analyses (Moher et al., 2009). PRISMA checklist items pertaining to quantitative synthesis (e.g. 13, 14, 20, 21) and risk of bias assessments (e.g. 12, 15, 19, 22) are not relevant to scoping reviews.

5.3.2. Mapping the data

The aim of a scoping review is to provide an overview of the type, extent and quantity of research underpinning a broad topic. A combination of narrative text, tables and figures can be used to provide a clear overview of the body of literature to readers. Narrative text is useful for framing the overview, providing context, and presenting extended descriptions of the research. Tables and figures should be used to efficiently present large amounts of information and convey complex relationships not easily described in text (Schriger et al., 2006). The latter also works
well to visually highlight data gaps and research needs.

A single graphic depicting the entire body of literature on a topic is likely to be too elaborate to provide a useful overview of the research. In order to avoid overwhelming readers with more information than they desire or can comprehend in a single graphic (Schriger et al., 2006), scoping review authors should consider partitioning the data into more manageable pieces. Bubble charts, heat map tables and tree diagrams are types of tables or figures that are particularly useful for the visual display of the type, extent and quantity of research available on a topic.

**Bubble chart**

A bubble chart is a variation of an x-y scatterplot that displays the relationship between three variables. In a bubble chart, data points are replaced with bubbles that correspond in size to the value of the data at the given (x, y) position. Compared to frequency tables, bubble charts can show at a glance how numeric variables relate to each other. An example of a bubble chart is shown in Figure 3.2. Bubble charts can be created in any spreadsheet applications such as Microsoft Excel (Microsoft Corporation, Redmond, WA).

**Heat map table**

A heat map table is a frequency table in which individual cells are shaded or colour-coded based on their relative value. The use of a colour scale allows readers to quickly identify variances, patterns, gaps and areas of depth in the body of research. Table 3.5 is an example of a heat map table from a scoping review that characterized the available research on the prevalence, risk factors and interventions for 16 microbial hazards in leafy green vegetables (Ilic et al., 2012). While the table displays a large amount of data, the shading allows readers to see data trends and gaps in the research at a quick glance. A heat map table can be created in any...
spreadsheet applications such as Microsoft Excel (Microsoft Corporation, Redmond, WA) using conditional formatting. Conditional formatting allows the user to define the colour ranges and rules for shading.

**Tree diagram**

A tree diagram can provide a graphical representation of the distribution of research literature existing on a topic. A tree diagram is useful for depicting the breakdown of broad categories into subgroups with increasing levels of detail. Figure 3.3 is an example of a tree diagram from a scoping review that characterized published research investigating the prevalence of zoonotic bacteria in wild and farmed aquatic species and seafood (Tuševljak et al., 2012). The tree diagram shows the breakdown of the 1760 included research studies according to type of study, topic, pathogen, aquatic species and point in the food chain. Although the figure displays a large amount of data, it provides a useful visual overview of the relationships between the different nodes of research.

**Stage 6: Optional stakeholder engagement**

Stakeholder engagement is an optional sixth step in the Arksey & O’Malley (2005) framework that Levac et al. (2010) argue should be considered a requirement when conducting a scoping review. We agree that stakeholder involvement can provide ‘added value’ to a scoping review (Arksey & O’Malley, 2005) and should be included when feasible. A multi-stakeholder committee should be assembled at the start of the review and their involvement in the process should be clearly laid out in the review protocol. Attempts should be made to include at least one representative from each key stakeholder group on the committee. For example, the stakeholder committee for a scoping review on the potential public health risks of three emerging zoonotic viruses (Wilhelm et al., 2015) included a swine industry representative, a human
gastroenterologist, a food safety microbiologist, a public health practitioner, and a regulatory veterinarian. A multi-stakeholder committee can help ensure that the priority issues for each stakeholder group are considered.

While stakeholders can be engaged at all stages of the review, we suggest three stages where stakeholder input may be most useful for enhancing the relevance, practicality and utility of the review results for policy, practice and/or decision making. First, we suggest that the review protocol be shared with stakeholders prior to initiating the scoping review to obtain their feedback on the review question and scope, additional sources to search for relevant studies, the data collection forms, and potential knowledge dissemination strategies (Levac et al., 2010; Brien et al., 2010). In our experience, engaging with stakeholders at this stage has helped to confirm the scope of the review and gain insight on the priority research questions for the different stakeholder groups. Second, we suggest that preliminary results be shared with stakeholders after the study characterization and analysis stage as an opportunity to gather their insights on how the results may be interpreted, the validity of the findings, potential research gaps, and potential implications of the findings for policy, practice and research (Levac et al., 2010). Lastly, we suggest that a final report be presented to stakeholders to disseminate the overall findings of the scoping review and to discuss any potential next steps.

**Summary and Conclusion**

We have described a methodological framework for conducting and reporting scoping reviews using examples from the field of agri-food public health. The framework is presented as a linear process, but is likely to be iterative in practice with previous steps revisited if *a posteriori* decisions are made based on greater familiarity with the topic and literature as the review progresses. This framework builds on the work of previous scoping review authors and
incorporates lessons we have learned from our own experiences in conducting scoping reviews. We do not contend that our framework is the only correct approach, but it provides a step-by-step guide for researchers—particularly those in the field agri-food public health—with worked examples and insights from our experiences that should be readily adaptable to other study sectors.

The methodological rigour and transparency outlined at each step of the framework demonstrates that a scoping review should not be viewed as a quick or easy alternative to a systematic review. In reality, the ‘rapid review’ is the more appropriate alternative for researchers seeking to expedite the systematic review process by applying methodological shortcuts. Risk of bias assessment and meta-analysis are not omitted from the scoping review process to save time, but because they are not needed to achieve the aims of a scoping review. To recapitulate, the aim of a scoping review is to ‘map the literature on a particular topic or research area and provide an opportunity to identify key concepts; gaps in the research; and types and sources of evidence to inform practice, policymaking, and research’ (Daudt et al., 2013). As such, a scoping review should be viewed as a complementary first step to one or more systematic reviews, or as a synthesis method with a different aim from a systematic review.

Scoping reviews are a relatively new research synthesis approach that continues to be refined and developed with time. We hope by presenting this framework, we will bring greater awareness about the scoping review as a research synthesis methodology and perhaps contribute to future advancements.

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Health Agency of Canada.
Figure 3.1. Overview of the scoping review stages.
Figure 3.2. Example of a bubble chart of 866 primary research articles investigating the role of wildlife in transmission of antimicrobial resistance (AMR) to the food chain showing the number of articles by publication date range investigating AMR in various bacterial species and study locations. Adapted from “A scoping review of the role of wildlife in the transmission of bacterial pathogens and antimicrobial resistance to the food chain,” by J. Greig, A. Rajić, I. Young, M. Mascarenhas, L. Waddell and J. LeJeune, 2014, Zoonoses and Public Health, p. 9. Copyright 2014 by Zoonoses and Public Health and Her Majesty the Queen in Right of Canada. Reproduced with the permission of the Minister of Canadian Food Inspection Agency. Adapted with permission.
Figure 3.3. Example of a tree diagram. This structure chart shows the distribution of primary research according to type of study, topic, pathogen, aquatic species and point in the food chain. Adapted from “Prevalence of zoonotic bacteria in wild and farmed aquatic species and seafood: a scoping study, systematic review, and meta-analysis of published research,” by N. Tuševljak, A. Rajić, L. Waddell, L. Dutil, N. Cernicchiaro, J. Greig, B.J. Wilhelm, W. Wilkins, S. Totton, F.C. Uhland, B. Avery, and S.A. McEwen, 2012, *Foodborne Pathogens and Disease*, 9(6), p. 491. Copyright 2012 by Mary Ann Liebert, Inc.
Table 3.1. Search algorithm for a scoping review on the use of search queries and social media for disease surveillance (Bernardo et al., 2013).

<table>
<thead>
<tr>
<th>ID</th>
<th>Search query</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>social media OR blog* OR microblog* OR crowdsourc* OR twitter OR facebook OR wiki* OR search engine OR</td>
</tr>
<tr>
<td>2</td>
<td>(google OR internet OR web OR online) AND (social network OR social networking OR search OR query)</td>
</tr>
<tr>
<td>3</td>
<td>#1 OR #2</td>
</tr>
<tr>
<td>4</td>
<td>disease OR illness* OR outbreak OR epidemic OR pandemic</td>
</tr>
<tr>
<td>5</td>
<td>surveillance OR track* OR forecast* OR monitor* OR predict*</td>
</tr>
<tr>
<td>6</td>
<td>PUBYEAR AFT 2001</td>
</tr>
<tr>
<td>7</td>
<td>#3 AND #4 AND #5 AND #6</td>
</tr>
</tbody>
</table>
Table 3.2. Examples of bibliographic databases that index journals publishing agri-food public health research.

<table>
<thead>
<tr>
<th>Database</th>
<th>Publisher</th>
<th>Description</th>
</tr>
</thead>
</table>
| AGRICOLA                              | National Agricultural Library, United States Department of Agriculture | • AGRICultural OnLine Access  
• Access to >5 million records for materials in all formats relating to agriculture and its related fields, including animal and veterinary sciences, entomology, plant sciences, forestry, aquaculture and fisheries, farming and farming systems, agricultural economics, extension and education, food and human nutrition, and earth and environmental sciences.  
• Available publicly through the USDA website or a variety of platform vendors such as ProQuest and EBSCO. |
| Animal Health and Production Compendium| CABI                             | • Access to datasheets (>20,000), images (>2,000) and bibliographic records (>290,000) on animal diseases, pathogens, disease vectors, genetics and nutrition of livestock and poultry species and breeds, animal husbandry, and food safety.  
• Available through the CABI platform. |
| Biological Science Collection         | ProQuest                         | • Access to >35 million abstracts and citations in the biological science fields including animal behaviour, aquatic life and fisheries, biochemistry, ecology, immunology genetics, toxicology, health and safety science, virology and microbiology, entomology and plant science.  
• Available through the ProQuest platform. |
| BIOSIS Citation Index                 | Thomson Reuters                  | • Access to nearly 5,000 journals and >20 million records in the life sciences field including coverage in molecular and cell biology, pharmacology, endocrinology, genetics, neurosciences, infectious disease, ecology and organismal biology.  
• Available only through the Thomson Reuters Web of Science platform. |
| CAB Abstracts                         | CABI                             | • Access to >7.7 million records in the applied life sciences field including coverage of agriculture, environment, veterinary sciences, applied economics, food science and nutrition.  
• Available through the Cab Direct platform. |
| Current Contents Connect              | Thomson Reuters                  | • A multidisciplinary current awareness database that is updated daily.  
• Available through the Web of Science platform. |
| EMBASE                                | Elsevier                         | • Access to >28 million records from the biomedical |
literature with a strong focus on drugs and pharmacology, medical devices, clinical medicine and basic science relevant to clinical medicine.
• Includes conference abstracts from biomedical, drug and medical device conferences since 2009.
• Available through a variety of platform vendors such as Ovid.

Environmental Sciences and Pollution Management ProQuest LLC

• Access to millions of abstracts and citations for literature relating to environmental sciences published from 1967 to present.
• Coverage includes: agricultural biotechnology, air quality, aquatic pollution, bacteriology, ecology, energy resources, environmental biotechnology, environmental engineering and hazardous waste.
• Available through the ProQuest platform.

FSTA –Food Science and Technology Abstracts International Food Information Service (IFIS)

• Access to >1 million records from over 4,600 publications in the areas of food science, food technology and nutrition.
• Covers topics relating to every aspect of the food chain plus biotechnology, microbiology, food safety, additives, nutrition, packaging and pet foods.
• Available through a variety of platform vendors such as Web of Science and OVID.

MEDLINE US National Library of Medicine

• Access to >21 million citations from journal articles in life sciences with a concentration on biomedicine.
• Updated daily with a time coverage dating back to 1946.
• Available publicly through PUBMED or a variety of platform vendors such as Web of Science.

ProQuest Agricultural Science Collection ProQuest LLC

• Access to >4.8 million records for literature covering all aspects of agriculture and related fields, such as: animal and veterinary sciences, plant sciences, forestry, aquaculture and fisheries, farming and farming systems, agricultural economics, and food and human nutrition.
• Available through the ProQuest platform.

Scopus Elsevier

• Multidisciplinary database with access to >50 million records from <21,000 journals.
• Covers the fields of science, mathematics, engineering, technology, health and medicine, social sciences and arts and humanities.
• Available through the Scopus website.

Zoological Record Thomson Reuters

• The world’s oldest continuing database of animal
biology with coverage dating back to 1864.
• Leading taxonomic reference with coverage in veterinary sciences, biodiversity, ecology, conservation and wildlife preservation.
• Available through the Web of Science platform.
Table 3.3. Summary details of additional sources to search for potentially relevant research.

<table>
<thead>
<tr>
<th>Sources</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference list of relevant review articles</td>
<td>Manually scan the reference list of 10-20 literature review articles that span the topic area. Any references that may be relevant to the review topic should be cross-checked against the list of citations already identified in the search to date.</td>
</tr>
<tr>
<td>Manual (or hand-searching) of key journals</td>
<td>Manually searching key journals relevant to the review topic may identify articles missed in the database searches. Any journal article that may be relevant to the review topic should be cross-checked against the list of citations already identified in the search to date.</td>
</tr>
<tr>
<td>Topic experts</td>
<td>Topics experts may be solicited to provide a list of articles relevant to the review topics; to suggest journals, websites or other sources that may be contain relevant articles; or to review the search strategy.</td>
</tr>
<tr>
<td>Forward citation tracking</td>
<td>Many databases allow users to track an article forward in time, to identify subsequent publications that have cited the article. Performing forward citation tracking on a selection of 10-20 relevant articles may identify potentially relevant journal articles missed in the database searches. Any journal article that may be relevant to the review topic should be cross-checked against the list of citations already identified in the search to date.</td>
</tr>
</tbody>
</table>
Table 3.4. Summary list of electronic and paper options for data collection.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Commercial software (e.g. DistillerSR (https://systematic-review.ca, Evidence Partners, Ottawa, ON), TrialStat® (www.trialstat.com, Jubilant Clinsys Inc., Ottawa, ON), SUMARI (http://www.joanna-briggs.org/sumari.html, Joanna Briggs Institute, Adelaide, South Australia)) | Web-based systematic review software designed to collect and manage all aspects of the review process. | • Manages bibliographic citations, screening and study characterization forms and full text articles in a single location.  
• Web-based application means that reviewers only need a computer with internet access.  
• User-friendly interface and structured data entry.  
• Automated function for identifying and managing discrepancies between reviewers.  
• Data can easily be merged into a single spreadsheet and exported for analysis.  
• All reviewer actions are archived. | • Cost of licences may be prohibitive.  
• Software training may be required for the project administrator prior to setting up the project. |
| Database management systems (e.g. Microsoft Access (Microsoft Corporation, Redmond, WA)) | A relational database to collect and manage data.                           | • User-friendly interface can be created with structured data entry.  
• Processes can be automated to simplify data management.  
• Database can be designed to manage bibliographic citations and full text articles. | • Potential cost of software.  
• Software may not be available for all operating systems (e.g. Microsoft Access and Mac OS)  
• Creating a database requires technical skills and can be very time-consuming for a beginner.  
• Not web-based.  
• Discrepancies |
<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online survey program (e.g. SurveyMonkey (<a href="http://www.surveymonkey.com">www.surveymonkey.com</a>; SurveyMonkey, Palo Alto, CA), LimeSurvey (limesurvey.org; LimeSurvey®, Hamburg, Germany))</td>
<td>Online survey as a data collection form.</td>
<td>• User-friendly interface.</td>
<td>• Potential cost of a user licence.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No cost with use of a free survey application.</td>
<td>• Bibliographic citations and articles need to be managed separately.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Data can easily be merged into a single spreadsheet and exported for analysis.</td>
<td>• Discrepancies between reviewers are identified and managed manually.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Web-based – reviewers only need a computer with internet access.</td>
<td></td>
</tr>
<tr>
<td>PDF forms via Adobe FormsCentral or Adobe Acrobat Pro (<a href="http://www.adobe.com">www.adobe.com</a>; Adobe Systems Incorporated, San Jose, CA)</td>
<td>Fillable .pdf form (with options such as dropdown lists, checkboxes, numeric fields, text fields and radio buttons) to collect data.</td>
<td>• User-friendly interface.</td>
<td>• Potential difficulty in managing all forms since each one is a separate file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Data from each form can easily be merged into a spreadsheet and exported for analysis.</td>
<td>• Potential cost of Adobe Acrobat Pro software or Adobe Forms Central licence to create the form.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No cost if Adobe Acrobat Pro is available.</td>
<td>• Bibliographic citations and articles need to be managed separately.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Discrepancies between reviewers are identified and managed manually.</td>
</tr>
<tr>
<td>Spreadsheet application (e.g. Microsoft Excel (Microsoft Corporation, Redmond, WA))</td>
<td>Data collection in a spreadsheet.</td>
<td>• No additional costs if access to a spreadsheet application is available.</td>
<td>• Responses from each spreadsheet will need to be compiled into a single spreadsheet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fast and easy to create and implement.</td>
<td>• Discrepancies between reviewers are identified and managed manually.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bibliographic citations can be imported into the spreadsheet.</td>
<td>• Data entry is less structured and more prone to</td>
</tr>
</tbody>
</table>
| Paper            | Paper data collection form. | • Fast and easy to create and implement.  
• Hard-copy automatically created for each form. | • Large quantity of paper required.  
• Difficulty in managing all forms.  
• Transcribing responses electronically is time-consuming and prone to human error.  
• Bibliographic citations and articles need to be managed separately.  
• Discrepancies between reviewers are identified and managed manually. |
Table 3.5. Example of a heat map table. This heat map table displays the number of research studies identified on the prevalence, risk factors and interventions for select microbial hazards in leafy green vegetables. The darker-shaded cells represent vegetable-pathogen combinations where many studies have been published relative to the lighter-shaded cells where few or no studies have been published. Adapted from “A scoping study characterizing prevalence, risk factor and intervention research, published between 1990 and 2010, for microbial hazards in leafy green vegetables,” by S. Ilic, A. Rajić, C.J. Britton, E. Grasso, W. Wilkins, S. Totton, B.J. Wilhelm, L. Waddell and J.T. LeJeune, 2012, *Food Control*, 23(1), p. 14. Copyright 2011 by Elsevier Ltd. Adapted with permission.

<table>
<thead>
<tr>
<th></th>
<th><em>Escherichia coli</em></th>
<th><em>Salmonella spp.</em></th>
<th><em>Listeria spp.</em></th>
<th><em>Staphylococcus spp.</em></th>
<th><em>Enterobacteriaceae</em></th>
<th><em>Shigella</em></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lettuce</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>231</td>
<td>147</td>
<td>123</td>
<td>46</td>
<td>31</td>
<td>17</td>
<td>463</td>
</tr>
<tr>
<td>Risk factor</td>
<td>161</td>
<td>9</td>
<td>84</td>
<td>22</td>
<td>19</td>
<td>10</td>
<td>325</td>
</tr>
<tr>
<td>Intervention</td>
<td>101</td>
<td>65</td>
<td>65</td>
<td>18</td>
<td>13</td>
<td>9</td>
<td>192</td>
</tr>
<tr>
<td><strong>Cabbage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>50</td>
<td>28</td>
<td>47</td>
<td>9</td>
<td>8</td>
<td>5</td>
<td>127</td>
</tr>
<tr>
<td>Risk factor</td>
<td>35</td>
<td>22</td>
<td>30</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>92</td>
</tr>
<tr>
<td>Intervention</td>
<td>17</td>
<td>11</td>
<td>14</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>39</td>
</tr>
<tr>
<td><strong>Herbs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>36</td>
<td>37</td>
<td>26</td>
<td>9</td>
<td>4</td>
<td>8</td>
<td>102</td>
</tr>
<tr>
<td>Risk factor</td>
<td>24</td>
<td>22</td>
<td>17</td>
<td>8</td>
<td>4</td>
<td>5</td>
<td>62</td>
</tr>
<tr>
<td>Intervention</td>
<td>21</td>
<td>23</td>
<td>13</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>57</td>
</tr>
<tr>
<td><strong>Spinach</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>61</td>
<td>29</td>
<td>18</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>Risk factor</td>
<td>20</td>
<td>14</td>
<td>10</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>47</td>
</tr>
<tr>
<td>Intervention</td>
<td>47</td>
<td>21</td>
<td>11</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>73</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>309</td>
<td>199</td>
<td>182</td>
<td>58</td>
<td>50</td>
<td>28</td>
<td>657</td>
</tr>
<tr>
<td>Risk factor</td>
<td>224</td>
<td>135</td>
<td>131</td>
<td>26</td>
<td>25</td>
<td>18</td>
<td>473</td>
</tr>
<tr>
<td>Intervention</td>
<td>133</td>
<td>87</td>
<td>86</td>
<td>24</td>
<td>36</td>
<td>12</td>
<td>268</td>
</tr>
</tbody>
</table>

Note that totals do not add up because one article often investigated multiple leafy greens and multiple pathogens.
References


a decision support synthesis. *Nursing Leadership (Toronto, Ont.)* **23**: 15-34.


Grindlay DJ, Brennan ML, Dean RS. 2012. Searching the veterinary literature: a comparison of
the coverage of veterinary journals by nine bibliographic databases. *Journal of Veterinary Medical Education* **39**(4): 404-412. DOI: 10.3138/jvme.1111.109R.


CHAPTER FOUR

The utility of systematic reviews and review-derived formats for informing policy decisions: a survey of Canadian policy makers and those who support them

1. Background

Research evidence is one of many inputs that policy and decision makers weigh in making decisions about policy and practice (Lavis et al., 2005; Mays et al., 2005; Rajić et al., 2013). Syntheses of research evidence—or knowledge syntheses—can be helpful to policy and decision makers as they contextualize and integrate the findings of individual studies within the larger body of research knowledge on the topic (Canadian Institutes of Health Research, 2008). Knowledge syntheses can provide a more reliable assessment of the state of knowledge on a topic than individual research studies and thus provide a stronger support for decision making. Furthermore, drawing on knowledge syntheses constitutes a more efficient use of time for busy decision makers who typically lack the necessary skills and expertise to identify, appraise, synthesize and interpret the results of individual studies (Lavis et al., 2005; Young et al., 2014).

Systematic reviews (SR) are widely regarded as the best source of synthesized research evidence as they use rigorous and transparent methods to identify, appraise and synthesize all relevant research evidence on a specific and clearly defined question (Centre for Reviews and Dissemination, 2008; Rajić & Young, 2013). When the results of included studies are synthesized quantitatively using meta-analysis, a more precise estimate of the effects of an intervention can be derived than from the individual studies (Higgins & Green, 2011). Although systematic reviews and meta-analyses (SR-MA) are increasingly being regarded as important sources of information for policy and decision makers (Moat et al., 2013), current evidence suggests that they may be infrequently used to inform decisions (Tricco et al., 2011; Murthy et
A major barrier to the uptake of SR-MAs by policy and decision makers may be that they are most commonly disseminated through publication in peer-reviewed journals (Tricco et al., 2011); a format often written for an academic audience, focused on methodological rigour (Tricco et al., 2011), and not readily accessible to audiences outside the academic community.

To date, there is limited evidence on how SR-MAs should be presented to enhance their uptake in decision making (Tricco et al., 2011). Lavis et al. (2005) found that the optimal way to present research evidence to policy and decision makers is through a graded-entry format such as the 1:3:25 approach, which consists of a one-page of take-home messages, a three-page executive summary that summarizes the full report in plain language, and a 25-page report that includes details of the methodology used in the review (Canadian Foundation for Healthcare Improvement, 2010). A number of research organizations have made efforts to make the findings of SR-MAs more accessible and user-friendly with the development of summary formats that highlight their key findings (Lavis et al., 2005; Moat et al., 2013; Tricco et al., 2011). Among these organizations is the Cochrane Collaboration, which has developed a summary-of-findings table which aims to present the main findings of an SR-MA in a tabular format and maintains a website titled Cochrane Summaries (http://summaries.cochrane.org/) that provides the general public with free-to-access, web-based plain language summaries for individual Cochrane reviews.

End user evaluation of the utility of review-derived formats is essential to determining the optimal format for presenting evidence from SR-MAs to policy and decision makers to enhance their uptake in decision making. The purpose of this study was to investigate the extent to which policy makers, advisors, analysts and program managers and directors in Canada—from any sector or discipline—are aware of and have used evidence from SR-MAs to inform their work,
to gather their feedback on the utility of SR-MAs and three review-derived formats to inform policy. The study was complementary to a pilot case study (Young et al., 2014) that developed summaries using a 1:3 page format (Lavis et al., 2005; Canadian Foundation for Healthcare Improvement, 2010) for a recently conducted scoping review and a series of SR-MAs addressing different farm- and processing-level interventions to reduce Salmonella in broiler chickens. Using the above case study topic, the specific objectives of this study were to evaluate their perceptions towards:

1. the utility of evidence from systematic reviews and other knowledge synthesis methods,
2. the suitability of a 1:3 page format for evidence-based contextual summaries for a completed SR-MA, and,
3. the utility of a summary-of-findings (SoF) table for summarizing the main findings of an SR-MA,

to inform policy and practice decisions in their organization.

2. Methods

2.1. Survey method

From July to October 2012, an online survey and follow-up interviews were conducted with policy makers, advisors, analysts and program managers and directors in Canada to assess their perceptions of the utility of various SR-MA summary formats. In this study, participants evaluated 1 and 3 page summaries developed by Young et al. (2014) for an SR-MA addressing the effectiveness of biosecurity and vaccination in reducing Salmonella spp. in broiler chickens (Totton et al., 2012):

1. An SoF table of the main findings of the SR-MA [see Appendix 4.1]. The SoF table was developed using the recommended Cochrane format (Higgins & Green, 2011) with some
modifications to account for considerations specific to agri-food public health research (e.g. level of evidence provided by challenge trials and observational studies).

2. A one-page summary sheet presenting the key take-home messages from the SR-MA using plain language in bullet points [see Appendix 4.2]. This one-page sheet focused on the practical implications of the evidence and was structured under the following subheadings: Background, Findings, ‘What does this mean?’ and ‘Next Steps’.

3. A three-page narrative and plain language summary of the main findings from the SR-MA as well as additional contextual information (e.g., cost, practicality, availability, public sensitivity, additional benefits or harms) gathered from rapid reviews of the peer-reviewed and grey literature and interviews with key topic experts (Young et al., 2014) [see Appendix 4.3].

Additional details on the process of developing the one- and three-page formats are reported in Young et al. (2014). The survey asked participants to review the systematic review and three summaries, and then complete an online questionnaire designed to capture their opinions on the utility of each document for decision making. The questionnaire also elicited information about respondent’s familiarity with SR-MAs and other knowledge synthesis methods. All participants were informed that their participation was completely voluntary, that individual responses would be kept confidential, and that submission of the online questionnaire was taken as informed consent to participate in the study. The Research Ethics Board at the University of Guelph approved the study (REB#: 11JN021).

2.2. Questionnaire development

An online questionnaire was created using the open source survey application LimeSurvey version 1.91 (http://www.limesurvey.org/) [see Appendix 4.4]. The questionnaire
consisted mainly of closed-ended questions with ordered response categories and one open-ended text box for additional comments. The 32 questions addressed four key areas: 1) demographic information, 2) familiarity with SR-MAs and other knowledge synthesis methods, 3) user experience with each format, and 4) the utility of material from each format for informing policy decisions. An invitation was included at the end of questionnaire for respondents to participate in a follow-up interview to discuss their survey responses in greater detail. The questionnaire was pre-tested by two individuals (a policy analyst and a program manager) prior to implementation.

2.3. Participant selection and recruitment

The target population for the study comprised policy makers, advisors, analysts and program managers and directors in Canada—from all levels of government and industry. As turnover and job movement are common among individuals working in these roles and because they often have a broad mandate (Lavis et al., 2005), we did not limit the study population to those working only in the field of agri-food public health. Searches of online government directories (e.g. Canadian Food Inspection Agency, Ontario Ministry of Agriculture, Food and Rural Affairs) and organizational websites (e.g. Chicken Farmers of Canada, Alberta Milk) were conducted to generate an initial list of potential participants. A convenience sample of participants was purposively selected from the list to ensure that a variety of organizations, including government (provincial, territorial and federal) and industry were included. Snowball sampling (i.e. identification of participants through key informants and their contacts) was also used to identify additional participants. Between July 27–31, 2012, e-mail invitations were sent to 212 potential participants and to the approximately 4500 registrants to the Policy Innovation and Leadership listserv. The survey was available online between July 27 and September 28,
A reminder e-mail was sent on September 19, 2012 to individuals from the convenience sample. A $20 gift card was offered as an incentive to take part in the survey.

2.4. Follow-up interview

Respondents indicating in the survey that they were interested in discussing their responses in further detail were contacted to schedule a follow-up interview. The semi-structured interviews followed a pre-determined question guide consisting of 21 potential questions that could be asked based on the participant’s survey responses [see Appendix 4.5]. The interviews were conducted between August 3 and October 28, 2012. All interviews were conducted by M.P. and were carried out over the telephone or in-person at the participant’s convenience. The interviews were audio-recorded and then transcribed verbatim by a transcription service.

2.5. Data analyses

Responses from the web-based questionnaire were downloaded into a Microsoft Excel 2010 spreadsheet (Microsoft Corporation, Redmond, WA). Descriptive tabulations were calculated using STATA version 12 (StataCorp, College Station, TX). The interview data were narratively summarized and used to supplement the results of the survey. A formal qualitative analysis was not performed due to the small number of interviews conducted.

3. Results

3.1. Survey

Part A: Demographic information

The online survey was started by 137 individuals; 111 from the e-mail listserv and 26 from the personal e-mail invitations. Twenty-nine individuals did not answer any questions beyond the initial five demographic questions and were thus excluded from the analysis. Our analysis included the responses from the remaining 108 respondents (86 from the e-mail listserv
and 22 from the personal e-mail invitations) and their demographic characteristics are displayed in Table 4.1. Not all questions were answered by all 108 respondents; hence, some analyses were conducted with smaller sample sizes as noted in the tables and figures. Nearly two-thirds of respondents were self-described as policy analysts (36.1%; 39/108) and advisors (28.7%; 31/108), compared with the smaller proportion that described their primary job function as policy makers (3.7%; 4/108) and program managers or directors (14.8%; 16/108). Respondents self-described as having “Other” job functions (16.7%; 18/108) included program coordinators and consultants, but the specific job function was often not reported. Most participants (94.4%; 101/107) had at least a bachelor’s degree. Among the 12 respondents (11.1%) that reported not knowing whether they had access to journal articles, 5 were self-described as policy analysts (5/39), 4 as “Other” (4/18), 2 as policy advisors (2/31) and 1 as a policy maker (1/4).

Part B: Familiarity with and perceptions towards synthesis research

Respondents’ self-described levels of familiarity with narrative reviews, SRs, MAs and scoping reviews are displayed in Figure 4.1. Nearly three-quarters of respondents (73.2%; 79/108) reported having read a SR sometime prior to participating in the survey, and approximately half of all respondents (50.9%; 55/108) had consulted a SR to inform their work in the past six months. When sorted by job function, those self-described as a program manager or director numerically had the highest proportion of respondents that reported having read a SR previous to participating in the study (93.8%; 15/16) or to have consulted a SR in the past six months (73.3%; 11/15). The majority of respondents (92.9%; 91/98) reported that they thought evidence from SRs could be useful to inform policy decisions in their organization. One respondent wrote in the comment box: “I believe that systematic reviews form the basis of strong evidence-based policy making.” When asked whether they would consider funding or
commissioning a SR in the future, 45.4% (49/108) of respondents selected ‘Not Applicable’ and 67.7% (40/59) of the remaining respondents reported that they would. Respondents were asked whether they generally read the full paper when reviewing any journal article, and if not, which sections they generally reviewed (Figure 4.2). The abstract or summary (76.9%; 83/108) and conclusion (70.4%; 76/108) were the sections most generally read by respondents.

Part C: User experience with systematic review and review-derived formats

This section of the questionnaire pertained to the systematic review manuscript and the three review-derived formats that respondents were asked to review. For each format, respondents were asked to rate 1) the ease or difficulty in interpreting the information (Figure 4.3), 2) the trustworthiness of the evidence (Figure 4.3), 3) the amount of detail presented for their day-to-day work (Figure 4.4), and 4) the utility for informing a policy decision (Figure 4.4). Only 52.1% (49/94) of respondents reported reading the systematic review article in full, compared to 90.4% for the one-page summary, 80.2% (73/91) for the three-page summary, and 80.0% (76/95) for the SoF table. Respondents were given a hypothetical scenario in which they were asked to attend a meeting to consult on an important policy decision and could only take one of the four documents in with them; the format most frequently chosen by respondents was the three-page summary (49.0%; 49/100), followed by the one-page summary (23.0%, 23/100), systematic review article (15.0%; 15/100) and SoF table (13.0%; 13/100).

Respondents were asked to rate the usefulness of each part of the full SR-MA manuscript for informing policy decisions (Table 4.2). The Conclusion section was most often rated to be ‘very useful’ (56.7%, 51/90), while the forest plots were most often rated to be ‘not useful’. Approximately two-thirds of respondents (66.3%) indicated that the full SR-MA contained too much detail for informing policy decisions (Figure 4.4), with one respondent commenting that:
“Much of the detail in the published journal article relates to the structure and research methodology used in the SR-MA, which is relevant to fellow researchers and academics, but not as relevant in a policy context. This does not necessarily mean that the information is not important, but it is not information that would make its way into materials that a policy advisor may prepare for decision makers.” Another respondent also commented: “The systematic review was too detailed and complex for non-researchers. As a policy specialist, I don't require that level of information on methodology, discussion, etc. What's key is the broad strokes of the studies, the results, the conclusions, and the recommended next steps.”

Respondents’ perceptions of the usefulness of each section of the SoF table for informing policy decisions are provided in Table 4.3. None of the sections was rated as ‘very useful’ by the majority of respondents; the Comments section—intended to help readers interpret the data in the corresponding row—was the most frequently rated as ‘very useful’ with 26.1% of respondents (23/88). A respondent commented on the perceived utility of the format: “The summary of finding analysis data page seems to be the least useful product and I'm not sure that [this] page adds more to the information from the full report.” Another respondent also commented that: “The table was a bit too sparse, without the necessary contextual information.”

Responses to the one-page summary were mixed. The format was most frequently rated as being ‘very easy’ to interpret (66.7%; 66/99) (Figure 4.3), and one survey respondent noted that it was useful to them “since it a) used plain language, and b) summarized a high volume of complicated material quickly”. However, the one-page summary was also most frequently rated as not containing enough detail (51.0%; 50/98) (Figure 4.4), and a respondent commented: “Not sure if there is value in producing a 1-page summary as it likely has too much of a risk of missing important information.” Respondents’ perceptions of the usefulness of each section of
the one-page summary are provided in Table 4.4.

The majority of optional (open-ended) comments submitted by survey respondents related to the three-page contextual summary. Many respondents commented on the utility of the additional contextual information (e.g., cost, practicality, availability, public sensitivity, additional benefits or harms) provided in the three-page summary (“The 3 page contextual summary is most useful for understanding the information and context quickly and for conveying the information to an audience.”). Many respondents also commented that the format provided the right amount of information to inform policy (“As someone who has to do a great deal of reading on research topics I may not be entirely familiar with and yet have to come up to speed quickly, I LOVED the 3-page contextual format. It gave me the right information, in the right quantity, and at the right level to be able to formulate or participate in a discussion. Far too often, given the current resource constraints and the number of different, and usually unlinked files I am working on, a meta-analysis is just far too much extraneous information for the purposes that I need it.”). Respondents’ perceptions of the usefulness of each section of the three-page contextual summary are provided in Table 4.5.

While the questionnaire did not explicitly seek to assess the summary formats as tools for graded entry into the full SR-MA, this was commented on by several respondents. For example, one respondent commented that: “It would have been most useful to begin with the 1-page summary and the 3-page contextual summary and then proceed to the full study report.”

3.2. Follow-up interviews

Six survey respondents participated in the follow-up interviews to discuss their survey responses in more detail; three self-described as policy advisors and three as program managers or directors. The respondents were employed in either provincial and federal levels of
government, with four in areas related to agri-food public health. The interviews ranged in time from 17 to 53 minutes, with five conducted by telephone and one in person. The technical aspect of SR-MAs was discussed by several participants as a key barrier to their uptake in policy and decision making (“We’re not researchers, so a lot of the more detailed information is just kind of lost on us…What I want to know is what did you look at? What were the results? And what are your conclusions, and possibly your recommendations? So, a lot of the detail on the controls and the way the research was conducted, I’m kind of trusting the researchers that they will use the appropriate controls and, you know, check all the variables and do quality clinical research. But I don’t necessarily need to know the how.”). A participant also commented that the SoF table was difficult to interpret due to terminology used in the format: “I thought the [summary-of-findings] table was a little bit difficult to understand…I don’t know exactly what is meant by ‘relative effect’, ‘study design’ or ‘weight’.”

As the one-page and three-page summaries were both presented in plain language and with similar layouts, participants were asked to elaborate on their preference for the three-page format. One participant explained: “The one-pager I thought was good for me; it gave me a quick overview. But if I was going into a meeting where I was probably going to be asked questions about different aspects, the three-pager was kind of the in-between, between the systematic review and the quick summary.” Another participant explained: “I thought the additional information that was included in the three-page one was more useful, and it wasn’t any harder to sift through.” One participant suggested that the two formats could be combined (“I would say combine the two…So you have all the relevant information right on the first page, but then you’re providing the detail below for when people have more questions.”).
4. Discussion

Our survey and follow-up interviews were designed to investigate the extent to which policy makers, advisors, analysts and program managers and directors in Canada are aware of and have used evidence from SR-MAs to inform their work, and to gather their opinions on the utility of SR-MAs and three review-derived formats to inform policy. Participation in the survey was lower than anticipated and our sample consisted largely of policy advisors and analysts. The majority of our survey respondents reported some sort of familiarity with SRs and many indicated that they had used evidence from SRs to inform a policy decision. Given a choice between the full SR-MA article and the three summary formats derived from the review, most survey respondents preferred the three-page format with additional contextual information (e.g., cost, practicality, availability, public sensitivity, additional benefits or harms) for informing policy decisions. This suggests that policy makers prefer research evidence in a summarized, plain language format, and favour additional information that places the evidence in the context of concomitant factors over the most succinct summary.

A number of respondents reported difficulty interpreting the SR-MA article. SR-MAs articles are generally written for a scholarly audience within a particular field; consequently, policy makers and their support staff may have difficulty reading SR-MAs since they are often non-experts (Lavis et al., 2005) and may not have a thorough understanding of research (Bowen et al., 2009). A lack of understanding of research may explain why policy and decision makers are sometimes thought to take the quality of research evidence for granted (Lavis et al., 2005). Some of our study participants expressed an assumption that studies published in peer-reviewed journals were of sound methodological quality; therefore details regarding methodology may have been perceived as irrelevant to them for informing policy decisions. This highlights the importance of using SR-MAs to inform decision making over individual studies since studies
included in a SR-MA have been assessed for risk of bias using a systematic and transparent process (Lavis et al., 2005), and the need for resources to help those involved in the policy process to better understand and interpret research evidence, such as the “Understanding Research Evidence” series of videos by the National Collaborating Centre for Methods and Tools (www.nccmt.ca).

The summary-of-findings (SoF) table format was developed to make evidence from SRs more useful and understandable for health professionals with limited time to read and review journal articles and reports (Rosenbaum et al., 2010). Although SoF tables are intended for a broader audience, including end users of SRs and guidelines (Guyatt et al., 2011), a quarter of our survey respondents found the format difficult to interpret. The numerical presentations of risk in the SoF tables may be useful and understandable for a clinical audience (Guyatt et al., 2011), but may be more difficult for those with non-clinical backgrounds to interpret without further elaboration. It has been shown that many individuals, including those with advanced levels of education, can have difficulty interpreting simple numerical expressions of risk (Lipkus et al., 2001), thereby increasing the importance of verbal expressions of probability and uncertainty when communicating risk information to policy and decision makers (Gurmankin et al., 2004).

Of the four formats presented to study participants, the three-page summary with additional contextual information was the preferred format for informing policy decisions. This preference appears to indicate that participants placed a higher value on the additional contextual information provided in the three-page summary over the shorter length of the one-page summary. This suggests that the addition of contextual information to the key findings of the SR-MA can help policy and decision makers assess the local applicability of the review findings and
highlight other decision-relevant information (e.g. potential risks or unintended consequences) (Lavis et al., 2005). The perceived ease of interpretation of the three-page format compared with the SR-MA article and SoF table indicates that the use of plain language was important in making the results of the SR-MA more user-friendly and digestible to participants.

A lack of time to research a topic and to consider research evidence has been reported as a key barrier to evidence-informed decision making (Bowen et al., 2009). It is possible that the 11.1% of respondents that reported not knowing whether they had access to journal articles had never tried to do so. The development of review-derived products targeted at policy and decision makers helps to address some of the challenges they face in incorporating research evidence into the decision making process (Lavis, 2009). The low percentage of respondents that reported reading the full SR article substantiates the concern that most research reports are too long and unlikely to be read by policy and decision makers unless the reports address an issue of top priority (Lavis et al., 2005). Summary formats that highlight the key findings of a review allow for rapid scanning for relevance and provide a graded entry to the full details of the review (Lavis et al., 2006). While the three-page summary was the preferred format among survey respondents, it is important to consider that more respondents reported reading the one-page summary in full. Therefore, the development of both the one- and three-page formats for SR-MAs with policy implications may be an ideal approach that addresses the different needs, timeframes, interests and levels of expertise of decision makers and support staff (Opiyo et al., 2013).

A strength of this study was having participants evaluate three different summary formats based on the same SR-MA article. This allowed for a comparison between the different formats and a better understanding of how policy and decision makers prefer to receive research
evidence. However, our study sample and response rate for the survey were small and given the sampling strategy used, our results may not be representative of the larger community of policy makers, advisors, analysts and program managers and directors in Canada. The representativeness of our sample cannot be adequately assessed since we did not collect demographic information about the study sector or level of government in which respondents were employed. However, it is estimated that at least 20.4% of respondents had a background in agri-food public health since 22 of the 108 respondents completed the survey using the link from the personal e-mail invitations. The selection of the convenience sample and the case study topic addressed in the SR-MA and summaries may have biased the study sample towards individuals with a background in agri-food public health. However this cannot be evaluated since respondents were not asked if they had any current or previous experience in agri-food public health. The case study topic may have also been a factor for the low response rate for our survey due to a lack of interest among individuals in other fields, as well as the amount of time required to review each format and complete the survey. Furthermore, respondents without a background in agri-food public health may have responded differently than those that did. Survey responses may not reflect actual practice; perceptions of each format may differ when consulting on an actual policy decision. Finally, our study only investigated participants’ perceptions and user satisfaction with each format and did not evaluate accuracy of understanding of information conveyed by each format.

5. Conclusions

Our survey of Canadian policy makers, advisors, analysts and program managers and directors contributes to the evaluative work being done to identify optimal ways of presenting evidence from SRs for use in policy and decision making. Most survey respondents reported
some level of familiarity with SRs, but indicated that the utility of the full SR for informing policy was limited by the large amount of detail it contained and difficulty of interpretation. Our study results indicate that summary formats highlighting the key findings of SRs in plain language and incorporating supportive contextual information may help to increase the potential uptake of evidence from SRs by policy and decision makers, but that quantitative SoF tables have limited utility among this audience. Future research replicating this study in other policy sectors with sector-relevant case study topics may provide an enhanced understanding of the perceptions of policy and decision makers in those sectors towards the utility of review-derived formats, and may help to validate the current findings. We concur with recommendations of previous authors that further evaluative work is needed to determine the optimal format for review-derived products targeted at policy and decision makers (Lavis et al., 2005) and whether these products are achieving their intended objectives (Moat et al., 2013).

Acknowledgements

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Figure 4.1. Level of familiarity with research synthesis methods (n=108).
Figure 4.2. Sections generally read when reviewing a journal article or knowledge synthesis paper.
Figure 4.3. Bubble plot of respondents’ perception of the ease of interpretation and trustworthiness of each format for informing policy decisions. The size of each bubble is proportional to the number of respondents who selected the corresponding response option.
Figure 4.4. Bubble plot of respondents’ perception of the level of detail and utility of each format for informing policy decisions. The size of each bubble is proportional to the number of respondents who selected the corresponding response option.
Table 4.1. Demographic characteristics of survey respondents (n = 108)

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary job function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy analyst</td>
<td>39</td>
<td>36.1%</td>
</tr>
<tr>
<td>Policy advisor</td>
<td>31</td>
<td>28.7%</td>
</tr>
<tr>
<td>Program manager or director</td>
<td>16</td>
<td>14.8%</td>
</tr>
<tr>
<td>Policy maker</td>
<td>4</td>
<td>3.7%</td>
</tr>
<tr>
<td>Other</td>
<td>18</td>
<td>16.7%</td>
</tr>
<tr>
<td><strong>Years of policy-related experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 2 years</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>2 to 5 years</td>
<td>31</td>
<td>28.7%</td>
</tr>
<tr>
<td>6-10 years</td>
<td>23</td>
<td>21.3%</td>
</tr>
<tr>
<td>Greater than 10 years</td>
<td>30</td>
<td>27.8%</td>
</tr>
<tr>
<td>No answer</td>
<td>24</td>
<td>22.2%</td>
</tr>
<tr>
<td><strong>Highest level of education completed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school diploma or equivalent</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td>Trade certification or diploma</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>College, CEGEP or other non-university or diploma</td>
<td>5</td>
<td>4.6%</td>
</tr>
<tr>
<td>Bachelor’s Degree</td>
<td>31</td>
<td>28.7%</td>
</tr>
<tr>
<td>Graduate (Master’s or Doctoral) or Professional Degree (MD, JD, DVM)</td>
<td>70</td>
<td>64.8%</td>
</tr>
<tr>
<td><strong>Perceived level of influence on policy- or decision making</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very low</td>
<td>11</td>
<td>10.2%</td>
</tr>
<tr>
<td>Low</td>
<td>27</td>
<td>25.0%</td>
</tr>
<tr>
<td>Moderate</td>
<td>47</td>
<td>43.5%</td>
</tr>
<tr>
<td>High</td>
<td>19</td>
<td>17.6%</td>
</tr>
<tr>
<td>Very high</td>
<td>4</td>
<td>3.7%</td>
</tr>
<tr>
<td><strong>Access to scientific journals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>68</td>
<td>63.0%</td>
</tr>
<tr>
<td>No</td>
<td>28</td>
<td>25.9%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>12</td>
<td>11.1%</td>
</tr>
</tbody>
</table>
Table 4.2. Respondents’ perceptions of the usefulness of various parts of the systematic review manuscript for informing policy decisions. Darker shaded cells indicate higher values.

<table>
<thead>
<tr>
<th>Part of Manuscript</th>
<th>Very useful</th>
<th>Useful</th>
<th>Somewhat useful</th>
<th>Not useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract (n = 94)</td>
<td>47 (50.0%)</td>
<td>32 (34.0%)</td>
<td>12 (12.8%)</td>
<td>3 (3.2%)</td>
</tr>
<tr>
<td>Introduction (n = 90)</td>
<td>25 (27.8%)</td>
<td>50 (55.6%)</td>
<td>14 (15.6%)</td>
<td>1 (1.1%)</td>
</tr>
<tr>
<td>Methods (n = 88)</td>
<td>7 (8.0%)</td>
<td>38 (43.2%)</td>
<td>25 (28.4%)</td>
<td>18 (20.5%)</td>
</tr>
<tr>
<td>PRISMA flowchart of study selection (n = 90)</td>
<td>12 (13.3%)</td>
<td>34 (37.8%)</td>
<td>27 (30.0%)</td>
<td>17 (18.9%)</td>
</tr>
<tr>
<td>Table summarizing characteristics of included studies (n = 90)</td>
<td>10 (11.1%)</td>
<td>26 (28.9%)</td>
<td>35 (38.9%)</td>
<td>19 (21.1%)</td>
</tr>
<tr>
<td>Forest plots of the effect of various treatments (n = 90)</td>
<td>10 (11.1%)</td>
<td>21 (23.3%)</td>
<td>38 (42.2%)</td>
<td>21 (23.3%)</td>
</tr>
<tr>
<td>Results (n = 91)</td>
<td>43 (47.3%)</td>
<td>34 (37.4%)</td>
<td>12 (13.2%)</td>
<td>2 (2.2%)</td>
</tr>
<tr>
<td>Discussion (n = 91)</td>
<td>43 (47.3%)</td>
<td>32 (35.2%)</td>
<td>14 (15.4%)</td>
<td>2 (2.2%)</td>
</tr>
<tr>
<td>Conclusions (n = 90)</td>
<td>51 (56.7%)</td>
<td>33 (36.7%)</td>
<td>6 (6.7%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>
Table 4.3. Respondents’ perceptions of the usefulness of various parts of the summary-of-findings table for informing policy decisions. Darker shaded cells indicate higher values.

<table>
<thead>
<tr>
<th>Section/heading</th>
<th>Very useful</th>
<th>Useful</th>
<th>Somewhat useful</th>
<th>Not useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of Population, Intervention, Comparison and Outcome (PICO) (n = 90)</td>
<td>21 (23.3%)</td>
<td>39 (43.3%)</td>
<td>27 (30.0%)</td>
<td>3 (3.3%)</td>
</tr>
<tr>
<td>Study design (n = 87)</td>
<td>11 (12.6%)</td>
<td>29 (33.3%)</td>
<td>34 (39.1%)</td>
<td>13 (14.9%)</td>
</tr>
<tr>
<td>Illustrated comparative risks (control group) (n = 88)</td>
<td>11 (12.5%)</td>
<td>41 (46.6%)</td>
<td>28 (31.8%)</td>
<td>8 (9.1%)</td>
</tr>
<tr>
<td>Illustrated comparative risks (treatment group) (n = 86)</td>
<td>9 (10.5%)</td>
<td>42 (48.8%)</td>
<td>27 (31.4%)</td>
<td>8 (9.3%)</td>
</tr>
<tr>
<td>Relative effect (95% C.I.) (n = 88)</td>
<td>10 (11.4%)</td>
<td>31 (35.2%)</td>
<td>37 (42.1%)</td>
<td>10 (11.4%)</td>
</tr>
<tr>
<td>Number of observations/trials/studies (n = 88)</td>
<td>16 (18.2%)</td>
<td>37 (42.1%)</td>
<td>26 (29.6%)</td>
<td>9 (10.2%)</td>
</tr>
<tr>
<td>Weight of evidence (GRADE) (n = 88)</td>
<td>18 (20.5%)</td>
<td>34 (38.6%)</td>
<td>26 (29.6%)</td>
<td>10 (11.4%)</td>
</tr>
<tr>
<td>Comments (n = 88)</td>
<td>23 (26.1%)</td>
<td>45 (51.1%)</td>
<td>16 (18.2%)</td>
<td>4 (4.6%)</td>
</tr>
<tr>
<td>Footnotes (below table) (n = 88)</td>
<td>9 (10.2%)</td>
<td>28 (31.8%)</td>
<td>35 (39.8%)</td>
<td>16 (18.2%)</td>
</tr>
</tbody>
</table>
Table 4.4. Respondents’ perceptions of the usefulness of various parts of the one-page summary for informing policy decisions. Darker shaded cells indicate higher values.

<table>
<thead>
<tr>
<th>Section/heading</th>
<th>Very useful</th>
<th>Useful</th>
<th>Somewhat useful</th>
<th>Not useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background (n = 90)</td>
<td>35 (38.9%)</td>
<td>44 (48.9%)</td>
<td>10 (11.1%)</td>
<td>1 (1.1%)</td>
</tr>
<tr>
<td>Findings (bulleted text) (n = 87)</td>
<td>47 (54.0%)</td>
<td>31 (35.6%)</td>
<td>8 (9.2%)</td>
<td>1 (1.2%)</td>
</tr>
<tr>
<td>Findings (table) (n = 90)</td>
<td>40 (44.4%)</td>
<td>37 (41.1%)</td>
<td>12 (13.3%)</td>
<td>1 (1.1%)</td>
</tr>
<tr>
<td>What does this mean? (n = 90)</td>
<td>50 (55.6%)</td>
<td>29 (32.2%)</td>
<td>10 (11.1%)</td>
<td>1 (1.1%)</td>
</tr>
<tr>
<td>Next steps (n = 89)</td>
<td>37 (41.6%)</td>
<td>31 (34.8%)</td>
<td>18 (20.2%)</td>
<td>3 (3.4%)</td>
</tr>
<tr>
<td>Footnotes (n = 89)</td>
<td>12 (13.5%)</td>
<td>35 (39.3%)</td>
<td>33 (37.0%)</td>
<td>9 (10.1%)</td>
</tr>
</tbody>
</table>
Table 4.5. Respondents’ perceptions of the usefulness of various parts of the three-page contextual summary for informing policy decisions. Darker shaded cells indicate higher values.

<table>
<thead>
<tr>
<th>Section/heading</th>
<th>Very useful</th>
<th>Useful</th>
<th>Somewhat useful</th>
<th>Not useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction (n = 86)</td>
<td>45 (52.3%)</td>
<td>33 (38.4%)</td>
<td>7 (8.1%)</td>
<td>1 (1.2%)</td>
</tr>
<tr>
<td>What are <em>Salmonella</em> vaccines (n = 85)</td>
<td>47 (55.3%)</td>
<td>25 (29.4%)</td>
<td>12 (14.1%)</td>
<td>1 (1.2%)</td>
</tr>
<tr>
<td>What you need to know (n = 87)</td>
<td>53 (60.9%)</td>
<td>22 (25.3%)</td>
<td>10 (11.5%)</td>
<td>2 (2.3%)</td>
</tr>
<tr>
<td>How effective are vaccines? (n = 86)</td>
<td>51 (59.3%)</td>
<td>27 (31.4%)</td>
<td>7 (8.1%)</td>
<td>1 (1.2%)</td>
</tr>
<tr>
<td>What vaccines are available for the broiler chicken industry? (n = 87)</td>
<td>43 (49.4%)</td>
<td>29 (33.3%)</td>
<td>13 (14.9%)</td>
<td>2 (2.3%)</td>
</tr>
<tr>
<td>At which stage is vaccination used? (n = 87)</td>
<td>38 (43.7%)</td>
<td>33 (37.9%)</td>
<td>13 (14.9%)</td>
<td>3 (3.5%)</td>
</tr>
<tr>
<td>Are there any concerns? (n = 87)</td>
<td>43 (49.4%)</td>
<td>29 (33.3%)</td>
<td>12 (13.8%)</td>
<td>3 (3.5%)</td>
</tr>
</tbody>
</table>
References


CHAPTER FIVE

Implications of applying methodological shortcuts to expedite systematic reviews: a comparative study using systematic reviews from agri-food public health

1. Background

Systematic reviews (SR) represent the highest level of evidence in intervention research since they use rigorous and transparent methods to identify, appraise and synthesize all relevant research evidence on a specific and clearly defined question (Centre for Reviews and Dissemination, 2008). As a result, they are considered to be more appropriate sources of research evidence to inform decision making than the newest or most highly-cited individual studies (Lavis et al., 2005). However, decision makers often require rapid access to current evidence on a topic to inform urgent policy and practice decisions (Ganann et al., 2010; Harker & Kleijnen, 2012; National Collaborating Centre for Methods and Tools, 2012). Frequently the timeframe available may be shorter than the typical six months to a year required to complete a full SR (Hemingway & Brereton, 2009). To better align with the needs of decision makers and other knowledge users, the rapid review (RR) has emerged as a streamlined approach to synthesizing research evidence when a shorter timeframe (e.g. less than six months) is available (Ganann et al., 2010; Harker & Kleijnen, 2012; Khangura et al., 2012).

Although there is currently no standardized approach for conducting RRs, they generally follow the same methodological process as traditional SRs, but with one or more methodological shortcuts (Ganann et al., 2010; Harker & Kleijnen, 2012). Some of the streamlined methods that have been adopted in RRs include: addressing a narrower research question (e.g. specific to a particular study population or setting); limiting the number of electronic databases searched; limiting or eliminating the search of the grey literature; defining narrower study eligibility
criteria (e.g. study design, language, location, publication dates); screening and reviewing by a single reviewer; eliminating risk-of-bias assessment, and not carrying out meta-analyses (MA) (Ganann et al., 2010; Harker & Kleijnen, 2012; Cameron et al., 2007; Grant & Booth, 2009; Van De Velde et al., 2011). While methodological shortcuts allow reviews to be conducted in less time and with fewer resources than a full SR, they may also increase the likelihood of introducing bias into the review process (Ganann et al., 2010; Harker & Kleijnen, 2012). The full implications of what is lost in terms of rigour, increased bias and accuracy of results when conducting a RR has not yet been elucidated (Ganann et al., 2010).

To date, there has been little research evaluating the impact of applying RR processes, or comparing the outcomes of RRs and SRs addressing the same question. A pilot study by Buscemi et al. (2006) found that data extraction by a single reviewer generated more errors than double data extraction with two reviewers. However, the greater error rate did not translate into substantial differences in “the direction, magnitude, precision or significance of pooled estimates for most outcomes” (Buscemi et al., 2006). In the only comparative study to date, Cameron et al. (2007) evaluated differences in methodologies and conclusions among four sets of SRs and RRs on the same topic published in the literature. They found that despite ‘axiomatic differences’ between the evaluated reviews, there were “no instances in which the essential conclusions of the different reviews were opposed.” Less formally, Van de Velde et al. (Van De Velde et al., 2011) noted in a letter to the editor that a SR (Vlachojannis et al., 2010) published in the journal concluded oppositely to their RR addressing the same topic (De Buck & Van Velde, 2010).

In this paper, we report on an empirical comparative study undertaken to assess the potential implications of four different methodological shortcuts on the outcome(s) of three completed SR-MAs addressing agri-food public health topics. For each review, the four
methodological shortcuts were applied individually with the objectives of assessing: the impact of the shortcut on the overall number of relevant studies included in the review; whether omitted studies affected the direction, magnitude or precision of summary estimates from MA; and if observed differences between summary estimates were statistically significant. The results of this study should help to better elucidate the implications of methodological shortcuts on the outcome of RRs.

2. Methods

2.1. Selection of systematic reviews-meta-analyses

Three SR-MAs evaluating the effectiveness of various agri-food public health interventions were selected for this study to serve as the reference standards (Greig et al., 2012; Wilhelm et al., 2011; Bucher et al., 2015). The review questions for each SR-MA are provided in Table 5.1. These SR-MAs were purposively selected since we had full access to their protocols, data collection forms and most data files, thereby ensuring that the original review processes could be duplicated.

2.2. Methodological shortcuts

For each SR-MA, the search and relevance screening steps were recreated while applying one of four methodological shortcuts. Each shortcut was applied separately while keeping all other methodological processes consistent with the original SR-MA. An overview of the study process is provided in Figure 5.1. An initial list of methodological shortcuts was developed based on a rapid scan of published RRs and methodological papers about rapid reviews:

1. Published RRs. A search was conducted in Scopus (SciVerse) using the search terms “rapid review” and “rapid systematic review”. Scanning the search output identified 43 articles on RRs; of which 38 were available in full-text through institutional holdings.
Data regarding the methodological processes reported in each RR were extracted and reviewed.

2. Methodological papers on RR. The following methodological papers were reviewed: two reviews of published RR (Ganann et al., 2010; Harker & Kleijnen, 2012), two articles describing the authors’ experiences in conducting RR (Khangura et al., 2012; Thomas et al., 2013), a survey of HTA agencies (Watt et al., 2008a), and two papers describing comparisons between RR and SR on the same topic (Van De Velde et al., 2011; Watt et al., 2008b).

Based on feasibility and prior use in the literature, the following four methodological shortcuts were selected for this study:

   i. Limiting the search of bibliographic databases to the one yielding the highest number of records from the search algorithm, in addition to ancillary sources searched in the original SR-MA (e.g. grey literature, hand-searching of key journals, reference lists and consultation with experts).

   ii. Limiting the search to bibliographic databases (i.e. excluding the grey literature and other non-bibliographic sources from the search).

   iii. Limiting inclusion of studies to those in which the full-text was available electronically through institutional holdings or publicly online (i.e. excluding studies that must be requested or photocopied from print sources).

   iv. Relevance screening of titles and abstracts by a single reviewer (rather than by two independent reviewers).

2.3. Shortcut 1 – One bibliographic database plus ancillary sources

For each SR-MA, the search documentation was examined to determine which of the
included bibliographic databases yielded the largest number of records. The records obtained from the single database were imported into a reference management program and merged with records arising from ancillary sources (e.g. grey literature search, hand-searching, consultation with experts), as reported in the original SR-MA. Studies included in the original SR-MA were cross-checked against these records to identify the relevant studies missed by not including the other bibliographic databases in the search.

2.4. Shortcut 2 – Limiting search to bibliographic databases

For each SR-MA, only records arising from the bibliographic database searches were imported into a reference management program. Studies included in the original SR-MA were cross-checked against these records to determine if, and how many, relevant studies were missed by omitting the grey literature and other non-bibliographic database sources from the search.

2.5. Shortcut 3 – Papers available electronically

A search was conducted to determine whether studies included in each of the original SR-MAs were readily available in a full-text electronic format (e.g. PDF, html), either publicly online or through institutional holdings (TriUniversity Group of Libraries, http://www.tug-libraries.on.ca/). Studies were excluded if the full-text was only available in print, through a library request, or purchase through the publisher.

2.6. Shortcut 4 – Single reviewer for title and abstract relevance screening

The potential implication(s) of this methodological shortcut was assessed by re-screening titles and abstracts for relevance in duplicate with two independent reviewers. Reviewer A was a veterinarian, had a master’s degree in epidemiology and had over five years of experience in relevance screening for reviews in agri-food public health. Reviewer B had a master’s degree in
public health and over two years of experience in relevance screening for reviews in agri-food public health. Reviewers were blinded to the study design and objectives, and to the identity of the other reviewer. Prior to screening, reviewers were provided a short document containing background information, the eligibility criteria and the relevance screening tool for the review. Each reviewer was then assigned a practice pre-test of 50 records of potentially relevant studies to screen in order to ensure adequate understanding of the review topic and screening criteria. Pre-test results for each reviewer were analyzed using Cohen’s kappa (κ), which assessed the extent of each reviewer’s agreement with the results of the original review above that expected by chance alone (Cohen, 1960). During screening, reviewers did not have access to the other reviewers’ responses. Studies included in the original SR-MA were cross-checked against the list of records included after screening by each reviewer to determine if, and how many, relevant studies were excluded.

2.7. Review management and data analysis

Bibliographic records for each review were managed in ProCite for Windows, Version 5.0.3 (ISI ResearchSoft, Berkeley, CA) or RefWorks 2.0 (RefWorks-COS, Besthesda, MD). Title and abstract relevance screening were performed in the electronic systematic review management program DistillerSR (Evidence Partners Incorporated, Ottawa, ON). Data were imported into Microsoft Excel 2010 (Microsoft Corporation, Redmond, WA) for tabulation. Analyses were conducted using the procedures reported in the original SR-MAs. All meta-analyses were performed in STATA/IC 13.1 (StataCorp. 2013. StataStatistical Software: Release 13. College Station, TX: StataCorp LP).

A standard Z test statistic was computed to assess the statistical significance of the difference between summary estimates:
where $\theta_1$ and $\theta_2$ are the effects’ estimates from the meta-analyses under comparison (Dohoo et al., 2012). The standard error of each summary estimate was derived from its 95% confidence interval:

$$SE(\theta) = \frac{(\text{upper limit} - \text{lower limit})}{1.96 \times 2}$$

The Microsoft Excel function NORM.S.DIST was used to calculate the p-value for each Z score (Microsoft Corporation, Redmond, WA). Statistical tests were two-sided and a p-value of <0.05 was considered statistically significant.

3. Results

3.1. Impact on the number of relevant studies omitted or excluded

The numbers of studies included in the original SRs and those remaining after implementing each methodological shortcut are displayed in Table 5.2. Single relevance screening by “Reviewer B” resulted in the highest number of relevant studies omitted from the Bucher et al. (2015) and Wilhelm et al. (2011) reviews, with 2/18 and 11/19 excluded, respectively. Limiting the bibliographic database search to one database resulted in 15/36 relevant studies not being captured in the Greig et al. (2012) search, and were thus omitted from the review. The number of separate MAs performed in each review and the number impacted by each shortcut are described in Table 5.3. The observed effects on summary estimates are summarized below by shortcut type.

3.2. Shortcut 1 – One bibliographic database plus ancillary sources

Overall, limiting the search of bibliographic databases to one database plus the ancillary sources affected the highest number of MAs (n=15). The affected MAs are listed in Table 5.4.
with their original summary estimate and the summary estimate obtained after applying the shortcut. The search output was limited to Biological Sciences/ProQuest for the Bucher et al. review, and Agricola for the Wilhelm et al. review. For the Greig et al. (2012) review, limiting the search output to MEDLINE/PubMed and other non-bibliographic database sources resulted in 15/36 relevant studies being omitted from the search and thus affecting 13/18 MAs. The shortcut was also applied with the output from CAB Abstracts/CABI (n=715) since the database yielded only 16 fewer hits than MEDLINE/PubMed (n=731) and was hypothesized to have a higher sensitivity due to its subject coverage that includes agriculture, veterinary science and food science (CABI, 2014). Applying the shortcut with the output from CAB Abstracts/CABI resulted in more relevant studies being omitted from the search (17/36) than with MEDLINE/PubMed (15/36), and so further analysis was discontinued with the CAB Abstracts/CABI output.

Of the 13 MAs affected in the Greig et al. (2012) review, eight resulted in summary estimates that were not statistically significant different (P>0.05), four meta-analyses were no longer possible since fewer than two studies remained, and one resulted in a statistically significant different summary estimate (SMD -1.741 vs -3.059, p= 0.0043). One MA by Greig et al. (2012) found that the odds of detecting an E. coli-positive broiler carcass was 5.233 (95% CI: 0.128–214.186) when spray chill was applied. Applying the shortcut resulted in all but one trial being omitted; this trial found a reduced odds of carcass contamination after spray chilling (OR 0.097, 95% CI: 0.057–0.165).

3.3. Shortcut 2 – Limiting search to bibliographic databases

This shortcut was not applicable to the Bucher et al. (2015) review since the original search was performed exclusively in bibliographic databases. Use of the shortcut resulted in a
MA from Greig et al. (2012) to no longer be possible since the original analysis was based on five trials from the same study, which was a study reported in an unpublished research report and thus not indexed in any commercial databases. For the Wilhelm et al. (2011) review, 4 of 5 MAs were affected (Table 5.5): three yielded odds ratios that were not statistically significant different from the original (P>0.05) and one MA was no longer possible since all but one study was omitted.

3.4. Shortcut 3 – Papers available electronically

Limiting eligibility criteria to studies directly available to the authors in an electronic format had no impact on the Bucher et al. (2015) review and resulted in one study (that was not included in any MAs) being omitted from the Wilhelm et al. (2012) review. The shortcut affected three MAs from the Greig et al. (2012) review (Table 5.6): two were no longer possible since fewer than two trials remained and one resulted in a summary estimate that was not significantly different from the original (P>0.05).

3.5. Shortcut 4 – Single reviewer for title and abstract relevance screening

The impact of using a single reviewer for title and abstract relevance screening differed between Reviewer A (Table 5.7) and Reviewer B (Table 5.8). For the Bucher et al. (2015) review, Reviewer A screened in all records corresponding to studies included in the original SR-MA (Table 5.2) and thus had no impact on the results of the review (Table 5.3). Records screened out by Reviewer A impacted one MA from the Greig et al. (2012) review and three MAs from the Wilhelm et al. (2011) review (Table 5.3). The resulting odds ratios were all closer to the null value of 1, but none were statistically different from the original values (Table 5.7). Single screening by Reviewer B had a large impact on the results of the Wilhelm et al. review (Table 5.8). The original review identified four studies evaluating the effectiveness of HACCP
on the prevalence of *Salmonella* spp. on poultry carcasses: one reporting a non-significant odds (OR 1.047, 95% CI: 0.826–1.327) (Cates *et al.*, 2001) and three reporting statistically significant reductions (OR 0.392, 95% CI: 0.173–0.866) (United States Department of Agriculture, Food Safety and Inspection Service, 2000; Ghafir *et al.*, 2005; Rose *et al.*, 2002). The latter three were among the 11 of 18 relevant studies screened out by Reviewer B, and thus would have resulted in a review that found no evidence of HACCP programs being effective in reducing *Salmonella* spp. contamination in poultry processing plants.

**4. Discussion**

This empirical comparative study identified the implications of four methodological shortcuts on the outcomes of three completed SR-MAs in the area of agri-food public health. Since each methodological shortcut was applied individually—with all other processes the same as the original SR-MA—we have been able to show the relative impact of each shortcut through the observed differences in the outcomes of the SRs and RRs. This is in contrast to previous comparisons of SRs and RRs on the same topic (Cameron *et al.*, 2007; Van De Velde *et al.*, 2011) where multiple dissimilarities in the review approaches (e.g. search algorithm, bibliographic databases searched, eligibility criteria) and the conditions in which they were conducted (e.g. extent of access to full-text journal articles, expertise of review team) made it difficult to assess the specific reasons for the observed differences in the outcomes of the reviews. Our approach also allowed us to assess the potential variability in the impact of each shortcut by applying them on three separate reviews. Furthermore, while MAs are not commonly undertaken in RRs, our study approach provided a quantitative measure of the relative impact some methodological shortcuts can have on the results of a SR-MA.

With the exception of two shortcuts applied on the Bucher *et al.* review, each of the
shortcuts resulted in at least one relevant study being omitted from the SR-MAs. The omission of studies had a large impact on the three SR-MAs evaluated in this study since several of the original MAs were conducted with only a small number of trials or studies, resulting in one third of the affected MAs (13/39) no longer being possible due to insufficient studies (<2 studies). For some of the review outcomes, the shortcuts increased the potential of the review to miss relevant literature and thus draw conclusions that would miss large amounts of evidence. For example, a MA of four trials from the original Greig et al. review found an uninformative odds of generic *E. coli* carcass contamination after spray chilling (OR 5.233, 95% CI: 0.128–214.186). However, limiting the search to one bibliographic database resulted in only one trial remaining (Corantin et al., 2005), a study that reported a significant reduction in the odds of contamination after spray chilling (OR 0.097, 95% CI: 0.057–0.165). Since none of the remaining 26 affected MAs (26/39) resulted in summary estimates that differed in direction from the original review, the shortcuts had the largest impact on outcomes for which only one or no relevant study remained.

Among the three SR-MAs examined in this study, the results of the Bucher et al. review were the least affected by the shortcuts applied. Limiting eligibility to studies available to the authors in a full-text electronic format likely did not have an impact on this review since the original search was limited to studies published after 2005 and did not include the grey literature. These characteristics of the original search may also account for why limiting the search to only one bibliographic database was still able to identify the majority of included papers (94%). The Bucher et al. review had the most narrowly defined question of all three reviews, with just one population group (i.e. broiler chicken carcasses), one intervention (i.e. chilling during primary processing) and one pathogen (i.e. *Campylobacter* spp.). The specificity of the Bucher et al. review question relative to the other two reviews may have made identification of relevant
studies more straightforward for reviewers, and thus explain why this review had the highest ascertainment of relevant studies after single screening by both of our reviewers.

Relevance screening by Reviewer B for the Wilhelm et al. review demonstrated the potential impact of single screening on the accuracy and reliability of the screening process. It is unclear why so many relevant studies were screened out by Reviewer B when Reviewer A, in contrast, included 89% of relevant studies and both reviewers had comparable kappa coefficients in the initial screening pre-test (0.68 vs. 0.72). Although single screening by Reviewer A resulted in only minor, non-statistically significant differences in the outcomes of the review, the large discrepancy between the screening results of the two reviewers highlights the potential risk of bias introduced with single screening. Relevance screening is susceptible to error because it is typically based on the limited information reported in the title and abstract of a record (Doust et al., 2005), and because records that are excluded during screening are typically not considered again (Edwards et al., 2002). Other studies have found that relevance screening by two reviewers increased the number of relevant records identified compared with screening by a single reviewer (Doust et al., 2005; Edwards et al., 2002). While Edwards et al. noted that a single reviewer is likely to identify the majority of relevant studies, they still recommended that screening be conducted by two reviewers whenever possible since it can increase by as much as one-third the number of relevant records identified (Edwards et al., 2002).

Our findings support the views of Watt et al. (Watt et al., 2008a) that it may not be possible to validate methodological strategies for conducting RRs given the inherent topic-specific variability underpinning research evidence. Our study found that the impact of the four methodological shortcuts varied between the three SR-MAs. Since the impact of any methodological shortcut will likely depend on the review question and its scope, rapid review
authors must consider the potential size and composition of the research evidence existing for a topic and the time and resources available to conduct the review to determine the most appropriate methodological approach. Streamlining SR processes will make a review more susceptible to bias and/or error, therefore it is imperative that RR authors are transparent regarding their methodology (Ganann et al., 2010; Watt et al., 2008b) and use caution when interpreting their findings. In the absence of a standardized approach for conducting RRs, transparent reporting of the methods undertaken and potential biases or limitations will better enable end-users to make informed judgements about the validity and utility of the review results.

There have been questions regarding the appropriateness and validity of RRs given the methodological processes used to prepare them (Ganann et al., 2010; Khangura et al., 2012; Watt et al., 2008b). In light of their potential to miss relevant information, it has been suggested that RRs be viewed only as interim guidance until a full SR can be conducted (Ganann et al., 2010; Watt et al., 2008b). Watt et al. (2008) contend that RRs are inappropriate for addressing questions that are complex or require in-depth investigation since they “cannot realistically be adequately evaluated in the timeframe of a rapid review”. Their study comparing the outcomes of four RRs and SRs addressing the same question found that the RRs reached “appropriate conclusions”, but that the scope of each RR was substantially narrower than that of the full SR (Cameron et al., 2007). Consequently, they suggested that RRs may be useful for answering highly refined research questions (Watt et al., 2008a). While this limits the generalizability of the review findings to other populations or settings, it can allow RRs to inform specific policy or practice decisions in a timely manner.

While our study empirically demonstrated the implications of applying methodological
shortcuts to the results of three SR-MAs, there are a number of study limitations to note. Our results were based on only three SR-MAs in a relatively narrow topic area and the impact of each shortcut may differ when applied to other SR-MAs. The impact of limiting eligibility criteria to studies readily available in a full-text electronic format will depend in part on the review authors’ access to electronic databases and journals; we had access to the electronic holdings of the TriUniversity Group of Libraries (TUG), an administrative co-operation between the libraries of three Ontario universities (http://www.tug-libraries.on.ca/). Continuing the screening pre-test until each reviewer achieved ‘almost perfect agreement’ (κ > 0.8) (Landis & Koch, 1977), may have increased the number of relevant studies identified by each reviewer. We cannot provide an estimate of the number of person-hours saved with these four methodological shortcuts since the number of person-hours employed was not tabulated for the original SRs or this study. Our study had low power to detect a difference between the original and affected meta-analyses. Finally, numerous methodological shortcuts have been reported in the literature to expedite SRs; only four were investigated in this study.

5. Conclusion

The results of this study demonstrated the relative effects of four methodological shortcuts on the outcomes of three completed SR-MAs. In all but two instances, the shortcuts resulted in at least one relevant study being omitted from the SR-MA; highlighting the risk of missing relevant literature when SR processes are streamlined. Overall, the omitted studies resulted in 13 meta-analyses (out of a possible 149) no longer being possible due to insufficient studies. However, of the remaining 26 MAs affected by the omitted studies, none resulted in summary estimates that differed in overall conclusions from the original. Given that requests for rapid syntheses of research evidence will undoubtedly continue, the results of this study improve
understanding of the implications of streamlining SR methods. Further research evaluating the implications of other methodological shortcuts will better enable RR authors to determine the most appropriate approach to synthesis when time is limited. In the absence of a standardized approach for conducting RRs, transparent reporting of the methods undertaken and potential biases or limitations will better enable end-users to make informed judgements about the validity and utility of the review results.
Figure 5.1. Overview of study process for evaluating the potential implications of methodological shortcuts on the outcome of rapid reviews. This process was repeated for each of three original systematic reviews-meta-analyses.
Table 5.1. Review question for the three original systematic reviews-meta-analyses

<table>
<thead>
<tr>
<th>Author</th>
<th>Review question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bucher <em>et al.</em> (2015)</td>
<td>Does chilling reduce <em>Campylobacter</em> spp. prevalence and/or concentration during the primary processing of broiler chickens?</td>
</tr>
<tr>
<td>Greig <em>et al.</em> (2012)</td>
<td>Do primary processing interventions reduce contamination of beef carcasses with generic or pathogenic <em>E. coli</em> (measured as prevalence or concentration)?</td>
</tr>
<tr>
<td>Wilhelm <em>et al.</em> (2011)</td>
<td>What is the effect of Hazard Analysis Critical Control Point (HACCP) programs on microbial prevalence and concentration on food animal carcasses in abattoirs through primary processing?</td>
</tr>
</tbody>
</table>
Table 5.2. Impact of the four methodological shortcuts on the number of relevant studies included.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Number of relevant studies included in original systematic review</td>
<td>18</td>
<td>36</td>
<td>19</td>
</tr>
<tr>
<td>Relevant studies included after:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shortcut 1 – 1 database plus ancillary sources</td>
<td>17 (94%)</td>
<td>21 (53%)</td>
<td>17 (89%)</td>
</tr>
<tr>
<td>Shortcut 2 – Only bibliographic databases</td>
<td>n/a*</td>
<td>35 (97%)</td>
<td>14 (74%)</td>
</tr>
<tr>
<td>Shortcut 3 – Papers available electronically</td>
<td>18 (100%)</td>
<td>33 (92%)</td>
<td>18 (95%)</td>
</tr>
<tr>
<td>Shortcut 4 – Screening by Reviewer A</td>
<td>18 (100%)</td>
<td>34 (94%)</td>
<td>17 (89%)</td>
</tr>
<tr>
<td>Shortcut 4 – Screening by Reviewer B</td>
<td>15 (83%)</td>
<td>29 (81%)</td>
<td>8 (42%)</td>
</tr>
</tbody>
</table>

*The Bucher et al. search included only bibliographic databases.
Table 5.3. Impact of the four methodological shortcuts on the meta-analyses for each review.

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of studies (trials) included in original meta-analysis</td>
<td>18 (44)</td>
<td>22 (107)</td>
<td>9 (n/a)</td>
</tr>
<tr>
<td>Number of meta-analyses performed in original paper</td>
<td>7</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>Number of meta-analyses affected by:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shortcut 1 – 1 database plus ancillary sources</td>
<td>1 (14%)</td>
<td>13 (72%)</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>Shortcut 2 – Only bibliographic databases</td>
<td>n/a*</td>
<td>1 (6%)</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>Shortcut 3 – Papers available electronically</td>
<td>0</td>
<td>3 (17%)</td>
<td>0</td>
</tr>
<tr>
<td>Shortcut 4 – Screening by Reviewer A</td>
<td>0</td>
<td>1 (6%)</td>
<td>3 (60%)</td>
</tr>
<tr>
<td>Shortcut 4 – Screening by Reviewer B</td>
<td>3 (43%)</td>
<td>4 (22%)</td>
<td>5 (100%)</td>
</tr>
</tbody>
</table>

*The Bucher et al. search included only bibliographic databases.
Table 5.4. Meta-analyses affected by limiting the search of bibliographic databases to one database plus ancillary sources (shortcut 1).

<table>
<thead>
<tr>
<th>Author</th>
<th>Meta-analysis</th>
<th>Obs/trials/studies</th>
<th>Summary estimate (95% CI)</th>
<th>P-value</th>
<th>Obs/trials/studies</th>
<th>Summary estimate (95% CI)</th>
<th>P-value</th>
<th>Difference P-value for Z-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bucher et al., 2015</td>
<td>7. Immersion chilling with unspecified disinfectant</td>
<td>316/4/3</td>
<td>OR 0.284 (0.026, 3.081)</td>
<td>0.301</td>
<td>244/3/2</td>
<td>OR 0.297 (0.014, 6.165)</td>
<td>0.432</td>
<td>0.503</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>2. Final carcass wash (+wash)</td>
<td>1145/18/2</td>
<td>OR 0.133 (0.050, 0.349)</td>
<td>&lt;0.001</td>
<td>640/8/1</td>
<td>OR 0.014 (0.005, 0.040)</td>
<td>&lt;0.001</td>
<td>0.061</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>3. Final carcass wash</td>
<td>838/10/4</td>
<td>OR 0.563 (0.414, 0.766)</td>
<td>&lt;0.001</td>
<td>588/5/2</td>
<td>OR 0.590 (0.359, 0.968)</td>
<td>0.037</td>
<td>0.560</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>4. Pasteurization – steam</td>
<td>3286/17/6</td>
<td>OR 0.134 (0.080, 0.223)</td>
<td>&lt;0.001</td>
<td>2866/12/4</td>
<td>OR 0.172 (0.100, 0.294)</td>
<td>&lt;0.001</td>
<td>0.732</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>5. Pasteurization – steam + lactic acid</td>
<td>150/3/2</td>
<td>OR 0.010 (0.002, 0.039)</td>
<td>&lt;0.001</td>
<td>All studies excluded</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>6. Pasteurization – hot water</td>
<td>450/9/2</td>
<td>OR 0.089 (0.053, 0.148)</td>
<td>&lt;0.001</td>
<td>300/6/1</td>
<td>OR 0.095 (0.051, 0.180)</td>
<td>&lt;0.001</td>
<td>0.558</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>7. Overall pasteurization rate</td>
<td>3986/31/10</td>
<td>OR 0.092 (0.062, 0.135)</td>
<td>&lt;0.001</td>
<td>3166/14/6</td>
<td>OR 0.134 (0.090, 0.199)</td>
<td>&lt;0.001</td>
<td>0.856</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>9. Dry chill</td>
<td>925/9/4</td>
<td>OR 0.166 (0.114, 0.242)</td>
<td>&lt;0.001</td>
<td>825/7/3</td>
<td>OR 0.159 (0.107, 0.234)</td>
<td>&lt;0.001</td>
<td>0.440</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>11. Spray chill</td>
<td>2156/4/2</td>
<td>OR 5.233 (0.128, 214.186)</td>
<td>0.382</td>
<td>2006/1/1</td>
<td>OR 0.097* (0.057, 0.165)</td>
<td>&lt;0.001</td>
<td>0.463</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>12. Final carcass wash (+wash)</td>
<td>1145/18/2</td>
<td>SMD -1.741 (-2.367, -1.116)</td>
<td>&lt;0.001</td>
<td>640/8/1</td>
<td>SMD -3.059 (-3.817, -2.300)</td>
<td>&lt;0.001</td>
<td>0.0043</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>13. Final carcass wash (wash)</td>
<td>566/9/3</td>
<td>SMD -0.279 (-0.521, -0.037)</td>
<td>0.024</td>
<td>250/5/1</td>
<td>SMD -0.301 (-0.580, -0.022)</td>
<td>0.034</td>
<td>0.454</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>14. Final carcass wash (wash+)</td>
<td>2200/5/1</td>
<td>SMD -0.206 (-0.339, -0.074)</td>
<td>0.002</td>
<td>Study excluded</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>17. Dry age chill</td>
<td>1119/3/2</td>
<td>SMD -0.130 (-0.205, -0.055)</td>
<td>0.001</td>
<td>80/1/1</td>
<td>SMD -0.100* (-0.218, 0.018)</td>
<td>0.096</td>
<td>0.663</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>18. Spray chill</td>
<td>3421/6/4</td>
<td>SMD -0.243 (-0.553, 0.067)</td>
<td>0.125</td>
<td>2246/2/2</td>
<td>SMD -0.200 (-0.337, -0.063)</td>
<td>0.004</td>
<td>0.598</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>1. HACCP on aerobic bacterial counts</td>
<td>2486/(n/a)/3</td>
<td>SMD -0.747 (-0.943, -0.551)</td>
<td>&lt;0.001</td>
<td>2006/(n/a)/2</td>
<td>SMD -1.059 (-1.859, -0.259)</td>
<td>0.009</td>
<td>0.229</td>
</tr>
</tbody>
</table>

*Effect estimate from a single trial, not a pooled estimate from meta-analysis. Obs = Observations; CI = confidence interval; OR = odds ratio; n/a = not applicable, SMD = standardized mean difference.
Table 5.5. Meta-analyses affected by limiting the search to only bibliographic databases (shortcut 2).

<table>
<thead>
<tr>
<th>Author</th>
<th>Meta-analysis</th>
<th>Original SR-MA</th>
<th>After shortcut</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obs/trials/studies</td>
<td>Summary estimate (95% CI)</td>
<td>P-value</td>
<td>Obs/trials/studies</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>14. Final carcass wash (wash+)</td>
<td>2200/5/1</td>
<td>SMD -0.206 (-0.339, -0.074)</td>
<td>0.002</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>2. HACCP on E. coli prevalence</td>
<td>6236/(n/a)/3</td>
<td>OR 0.585 (0.298, 1.149)</td>
<td>0.129</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>3. HACCP on Salmonella spp. Prevalence – beef</td>
<td>7843/(n/a)/5</td>
<td>OR 0.887 (0.530, 1.485)</td>
<td>0.648</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>4. HACCP on Salmonella spp. Prevalence – pork</td>
<td>11540/(n/a)/3</td>
<td>OR 0.776 (0.535, 1.123)</td>
<td>0.179</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>5. HACCP on Salmonella spp. Prevalence – poultry</td>
<td>16417/(n/a)/2</td>
<td>OR 0.392 (0.173, 0.886)</td>
<td>0.024</td>
</tr>
</tbody>
</table>

*Effect estimate from a single study, not a pooled estimate from meta-analysis. Obs = Observations; CI = confidence interval; OR = odds ratio; n/a = not applicable.
Table 5.6. Meta-analyses affected by limiting eligibility to studies readily available to the authors in a full-text electronic format through institutional holdings or publicly online (shortcut 3).

<table>
<thead>
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<th>Original SR-MA</th>
<th>After shortcut</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obs/trials/studies</td>
<td>Summary estimate (95% CI)</td>
<td>P-value</td>
<td>Obs/trials/studies</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>14. Final carcass wash (wash+)</td>
<td>2200/5/1</td>
<td>OR -0.206 (-0.339, -0.074)</td>
<td>0.002</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>17. Dry age chill</td>
<td>1119/3/2</td>
<td>SMD -0.130 (-0.205, -0.055)</td>
<td>0.001</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>18. Spray chill</td>
<td>3421/6/4</td>
<td>SMD -0.243 (-0.553, 0.067)</td>
<td>0.125</td>
</tr>
</tbody>
</table>

*Effect estimate from a single trial, not a pooled estimate from meta-analysis. OBS = Observations; CI = confidence interval; OR = odds ratio; n/a = not applicable, SMD = standardized mean difference.
Table 5.7. Meta-analyses affected by relevance screening performed by a single reviewer (shortcut 4 – reviewer A).

<table>
<thead>
<tr>
<th>Author</th>
<th>Meta-analysis</th>
<th>Obs/trials/studies</th>
<th>Summary estimate (95% CI)</th>
<th>P-value</th>
<th>Obs/trials/studies</th>
<th>Summary estimate (95% CI)</th>
<th>P-value</th>
<th>P-value for Z-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greig et al., 2012</td>
<td>3. Final carcass wash</td>
<td>838/10/4</td>
<td>OR 0.563 (0.414, 0.766)</td>
<td>&lt;0.001</td>
<td>538/9/3</td>
<td>OR 0.747 (0.497, 1.123)</td>
<td>0.061</td>
<td>0.560</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>3. HACCP on Salmonella spp. Prevalence – beef</td>
<td>7843/(n/a)/5</td>
<td>OR 0.887 (0.530, 1.485)</td>
<td>0.648</td>
<td>7532/(n/a)/4</td>
<td>OR 0.953 (0.565, 1.608)</td>
<td>0.857</td>
<td>0.573</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>4. HACCP on Salmonella spp. Prevalence – pork</td>
<td>11540/(n/a)/3</td>
<td>OR 0.776 (0.535, 1.123)</td>
<td>0.179</td>
<td>10789/(n/a)/2</td>
<td>OR 0.913 (0.658, 1.266)</td>
<td>0.0585</td>
<td>0.737</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>5. HACCP on Salmonella spp. Prevalence – poultry</td>
<td>18938/(n/a)/3</td>
<td>OR 0.392 (0.173, 0.886)</td>
<td>0.024</td>
<td>18237/(n/a)/2</td>
<td>OR 0.564 (0.262, 1.212)</td>
<td>0.142</td>
<td>0.715</td>
</tr>
</tbody>
</table>

Obs = Observations; CI = confidence interval; OR = odds ratio; n/a = not applicable, SMD = standardized mean difference.
### Table 5.8. Meta-analyses affected by relevance screening performed by a single reviewer (shortcut 4 – reviewer B).

<table>
<thead>
<tr>
<th>Author</th>
<th>Meta-analysis</th>
<th>Obs/trials/studies</th>
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<th>P-value</th>
<th>After shortcut Summary estimate (95% CI)</th>
<th>P-value</th>
<th>Difference P-value for Z-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bucher et al., 2015</td>
<td>2. Immersion chilling with chlorine</td>
<td>300/6/4</td>
<td>SMD -1.955 (-2.609, -1.302)</td>
<td>&lt;0.001</td>
<td>220/5/3</td>
<td>SMD -1.960 (-2.977, -0.942)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bucher et al., 2015</td>
<td>4. Immersion chilling with unspecific disinfectant – BaA trials</td>
<td>192/5/2</td>
<td>SMD -2.472 (-3.387, -1.156)</td>
<td>&lt;0.001</td>
<td>All studies excluded</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Bucher et al., 2015</td>
<td>7. Immersion chilling with unspecified disinfectant - ChT</td>
<td>316/4/3</td>
<td>OR 0.284 (0.026, 3.081)</td>
<td>0.301</td>
<td>244/3/2</td>
<td>OR 0.297 (0.014, 6.165)</td>
<td>0.432</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>3. Final carcass wash</td>
<td>838/10/4</td>
<td>OR 0.563 (0.414, 0.766)</td>
<td>&lt;0.001</td>
<td>538/9/3</td>
<td>OR 0.747 (0.497, 1.123)</td>
<td>0.061</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>4. Pasteurization – steam</td>
<td>3286/17/6</td>
<td>OR 0.134 (0.080, 0.223)</td>
<td>&lt;0.001</td>
<td>3006/10/5</td>
<td>OR 0.094 (0.066, 0.135)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>7. Overall pasteurization rate</td>
<td>3986/31/10</td>
<td>OR 0.092 (0.062, 0.135)</td>
<td>&lt;0.001</td>
<td>3706/24/9</td>
<td>OR 0.076 (0.053, 0.109)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Greig et al., 2012</td>
<td>9. Dry chill</td>
<td>925/9/4</td>
<td>OR 0.166 (0.114, 0.242)</td>
<td>&lt;0.001</td>
<td>540/8/3</td>
<td>OR 0.222 (0.111, 0.442)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>1. HACCP on aerobic bacterial counts</td>
<td>2486/(n/a)/3</td>
<td>SMD -0.747 (-0.943, -0.551)</td>
<td>&lt;0.001</td>
<td>520/(n/a)/2</td>
<td>SMD -1.027 (-1.923, -0.132)</td>
<td>0.026</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>2. HACCP on E. coli prevalence</td>
<td>6236/(n/a)/3</td>
<td>OR 0.585 (0.298, 1.149)</td>
<td>0.129</td>
<td>All studies excluded</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>3. HACCP on Salmonella spp. prevalence – beef</td>
<td>7843/(n/a)/5</td>
<td>OR 0.887 (0.530, 1.485)</td>
<td>0.648</td>
<td>All studies excluded</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>4. HACCP on Salmonella spp. prevalence – pork</td>
<td>11540/(n/a)/3</td>
<td>OR 0.776 (0.535, 1.123)</td>
<td>0.179</td>
<td>All studies excluded</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Wilhelm et al., 2011</td>
<td>5. HACCP on Salmonella spp. prevalence – poultry</td>
<td>16417/(n/a)/2</td>
<td>OR 0.392 (0.173, 0.886)</td>
<td>0.024</td>
<td>All studies excluded</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Obs = Observations; CI = confidence interval; OR = odds ratio; n/a = not applicable, SMD = standardized mean difference.
References


Ganann R, Ciliska D, Thomas H. 2010. Expediting systematic reviews: Methods and


CHAPTER SIX
Summary Discussion, Recommendations and Conclusions

Summary Discussion and Recommendations

The research described in this thesis advances the use and application of knowledge syntheses, particularly in the field of agri-food public health. The findings help to provide a better understanding of the methodological processes underpinning scoping reviews and rapid reviews, and of the perceptions of policy and decision makers—and those who support them—on the utility of different review-derived formats for informing decisions about policy, planning and practice.

Our scoping review of scoping reviews (Chapter 2) found that the identified reviews varied in terms of terminology, purpose, methodological rigor, and level of detail of reporting. The observed variability in the conduct of scoping reviews published to date can be attributed to the lack of an established standard definition and definitive process for conducting scoping reviews. Based on the characteristics, range of methodologies and reported challenges in the included scoping reviews, we have proposed some recommendations for advancing the scoping review approach and enhancing the consistency with which they are undertaken and reported. These recommendations were integrated with the collective work of others to advance the methodology (Arksey & O'Malley, 2005; Daudt et al., 2013; Levac et al., 2010; Brien et al., 2010; Davis et al., 2009; Anderson et al., 2008) and our experiences in conducting scoping reviews to develop the methodological framework presented in Chapter 3. The framework was presented with guidance and specific examples relevant to the field of agri-food public health to encourage its wider adoption in this field.

Systematic reviews are the most frequently used and applied knowledge synthesis method
in agri-food public health (Rajić & Young, 2013) and the study presented in Chapter 4 was aimed at gaining a better understanding of how policy makers—and those who support them—perceive knowledge syntheses and review-derived formats so that researchers can be better informed about ways to present evidence from knowledge syntheses that will enhance their uptake in policy, practice and planning. The results of our survey and follow-up interviews corroborate the concept of “the way to get people to care is provide context” (Heath & Heath, 2007). Disseminating evidence from systematic reviews-meta-analyses with additional contextual information (e.g., cost, practicality, availability, public sensitivity, additional benefits or harms) can better enable policy makers, practitioners and other end-users to assess the local applicability of the review findings and other decision-relevant information (e.g. unintended consequences) and thus may increase the likelihood of its uptake in policy and practice (Lavis et al., 2005).

Replicating the study presented in Chapter 4 in other policy sectors and with a case study topic relevant to the particular sector would be useful in order to provide an enhanced understanding of the perceptions of policy and decision makers in those sectors towards the utility of review-derived formats. The target population for our survey and follow-up interviews was broad and included policy makers, decision makers, program managers and directors, policy analysts and policy advisors from all levels of government and industry in Canada. Subgroup analysis could have determined whether our survey results differed by the subject area, sector (e.g. public, private or non-profit) and level (e.g. local, regional, provincial or federal) in which respondents were employed, but these demographic data were not collected for our survey respondents. An understanding of the preferences and abilities of policy and decision makers for receiving research information can better enable researchers to disseminate evidence in a way
that will increase its potential uptake in decision making.

Plain language summary formats should be developed for systematic reviews and other knowledge syntheses that can have important implications on policy, practice and planning. The development of such resources can overcome the short timeframes available to policy and decision makers to consider research evidence (Bowen et al., 2009) and their lack of skills to identify, evaluate, synthesize and interpret scientific evidence (Young et al., 2014). A combination of the one- and three-page format—in which the one-page summary is the front page of the three-page summary with added contextual information—should be considered as it provides a graded entry to the full details of the review and addresses the different needs, timeframes, and interests of decision makers and support staff. Furthermore, evaluating correct understanding of information presented in the review-derived formats by policy and decision makers would provide additional information about the utility of each format.

While researchers should aim to make their findings more user-friendly for policy and decision makers, policy and decision makers should also seek to increase their understanding of research. A lack of skills and expertise has been described as a barrier to the use of research by policy and decision makers (Lavis et al., 2005; Bowen et al., 2009) and a number of our survey and interview participants reported difficulty in interpreting the methodology and results of the systematic review and meta-analysis provided. Consequently there is a need for additional resources to help those involved in the policy process to better understand and interpret research evidence, such as the “Understanding Research Evidence” series of videos by the National Collaborating Centre for Methods and Tools (www.nccmt.ca).

Similar to the scoping review, the rapid review is a relatively new knowledge synthesis approach for which a full definitive definition and process have not been established. The
comparative study presented in Chapter 5 aimed to gain a better understanding of the implications of rapid review processes on the outcome of three systematic reviews addressing agri-food public health topics. The results highlighted the risk of missing relevant literature when methodological shortcuts are applied and will better enable rapid reviews authors to determine the most appropriate approach to synthesis when time is limited. Establishing a standard definition for the rapid review would be useful to the extent that it would provide greater clarity about the approach and how it differs from other knowledge synthesis methods, particularly scoping reviews and systematic reviews. Establishment of such a standard may however limit the utility of rapid reviews and may not be appropriate given the inherent topic-specific variability underpinning research evidence.

Further research evaluating the implications of additional methodological shortcuts, as well as varying combinations of shortcuts, will better enable rapid review authors to determine the most appropriate approach to synthesis when time is limited. Furthermore, replicating the study presented in Chapter 5 with systematic reviews addressing other topic areas may validate the results of our study or determine whether the impact of methodological shortcuts differs between different sectors. Evaluation studies that include estimates of the person-hours saved with each shortcut, or combination of shortcuts, would also be useful to review authors and those commissioning rapid reviews in estimating potential costs and resources required for conducting rapid reviews, or in determining a rapid review approach given available time and resources.

The overall focus of this thesis research within the context of agri-food public health was done with the aims of advancing the use and application of knowledge syntheses in this sector. As the essential steps for conducting and disseminating a knowledge synthesis are the same for any field of study, the results from this thesis research can also have applications in areas beyond
the bounds of agri-food public health. Thus, the focus on agri-food public health may be both a strength and a limitation of this thesis; in aiming to appeal to researchers in the field of agri-food public health, the results of this thesis may have limited uptake in other sectors.

Throughout this thesis, the application of the scoping review, rapid review and systematic review to address agri-food public health topics has been demonstrated with worked examples from the literature and the empirical work conducted in Chapter 5. While the scoping review is better able to address topics of a complex or heterogeneous nature than the systematic review or the rapid review (Mays et al., 2001), neither of the three knowledge synthesis approaches are particularly well suited to address more complex agri-food public health issues that may involve multiple microorganisms, interventions, animal species, food and other environmental exposure pathways. Complexity presents practical implications for knowledge synthesis, and there is considerable interest among researchers, policy makers and practitioners in how evidence for complex interventions or topics can be appropriately synthesized in a timely manner (Pettigrew et al., 2013).

Conclusions

Knowledge synthesis approaches can provide a reliable evidentiary base to inform further research and decisions about policy and practice. Further developing and enhancing knowledge synthesis approaches helps to ensure the accuracy and reliability of the process and the utility of the results. Enhancing the uptake of evidence from knowledge syntheses can help ensure that the best available evidence is used to inform decisions. This thesis research advances the use of knowledge synthesis to inform policy and decision making, particularly in the field of agri-food public health, by better enabling researchers to undertake knowledge syntheses and to disseminate their findings in a way that will increase its potential uptake in decision making.
References


Appendices

Appendix 2.1: Scoping review search strategy

Original search

A. Electronic databases

<table>
<thead>
<tr>
<th>Database/platform</th>
<th>SciVerse Scopus (Elsevier)</th>
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<td></td>
</tr>
<tr>
<td>Date of search</td>
<td>Friday, June 17, 2011</td>
<td></td>
</tr>
<tr>
<td>Limits</td>
<td>In: &quot;Article Title, Abstract, Keywords&quot; Published: &quot;All years&quot; to &quot;Present&quot; Document type: &quot;All&quot; Subject Areas: All checked (default)</td>
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</tr>
<tr>
<td>Search query</td>
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</tr>
<tr>
<td>Limits</td>
<td>In: &quot;All fields&quot; Date range: All years</td>
<td></td>
</tr>
<tr>
<td>Search query</td>
<td>scoping stud* OR scoping review* OR scoping project* OR literature map* OR scoping exercise* OR scoping report* OR evidence map* OR systematic map* OR rapid review*</td>
<td></td>
</tr>
<tr>
<td>Number of hits</td>
<td>454</td>
<td></td>
</tr>
</tbody>
</table>

| Database/platform          | CINAHL® (EBSCO)                                                                            | Full text coverage from 1981 to present                             |
|---------------------------|-------------------------------------------------------------------------------------------|                                                                     |
| Library                   | University of Guelph                                                                       |                                                                     |
| Date of search            | Friday, June 17, 2011                                                                      |                                                                     |
| Limits                    | In: "Select a field (optional)" Search mode: "Boolean/Phrase" Apply related words: [checked] Limit your results: [None, all unchecked or left blank (Default)] |                                                                     |
| Search query              | "scoping stud**" OR "scoping review**" OR "scoping project**" OR "literature map**" OR "scoping exercise**" OR "scoping report**" OR "evidence map**" OR "systematic map**" OR "rapid review**" |
Number of hits: 133

**Database/platform:** Current Contents Connect® (ISI Web of Knowledge)

**Time coverage:** 1998 to present

**Library:** University of Guelph

**Date of search:** Friday, June 17, 2011

**Limits:**
- In: "Topic"
- Timespan: "All years"
- Databases: ABES, SBS, CM, LS, PCES, ECT, AH

**Search query:**
"scoping study" OR "scoping studies" OR "scoping review*" OR "literature scoping" OR "literature mapping" OR "literature map" OR "scoping project*" OR "scoping exercise*" OR "evidence mapping" OR "systematic map" OR "systematic mapping" OR "rapid review"

**Number of hits:** 750

B. Web search and websites

**Database/platform:** SciVerse Scopus Web (Elsevier)

**Library:** Public Health Agency of Canada & Health Canada Canada Libraries

**Date of search:** Wednesday, July 6, 2011

**Limits:**
- In: "Article Title, Abstract, Keywords"
- Published: "All years" to "Present"
- Document type: "All"
- Subject Areas: All checked (default)

**Search query:**
"scoping study" OR "scoping review" OR "scoping project" OR "literature scoping" OR "literature mapping" OR "scoping exercise" OR "scoping report" OR "evidence map" OR "evidence mapping" OR "systematic map" OR "systematic mapping" OR "rapid review"

**Number of hits:** 92,924

**Notes:** Reviewed first 100 hits

**Website:** National Institute for Health Research (NIHR) Service Delivery and Organisation Programme (SDO) Health Services and Delivery Research Programme

**URL:** [http://www.sdo.nihr.ac.uk/newpublicationsandevents.html](http://www.sdo.nihr.ac.uk/newpublicationsandevents.html)

**Date of search:** Friday, July 8, 2011

**Website:** The University of York Social Policy Research Unit

**URL:** [http://php.york.ac.uk/inst/spru/pubs/main.php](http://php.york.ac.uk/inst/spru/pubs/main.php)

**Date of search:** Friday, July 8, 2011
C. Reference lists

Articles on scoping reviews:


Randomly-selected scoping review articles:


**Updated search**

A. Electronic databases

<table>
<thead>
<tr>
<th>Database/platform:</th>
<th>SciVerse Scopus (Elsevier)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date coverage:</td>
<td>1823 to present (greater than half of which are from 1996 to present)</td>
</tr>
<tr>
<td>Library:</td>
<td>Public Health Agency of Canada &amp; Health Canada Libraries</td>
</tr>
<tr>
<td>Date of search:</td>
<td>Monday, October 1, 2012</td>
</tr>
<tr>
<td>Limits:</td>
<td>In: &quot;Article Title, Abstract, Keywords&quot;</td>
</tr>
<tr>
<td></td>
<td>Published: &quot;&gt;2010&quot;</td>
</tr>
<tr>
<td></td>
<td>Document type: &quot;All&quot;</td>
</tr>
<tr>
<td></td>
<td>Subject Areas: All checked (default)</td>
</tr>
<tr>
<td>Database/platform:</td>
<td>MEDLINE (PubMed)</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>Search query:</strong></td>
<td>&quot;scoping study&quot; OR &quot;scoping review&quot; OR &quot;scoping project&quot; OR &quot;literature scoping&quot; OR &quot;literature mapping&quot; OR &quot;scoping exercise&quot; OR &quot;scoping report&quot; OR &quot;evidence map&quot; OR &quot;evidence mapping&quot; OR &quot;systematic map&quot; OR &quot;systematic mapping&quot; OR &quot;rapid review&quot;</td>
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<tr>
<td><strong>Number of hits:</strong></td>
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</tr>
<tr>
<td><strong>Time coverage:</strong></td>
<td>Generally 1946 to present</td>
</tr>
<tr>
<td><strong>Library:</strong></td>
<td>Free access</td>
</tr>
<tr>
<td><strong>Date of search:</strong></td>
<td>Monday, October 1, 2012</td>
</tr>
</tbody>
</table>
| **Limits:** | In: "All fields"  
Publication date: “from 2011/06/01” |

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<tr>
<th>Database/platform:</th>
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<tr>
<td><strong>Search query:</strong></td>
<td>scoping stud* OR scoping review* OR scoping project* OR literature map* OR scoping exercise* OR scoping report* OR evidence map* OR systematic map* OR rapid review*</td>
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<tr>
<td><strong>Number of hits:</strong></td>
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<tr>
<td><strong>Time coverage:</strong></td>
<td>Full text coverage from 1981 to present</td>
</tr>
<tr>
<td><strong>Library:</strong></td>
<td>University of Guelph</td>
</tr>
<tr>
<td><strong>Date of search:</strong></td>
<td>Monday, October 1, 2012</td>
</tr>
</tbody>
</table>
| **Limits:** | In: "Select a field (optional)"  
Search mode: "Boolean/Phrase"  
Apply related words: [checked]  
Limit your results: “Published date from 2011-06-01 to 2012-10-31” |

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<tr>
<th>Database/platform:</th>
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<tbody>
<tr>
<td><strong>Search query:</strong></td>
<td>&quot;scoping study&quot; OR &quot;scoping studies&quot; OR &quot;scoping review*&quot; OR &quot;literature scoping&quot; OR &quot;literature mapping&quot; OR &quot;literature map&quot; OR &quot;scoping project*&quot; OR &quot;scoping exercise*&quot; OR &quot;scoping report*&quot; OR &quot;evidence mapping&quot; OR &quot;systematic map&quot; OR &quot;systematic mapping&quot; OR &quot;rapid review*&quot;</td>
</tr>
<tr>
<td><strong>Number of hits:</strong></td>
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<tr>
<td><strong>Time coverage:</strong></td>
<td>1998 to present</td>
</tr>
<tr>
<td><strong>Library:</strong></td>
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</tr>
<tr>
<td><strong>Date of search:</strong></td>
<td>Monday, October 1, 2012</td>
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</tbody>
</table>
| **Limits:** | In: "Topic"  
Timespan: "2011-06-01 - 2012-10-01"  
Current Contents Editions: all checked (default)  
Current Contents Connect on WofS from 1998-
### B. Web search and websites

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<thead>
<tr>
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<th>SciVerse Hub</th>
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<tr>
<td><strong>Date of search:</strong></td>
<td>Monday, October 1, 2012</td>
</tr>
<tr>
<td><strong>Search query:</strong></td>
<td>&quot;scoping study&quot; OR &quot;scoping review&quot; OR &quot;scoping project&quot; OR &quot;literature scoping&quot; OR &quot;literature mapping&quot; OR &quot;scoping exercise&quot; OR &quot;scoping report&quot; OR &quot;evidence map&quot; OR &quot;evidence mapping&quot; OR &quot;systematic map&quot; OR &quot;systematic mapping&quot; OR &quot;rapid review&quot;</td>
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<tr>
<td><strong>Exact query:</strong></td>
<td>(TITLE-ABS-KEY(&quot;scoping study&quot; OR &quot;scoping review&quot; OR &quot;scoping project&quot; OR &quot;literature scoping&quot; OR &quot;literature mapping&quot; OR &quot;scoping exercise&quot; OR &quot;scoping report&quot; OR &quot;evidence map&quot; OR &quot;evidence mapping&quot; OR &quot;systematic map&quot; OR &quot;systematic mapping&quot; OR &quot;rapid review&quot;) AND PUBYEAR &gt; 2009) and not srctype(jnl or pat or sc or mdc)</td>
</tr>
<tr>
<td><strong>Limits:</strong></td>
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</tr>
<tr>
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<tr>
<td><strong>Citations added:</strong></td>
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</table>

<table>
<thead>
<tr>
<th>Website:</th>
<th>National Institute for Health Research (NIHR) Service Delivery and Organisation Programme (SDO) Health Services and Delivery Research Programme</th>
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<tbody>
<tr>
<td><strong>URL:</strong></td>
<td><a href="http://www.sdo.nihr.ac.uk/newpublicationsandevevents.html">http://www.sdo.nihr.ac.uk/newpublicationsandevevents.html</a></td>
</tr>
<tr>
<td><strong>Date of search:</strong></td>
<td>Monday, October 15, 2012</td>
</tr>
<tr>
<td><strong>Number of hits:</strong></td>
<td>“about 775”</td>
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<td><strong>Notes:</strong></td>
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<td>2</td>
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<table>
<thead>
<tr>
<th>Website:</th>
<th>The University of York Social Policy Research Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>URL:</strong></td>
<td><a href="http://php.york.ac.uk/inst/spru/pubs/main.php">http://php.york.ac.uk/inst/spru/pubs/main.php</a></td>
</tr>
<tr>
<td><strong>Date of search:</strong></td>
<td>Monday, October 15, 2012</td>
</tr>
<tr>
<td><strong>Search date range:</strong></td>
<td>From 2011 to present</td>
</tr>
<tr>
<td><strong>Limits:</strong></td>
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<table>
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<tr>
<th>Website:</th>
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<tr>
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</tr>
<tr>
<td><strong>Search term:</strong></td>
<td>scoping</td>
</tr>
<tr>
<td><strong>Number of hits:</strong></td>
<td>2737</td>
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<tr>
<td>Website:</td>
<td>The Department of Health</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
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</tr>
<tr>
<td>Search term:</td>
<td>scoping</td>
</tr>
<tr>
<td>Search date range:</td>
<td>“1 June 2011” to “16 October 2012”</td>
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<td>Number of hits:</td>
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<td>Citations added:</td>
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</table>

<table>
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<tr>
<th>Website:</th>
<th>British Association for Counselling &amp; Psychotherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>URL:</td>
<td><a href="http://bacp.co.uk/research/publications/index.php">http://bacp.co.uk/research/publications/index.php</a></td>
</tr>
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<table>
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<th>Google</th>
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</thead>
<tbody>
<tr>
<td>URL:</td>
<td>google.com</td>
</tr>
<tr>
<td>Date of search:</td>
<td>Monday, October 15, 2012</td>
</tr>
<tr>
<td>Search query:</td>
<td>“scoping review”</td>
</tr>
<tr>
<td>Notes:</td>
<td>Reviewed first 100 hits</td>
</tr>
<tr>
<td>Citations added:</td>
<td>10</td>
</tr>
</tbody>
</table>
Appendix 2.2: Scoping review title and abstract relevance screening tool

1. Does the citation report the use of a scoping review\(^1\) methodology to identify and characterize the existing literature or evidence base on a broad topic?
   - [ ] Yes, a primary scoping review.
   - [ ] No, a methodological review of scoping reviews\(^2\).
   - [ ] No, a narrative review\(^3\) of scoping reviews.
   - [ ] No, none of the above.\(^4\)
   - [ ] Can’t tell.\(^5\)

2. Does the citation describe research in English, French or Spanish\(^6\)?
   - [ ] Yes, in English.
   - [ ] Yes, in French.
   - [ ] Yes, in Spanish.
   - [ ] No.
   - [ ] Can’t tell

Reviewer Decision:
The following will be incorporated into the ScS electronic review and will happen automatically:
- If the reviewer answer is “Yes” to both questions 1 and 2, the article will be included in RS2 for further screening and appraisal.
- If the reviewer answer is “Can’t tell” for either or both questions, the full article will be obtained for further appraisal and decision making on this level.

\(^1\) A scoping review is a type of literature review that aims to ‘map’ the relevant literature in a field of interest (Arkey & O’Malley, 2005). They can be used to summarize findings of research, identify research gaps, and inform a systematic review (Arksey & O’Malley, 2005; Armstrong \textit{et al.}, 2010). Other terminologies used to describe scoping reviews may include, but is not limited to: scoping studies, evidence mapping, systematic mapping, scoping literature reviews, literature mapping, literature scoping, scoping project and rapid reviews.

\(^2\) A methodological review would focus on the methodology of primary scoping reviews rather than on their results. It could be used to identify methodological strengths and weaknesses of published scoping reviews, and examine how research practices differ across groups, time or settings.

\(^3\) A narrative review provides a general overview of the research literature in a specific area.

\(^4\) Example: systematic reviews.

\(^5\) Reviewers should only select the “Can’t tell” option if the article may be relevant. If the article is obviously not relevant, “No” should be selected. Full articles must be obtained for any “Can’t tell” responses.

\(^6\) If the citation states that the article is in a language other than English, French or Spanish, “No” should be selected.
### Appendix 2.3: Scoping review data characterization and utility tool

#### A. General Study Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
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<td>1. Publication type</td>
<td>☐ Journal article</td>
<td>Please select one.</td>
</tr>
<tr>
<td></td>
<td>☐ Conference proceeding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Thesis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Government or research station report</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Other</td>
<td>(please specify: __________________________)</td>
</tr>
<tr>
<td>2. Institution(s) that funded the study</td>
<td>☐ None</td>
<td>Please list if reported.</td>
</tr>
<tr>
<td></td>
<td>☐ Not reported</td>
<td><strong>None</strong>: Select if nothing is declared under the “Disclosures” (or similar) section, or it is specifically stated that the study did not receive funding.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Include stipend and scholarship money (Sep 2 2011)</td>
</tr>
<tr>
<td>3. Institution(s) that commissioned the study</td>
<td>☐ Same as above</td>
<td>Please list if reported.</td>
</tr>
<tr>
<td></td>
<td>☐ None</td>
<td><strong>None</strong>: Select if nothing is declared under the “Disclosures” (or similar) section, or it is specifically stated that the study was not commissioned.</td>
</tr>
<tr>
<td></td>
<td>☐ Not reported</td>
<td></td>
</tr>
<tr>
<td>4. Study sector setting</td>
<td>☐ Agriculture and agri-food</td>
<td>Check all that apply.</td>
</tr>
<tr>
<td></td>
<td>☐ Business</td>
<td><strong>Agriculture and agri-food</strong>: field crops, forestry, fishery, livestock.</td>
</tr>
<tr>
<td></td>
<td>☐ Education</td>
<td><strong>Business</strong>: manufacturing, commerce, finance.</td>
</tr>
<tr>
<td></td>
<td>☐ Health</td>
<td><strong>Education</strong>: K-12, post-secondary, professional development.</td>
</tr>
<tr>
<td></td>
<td>☐ Social sciences</td>
<td><strong>Health</strong>: nursing, medicine, dentistry, nutrition, public health, occupational therapy.</td>
</tr>
<tr>
<td></td>
<td>☐ Other</td>
<td>(please specify: __________________________)</td>
</tr>
</tbody>
</table>
5. How was ScS defined in the study?

- Not defined

If defined, please copy-and-paste author(s) wording into the text box and/or list page number, column, and paragraph number.

6. Does the article report the use of a scoping review methodology to identify and characterize the existing literature or evidence base on a broad topic?

- Yes, a primary scoping review
- No, a methodological review of scoping reviews
- No, a narrative review of scoping reviews
- No, none of the above

Check one.

Continue ONLY if the answer to the above question is “Yes, a primary scoping review.”

7. What is the broad topic addressed by the ScS?

Please copy-and-paste author(s) wording into the text box and/or list page number, column, and paragraph number.

8. What was the main purpose or objective of using a ScS methodology, as stated by the author(s) in the Introduction or Methods section?

- To identify, characterize and summarize research evidence on a topic (including identification of research gaps)
- To identify or prioritize questions for a systematic review
- Other (please specify: ____________________________)
- Not reported

Check all that apply.

---

### B. Scoping Review Characterization (& Utility) Tool

<table>
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<tr>
<th>Variable</th>
<th>Category</th>
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<tr>
<td>Question</td>
<td>Options</td>
<td>Notes</td>
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<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>9. Does the study reference a ScS framework?</td>
<td>☐ Yes (please specify: _ _ _ _ _ _ _ )</td>
<td>If applicable, please specify the author(s) of the framework (e.g., Pham et al., 2001).</td>
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<tr>
<td></td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>10. Which of the following was reported for the search?</td>
<td>☐ Complete search strings or list of keywords</td>
<td>Check all that apply.</td>
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<tr>
<td></td>
<td>☐ Publication date range</td>
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</tr>
<tr>
<td></td>
<td>☐ Search limits or parameters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Date of search</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Date of updated search</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ List of data sources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Directed to supporting document(s) for information</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Which data sources were included in the search strategy?</td>
<td>☐ Electronic bibliographic databases</td>
<td>Check all that apply.</td>
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<tr>
<td></td>
<td>☐ Bibliography/reference list from relevant article(s)</td>
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</tr>
<tr>
<td></td>
<td>☐ Hand searching of select journal(s)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Internet/website searching</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Consultation with experts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Other (please specify: _ _ _ _ _ _ _ _ _ )</td>
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</tr>
<tr>
<td></td>
<td>☐ Directed to supporting document(s)</td>
<td>Directed to supporting document(s): e.g., appendix.</td>
</tr>
<tr>
<td></td>
<td>☐ Not reported</td>
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<tr>
<td>12. How was data/study selection performed?</td>
<td>☐ Relevance screening of titles and abstracts conducted by one reviewer</td>
<td>Check all that apply.</td>
</tr>
<tr>
<td></td>
<td>☐ Relevance screening of titles and abstracts conducted by two or more independent</td>
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<tr>
<td></td>
<td></td>
<td><em>a priori</em>: Determined prior to start of study selection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Directed to supporting document(s): e.g., appendix.</td>
</tr>
<tr>
<td>reviewers</td>
<td>document(s): e.g., appendix.</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Relevance screening of full articles/papers conducted by one reviewer</td>
<td>Using a relevance screening form or tool with a priori-determined inclusion and exclusion criteria: Select if the use of any inclusion/exclusion criteria is reported for relevance screening.</td>
<td></td>
</tr>
<tr>
<td>Relevance screening of full articles/papers conducted by two or more independent reviewers</td>
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<td></td>
</tr>
<tr>
<td>Using a relevance screening form or tool with a priori-determined inclusion and exclusion criteria</td>
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<td></td>
</tr>
<tr>
<td>Other</td>
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<tr>
<td>(please specify: _ _ _ _ _ _ _ _)</td>
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<td></td>
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<tr>
<td>Directed to supporting document(s)</td>
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<td></td>
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<tr>
<td>Not reported</td>
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</table>

13. If relevance screening was carried out by more than 1 reviewer, how was the level of reviewer agreement reported?

<table>
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<th>Check one.</th>
<th>Check all that apply.</th>
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<td>Cohen’s kappa</td>
<td><strong>Not applicable</strong>: Select if there was only one reviewer.</td>
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<td>Percentage agreement</td>
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<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>(please specify: _ _ _ _ _ _ _ _)</td>
<td></td>
</tr>
<tr>
<td>Not reported/calculated</td>
<td></td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
</tr>
</tbody>
</table>

14. What type(s) of primary (original) research studies were included* in the ScS?

*a study is considered “included” if it listed in a table and/or synthesized in the results section

<table>
<thead>
<tr>
<th>Check all that apply.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All study designs</td>
<td>All study designs: Select if a list of study designs is listed in a non-specific manner.</td>
</tr>
<tr>
<td>[Otherwise, check all that apply below: ]</td>
<td></td>
</tr>
<tr>
<td>Observational studies (if reported, please specify type(s): _ _ _ _ _ _ _ _)</td>
<td><strong>Primary (original) research</strong>: Investigator(s) collected samples or data themselves for analysis.</td>
</tr>
<tr>
<td>Experimental studies (if reported, please specify type(s): _ _ _ _ _ _ _ _)</td>
<td></td>
</tr>
<tr>
<td>Qualitative studies (if reported, please specify type(s): _ _ _ _ _ _ _ _)</td>
<td><strong>Observational study</strong>: Assignment of subjects into a treated group versus a control group is outside the control of the investigator. <em>E.g.</em>, cross-sectional study, cohort study, case-control study.</td>
</tr>
<tr>
<td>Other (please specify: _ _ _ _ _ _ _ _)</td>
<td><strong>Experimental study</strong>: Each subject is randomly assigned to a treated group or a control group before the start of the treatment. <em>E.g.</em>, challenge trial, controlled</td>
</tr>
</tbody>
</table>
### 15. Were secondary research studies included* in the ScS?

*If reported, please specify type(s): ___________ __

- Yes
- No
- Not reported

*Check one.

**Secondary research**: Summary, collation and/or synthesis of existing data. *E.g.*: systematic review, meta analysis, narrative review, scoping review.

- **No**: Select if only articles describing primary (original) research were included.

### 16. What type(s) of publication(s) were included* in the ScS?

*All publication types

[Otherwise, check all that apply below:]

- Articles published in scientific journals (peer-reviewed and non-peer-reviewed)
- Research documents not published in scientific journals
- Thesis dissertations
- Other (please specify: ___________ __)
- Not reported

*Check all that apply.

**Research documents not published in scientific journals**: *e.g.*, research studies published on a website, in a report or policy paper.

### 17. How was data extraction of studies conducted?

- By one reviewer
- By two or more independent reviewers
- Using a data extraction form or tool
- Other (please specify: ___________ __)
- Directed to supporting document(s): *e.g.*, appendix.
- Other: Any report of coding analysis.

*Directed to supporting document(s)*: *e.g.*, appendix.

**Other**: Any report of coding analysis.
<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>18. Was the flow of the literature search and selection of studies through the review reported?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>19. In which format(s) were the results summarized?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>20. Was quality assessment of included studies reported?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>21. How many studies were included for review, as reported by the author(s)?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>22. Did the author(s) report the use of specialized computer software or application(s) to map the data?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**3. Impact on future research and policy- and/or decision making**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>23. How was evidence from the ScS used by the author(s)?</td>
<td>— — — — —</td>
<td>Please copy-and-paste author(s) wording into the text box and/or list page number, column, and paragraph number. E.g.: To recommend or support a policy action; to frame options for action implementation; to identify/recommend questions</td>
</tr>
</tbody>
</table>
and topics for future research; to inform and/or frame questions for a systematic review; to inform gaps in the existing research or evidence; and to clarify a particular problem or issue.

| 24. Who were the primary stakeholders for the ScS, as reported by the author(s)? | ☐ Researchers | ☐ Practitioners, clinicians or service providers | ☐ Consumers or patients | ☐ General public | ☐ Policy and/or decision makers | ☐ Private sector or industry | ☐ Research funding body | ☐ Volunteer sector or non-governmental organization | ☐ Media | ☐ Other (please specify: ______________________) | ☐ Not reported | Check all that apply. |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  | **Policy and/or decision makers**: In organization, community or government. |
|  |  |  |  |  |  |  |  |  |  |  |  |  | *Check if:*
|  |  |  |  |  |  |  |  |  |  |  |  |  | • author(s) report some sort of involvement of the stakeholder(s) in the study process
|  |  |  |  |  |  |  |  |  |  |  |  |  | • study has been commissioned
|  |  |  |  |  |  |  |  |  |  |  |  |  | • experts were consulted |

| 25. What was the degree of stakeholder engagement in the study process, as reported by the author(s)? | ☐ Shaping the research question(s) | ☐ Identification of relevant studies | ☐ Interpretation of study findings | ☐ Provision of comments at the report writing stage | ☐ Dissemination of study results | ☐ Moving the results into their practice | ☐ Other (please specify: ______________________) | ☐ Not reported | Check all that apply. |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  | **Not applicable**: Select if involvement of stakeholder(s) was not reported by the author(s). |

<table>
<thead>
<tr>
<th>26. Was knowledge translation (KT) reported as part the study process?</th>
<th>☐ Yes, integrated KT</th>
<th>☐ Yes, end of grant KT</th>
<th>☐ No</th>
<th>Check one.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Knowledge translation</strong>: A dynamic and iterative process</td>
</tr>
</tbody>
</table>
that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve health, provide more effective health services and products and strengthen the health care system.

**Integrated KT:** Throughout the research process (i.e., from idea formulation to dissemination of research results). This form of KT is often reported in the Methods section.

**End of grant KT:** Dissemination of research findings once a project is completed. This form of KT is more often only reported in the Discussion section.

<table>
<thead>
<tr>
<th>27. Were any of the following KT activities used to disseminate research findings to stakeholders?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Workshop</td>
</tr>
</tbody>
</table>

Check all that apply.

**Document distribution:** e.g., briefing paper, technical report, summary document.

**Presentation(s):** e.g., conference, seminar, meeting.

<table>
<thead>
<tr>
<th>28. Was an evaluation of the effectiveness of the KT activity (or activities) reported by the author(s)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Yes</td>
</tr>
</tbody>
</table>

Check one.

**No:** Select if a KT activity was reported, but an evaluation of its effectiveness was not reported.

**Not applicable:** Select if a KT activity was not reported in the study.

<table>
<thead>
<tr>
<th>29. Does the author propose “next steps” or actions, based on the ScS results?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ KT activities to disseminate research findings</td>
</tr>
</tbody>
</table>

Check all that apply.
| 30. Was feedback regarding the overall scoping review process reported in the Discussion or Conclusion section? | ☐ Yes (please list page number, column, and paragraph number: _ _ _ _ _ _ _ _ _ _ _ _ _ )  
☐ No | If defined, please copy-and-paste author(s) wording into the text box and/or list page number, column, and paragraph number.  
**Feedback**: From either the author(s) or stakeholder(s); *e.g.*, overall length of the study process, practicality or utility, strengths or limitations reported. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>31. Please provide any additional comments or notes in the space below:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 2.4: List of included scoping reviews


### Summary of findings table

**Summary of findings from a systematic review of the effectiveness of vaccination for reducing Salmonella colonization in broiler chickens**

*Population:* Broiler chickens  
*Intervention:* Vaccination against Salmonella using live or killed strains  
*Comparison:* No vaccination  
*Outcome:* Prevalence of Salmonella determined by cecal sample

<table>
<thead>
<tr>
<th>Intervention (Totton et al. 2011)</th>
<th>Study design</th>
<th>Percent of Salmonella positive carcasses in the control group</th>
<th>Predicted percent of Salmonella positive carcasses in the treated group</th>
<th>Relative effect (95% CI)</th>
<th>Number of observations / trials / studies</th>
<th>Weight of evidence (GRADE)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live S. Typhimurium</td>
<td>ChT</td>
<td>21%</td>
<td>1% (0.4)</td>
<td>OR 0.21 (0.08, 0.77)</td>
<td>326/5/4</td>
<td>***</td>
<td>A consistent protective effect was observed</td>
</tr>
<tr>
<td>Killed S. Typhimurium</td>
<td>ChT</td>
<td>100%</td>
<td>100%</td>
<td>OR² 0.71</td>
<td>17/1/1</td>
<td>**</td>
<td>A very high prevalence was found in the control group</td>
</tr>
<tr>
<td>Live S. Enteritidis</td>
<td>ChT</td>
<td>81%</td>
<td>19%</td>
<td>OR³ 0.058</td>
<td>189/1/1</td>
<td>**</td>
<td>The live vaccine trial found protective results but inconsistent results were observed in killed vaccine trials</td>
</tr>
<tr>
<td>Killed S. Enteritidis</td>
<td>ChT</td>
<td>50%</td>
<td>8-64%</td>
<td>OR² (0.09, 1.75)</td>
<td>118/3/2</td>
<td>**</td>
<td>These trials found a protective effect</td>
</tr>
<tr>
<td>Killed S. Enteritidis and Typhimurium</td>
<td>ChT</td>
<td>78%</td>
<td>35-76%</td>
<td>OR³ (0.15, 0.67)</td>
<td>98/3/1</td>
<td>**</td>
<td>Inconsistent results were observed in these trials</td>
</tr>
<tr>
<td>Live S. Typhimurium and killed S. Hadar, Kentucky, and Heidelberg</td>
<td>ChT</td>
<td>91%</td>
<td>71-97%</td>
<td>OR³ (0.24, 3.26)</td>
<td>393/4/1</td>
<td>**</td>
<td>Inconsistent results were observed in these trials</td>
</tr>
</tbody>
</table>

1. The percent of Salmonella positive carcasses in the control group was calculated from the prevalence of Salmonella in the control group for each intervention. The predicted percent of Salmonella positive carcasses in the treated group was derived from the percent of Salmonella positive carcasses in the control group and the relative effect of the intervention.
2. Odds ratios were calculated from meta-analyses. Medians and ranges are reported when meta-analysis could not be conducted.
3. Adjusted from 0 or 100% controlled group risk to be 0.1 or 99.9%.

**Weight of evidence (GRADE) explanation:**

- **** High quality: Further research is unlikely to change our confidence in the estimate of effect.
- *** Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
- ** Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
- * Very low quality: We are very uncertain about the estimate.

ChT = Challenge trials; CI = Confidence interval; OR = Odds ratio; * = range; ² = Estimate is from a single study.

**Note:** The evidence for the efficacy of live and killed Salmonella vaccines using different strains and, in some studies, mixed strains is very weak. Only challenge studies were identified, the trials tended to be small and only in the case of the live S. Typhimurium vaccine were there enough trials to warrant conducting a meta-analysis. Although these trials largely show that vaccination may be protective against some strains of Salmonella, most studies were small and there was a lot of variation in both the challenge and the intervention. Future study results may be very different from what has been summarized in this review.
Appendix 4.2: One-page summary sheet

Can vaccines reduce *Salmonella* in broiler chickens?

*Making sense of the global body of knowledge using SR-MAs*†

**Background:**
- Broiler chickens produced for meat are linked to 15% of human salmonellosis cases.
- *Salmonella* bacteria survive in a range of environments, thus a number of control measures are usually used in combination to minimize bacteria levels on broiler farms.
- In Canada, five commercial *Salmonella* vaccines are licensed for use in the poultry industry.
- Available vaccines are made with either live or killed *Salmonella* strains, which affect how the vaccine is given and how it works.

**Findings:**
- Twenty-two studies investigated the effectiveness of six experimental vaccines for *Salmonella* in broiler chickens. The systematic review included both live and killed *Salmonella* vaccines.
- The review found 10 studies with clear findings, summarized in the table below. All studies were done outside of Canada in research facilities, using small trial sizes.
- This review did not capture vaccines that are commercially available in Canada.

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Live or killed?</th>
<th>How many studies looked at this vaccine?</th>
<th><em>Salmonella</em> positive birds in flock</th>
<th>Salmonella positive birds in flock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No vaccine</td>
<td>With vaccine</td>
<td>(Predicted)</td>
</tr>
<tr>
<td>S. Typhimurium</td>
<td>Live</td>
<td>4 studies/5 trials</td>
<td>21%</td>
<td>1%</td>
</tr>
<tr>
<td>S. Enteritidis</td>
<td>Live</td>
<td>1 study/1 trial</td>
<td>81%</td>
<td>19%</td>
</tr>
<tr>
<td>S. Enteritidis/Typhimurium (combined)</td>
<td>Killed</td>
<td>1 study/3 trials</td>
<td>78%</td>
<td>(35–76%)</td>
</tr>
<tr>
<td>S. Typhimurium</td>
<td>Killed</td>
<td>1 study/1 trial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. Enteritidis</td>
<td>Killed</td>
<td>2 studies/3 trials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. Typhimurium and killed S. Hadar, Kentucky and Heidelberg (combined)</td>
<td>Live/Killed</td>
<td>1 study/4 trials</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Findings of studies examining vaccines for *Salmonella* in broiler chickens. †Data abstracted from meta-analysis.


SR-MA: Systematic Review and Meta-analysis

Publication Date: MM/DD/2012

Population Risk Analysis Division
Laboratory for Foodborne Zoonoses

SR-MA Report 005- Report 5 of 7 on *Salmonella* and broilers
Can vaccines reduce *Salmonella* in broiler chickens?
*Transforming research into practice*

**Introduction:**

There are two types of chicken flocks: broilers and layers. Layer chickens only produce eggs, whereas broiler chickens are raised for meat. The broiler and layer chicken industries are managed and governed separately.

Broiler chickens are common carriers of *Salmonella* bacteria. *Salmonella* is a zoonotic pathogen, meaning that it can cause disease in both humans and animals. It has many different strains (serovars). *Salmonella Typhimurium* and *Enteritidis* are two common strains of public health concern, that are carried by chickens. Most poultry-associated outbreaks of *Salmonella* in humans are related to cross-contamination and improper cooking of chicken meat and eggs.

*Salmonella* can easily adapt to different environments and spread between animals. Currently, no single intervention is enough to eliminate *Salmonella* on broiler farms. Preventing the introduction of *Salmonella* to the production chain usually involves a combination of several interventions.

**What are *Salmonella* vaccines?**

*Salmonella* vaccines can be given to broiler chickens to help them build their own immune defence. They can be given through water, spray or an injection and are made with either live or killed strains of *Salmonella*. The main differences between these two types of vaccines are summarized in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Comparison of live and killed strains of the <em>Salmonella</em> bacteria.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Live Vaccine</strong></td>
</tr>
<tr>
<td>Contains a living <em>Salmonella</em> strain</td>
</tr>
<tr>
<td>Activates antibodies and immune cells to build the bird’s defence</td>
</tr>
<tr>
<td>Usually more effective because the effects last longer</td>
</tr>
</tbody>
</table>

Most research on vaccines is experimental and little information is available about their use under commercial farm conditions.

**What you need to know**

- In Canada, there are five *Salmonella* vaccines that are licensed for use in poultry.
- The Great-grandparent and grandparent generations are suggested stages for vaccination. This could prevent the spread of infection early in the production chain.
- More Canadian research is needed for these vaccines at a commercial level.
- If a new or existing vaccine shows evidence of increased profits, safety and production for the industry, vaccines may become a valuable preventative tool against *Salmonella*.
Can vaccines reduce *Salmonella* in broiler chickens?

How effective are vaccines?

A recent SR-MA evaluated live and killed *Salmonella* vaccines in broiler chickens. The findings of the systematic review are summarized in Table 2.

- 10 suitable studies were found. None of the studies were Canadian.
- The live S.Typhimurium vaccine showed greatest effectiveness in reducing *Salmonella*.
- Poultry industry experts postulate that using a combination of live and killed vaccines would be more effective than just using one type.

Table 2. Summary of findings of studies examining vaccines for *Salmonella*.

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Live or killed?</th>
<th>How many studies looked at this vaccine?</th>
<th><em>Salmonella</em> positive birds in flock</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. Typhimurium</td>
<td>Live</td>
<td>4 studies/5 trials</td>
<td>21%</td>
</tr>
<tr>
<td>S. Enteritidis</td>
<td>Live</td>
<td>1 study/1 trial</td>
<td>81%</td>
</tr>
<tr>
<td>S. Enteritidis/Typhimurium</td>
<td>Killed</td>
<td>1 study/3 trials</td>
<td>78%</td>
</tr>
<tr>
<td>S. Typhimurium</td>
<td>Killed</td>
<td>1 study/1 trial</td>
<td>(35–76%)</td>
</tr>
<tr>
<td>S. Enteritidis</td>
<td>Killed</td>
<td>2 studies/3 trials</td>
<td>No decrease predicted</td>
</tr>
<tr>
<td>S. Typhimurium and killed S. Hadar, Kentucky and Hedeland (combined)</td>
<td>Live/Killed</td>
<td>1 study/4 trials</td>
<td>81%</td>
</tr>
</tbody>
</table>

*Data abstracted from meta-analysis.*


What vaccines are available for the broiler chicken industry?

Vaccines for *Salmonella* are available in Canada and are regulated by the Canadian Food Inspection Agency (CFIA). There are currently five vaccines approved and licensed for use in poultry in Canada. See Table 3 for a summary of these vaccines and how they are given.

Table 3. The five *Salmonella* broiler vaccines currently approved for use in Canada.

<table>
<thead>
<tr>
<th>Product name</th>
<th>Live or killed?</th>
<th>Scientific name</th>
<th>Manufacturer</th>
<th>How is it given?</th>
<th>Date licensed in Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>AviPro MEGAN VAC1</td>
<td>Live</td>
<td>S. Typhimurium Vaccine, Live Culture</td>
<td>Lohmann Animal Health International, USA</td>
<td>Drinking water or spray</td>
<td>Feb. 24, 2009</td>
</tr>
<tr>
<td>Poultvac ST</td>
<td>Live</td>
<td>S. Typhimurium Vaccine, Live Culture</td>
<td>Pfizer Animal Health, USA</td>
<td>Drinking water or spray</td>
<td>Jan. 9, 2007</td>
</tr>
<tr>
<td>Salmun</td>
<td>Live</td>
<td>S. Typhimurium Vaccine, Live Culture</td>
<td>Biomune Company</td>
<td>Drinking water or spray</td>
<td>June 12, 2003</td>
</tr>
<tr>
<td>Layernune SE</td>
<td>Killed</td>
<td>S. Enteritidis Bacterin</td>
<td>Biomune Company, USA</td>
<td>Injection</td>
<td>Sept. 1, 1992</td>
</tr>
</tbody>
</table>

*SR-MA: Systematic Review and Meta-analysis
2Systematic Review: a transparent process to analyze all published studies on a specific area of knowledge or intervention.
3Meta-analysis: a statistical method for combining results of many studies into a single finding.

Population Risk Analysis Division
Laboratory for Foodborne Zoonoses

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Can vaccines reduce *Salmonella* in broiler chickens?

**At which stage is vaccination used?**

To decide which stage is the best for vaccinating the flock, we must first understand how the broiler chicken production chain works. The broiler chicken industry is a complex system with multiple levels of breeding and production. Targeting infection early in the production chain would be the best way to prevent the spread of *Salmonella* to subsequent generations.

![Diagram of the Broiler Chicken Production Chain]

**START:** The industry begins with a pure line of chickens with a perfected pedigree. These few birds are used to produce the following three generations in the production chain: the great-grandparents, grandparents and parents.

**Potential Vaccination Stage**

Multiplicies and broiler grow-outs produce the broiler chickens that are used for meat. In chicken breeding, it takes 4 to 5 years for the pedigree selection at the top of the pyramid to be seen as retail chicken meat.

**Figure 1. The Broiler Chicken Production Chain:** Primary breeders develop the first three generations which then proceed through the stages of the production chain to supply meat to the end consumer.

- Vaccinating the great-grandparent and grandparent breeder groups would be the most practical and cost effective use of vaccines in the broiler industry. Vaccination early in the production chain impacts the parent flock so that immunity to *Salmonella* can be carried down the production chain, saving on time, labour and money.
- It would not be beneficial to the producer if broiler chickens were vaccinated against *Salmonella* at the broiler grow-out stage. This is because they are only on the farm for 6–8 weeks before being sent to slaughter, which is not long enough to see an immune response.
- Rather than vaccination, broiler grow-out farms focus on a combination of interventions such as biosecurity practices and water or feed additives to reduce the chances of *Salmonella* contamination on the farm.
- More scientific evidence is needed to evaluate the effectiveness of *Salmonella* vaccines on Canadian broiler farms.

**Are there any concerns?**

- Farmers are generally open minded towards the use of vaccines and consumers have yet to express concerns with it.
- Most farmers are willing to learn about new ways of maintaining a healthy flock and product; however, the cost and long-term financial impact of implementing vaccines may be a concern for farmers.
- If there is evidence that production rates could be enhanced and profits increased with vaccine use, more farmers may be willing to invest in them.
Appendix 4.4: Questionnaire for survey of policy and decision makers

Part A: Demographic

1. How would you self-describe your primary job function? (Please check only one option)
   - Policy maker
   - Policy analyst
   - Policy advisor
   - Program manager or director
   - Other, please specify: ______________________

2. Please indicate your level of experience working in policy-related functions:
   - <2 years
   - 2-5 years
   - 6-10 years
   - >10 years

3. What is the highest level of education you have completed?
   - Less than high school
   - High school diploma or equivalent
   - Trade certification or diploma (vocational or apprenticeship)
   - College, CEGEP or other non-university certificate or diploma
   - Bachelor’s Degree
   - Graduate (Master’s or Doctoral) or Professional Degree (MD, JD, DVM)

4. In your current position, what is your perceived level of influence on policy making?

<table>
<thead>
<tr>
<th>Very low level of influence</th>
<th>Low level of influence</th>
<th>Moderate level of influence</th>
<th>High level of influence</th>
<th>Very high level of influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

5. Do you have open access to scientific journal articles at your current workplace?
   - Yes
   - No
   - Don’t know

Part B: Familiarity with synthesis research

Definitions:
A narrative review provides a general review of the research literature on a particular topic. The methodology for identifying and selecting relevant papers is generally not reported.

A scoping review is a type of literature review that aims to ‘map’ the extent, range and nature of relevant literature in a field of interest, using transparent and replicable procedures.

A systematic review is a type of literature review that aims to comprehensively locate and synthesize research addressing a particular question, using transparent and replicable procedures.

A meta-analysis is a statistical technique for combining the results from multiple studies to produce an overall measure of effect of a treatment or intervention.

A policy is any plan, course of action, or set of guiding principles intended to influence and determine decisions at the government or organizational level.

6. Prior to participating in this study, how familiar were you with each the following knowledge synthesis methods?

<table>
<thead>
<tr>
<th></th>
<th>Very familiar</th>
<th>Familiar</th>
<th>Unfamiliar</th>
<th>Very unfamiliar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrative review</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Systematic review</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Meta-analysis</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Scoping review</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

7. Have you ever read a systematic review before participating in this study?
   - Yes
   - No

8. Have you ever collaborated on a systematic review project?
   - Yes, as a researcher
   - Yes, as a stakeholder
   - No

9. Have you ever used evidence from any of the following research synthesis methods to inform a policy decision?

<table>
<thead>
<tr>
<th>Method</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrative review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systematic review with qualitative analysis (no formal meta-analysis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systematic review with formal meta-analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meta-analysis (without systematic review)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scoping review</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10. When you review a knowledge synthesis paper (e.g., systematic review, scoping review, narrative review) or other journal article, which of the following sections do you generally read? [Check any that apply]

- Full paper
- Executive summary or abstract
- Background/introduction
- Methods
- Results
- Discussion
- Conclusion
- Not applicable

11. Over the past 6 months, on how many occasion(s) have you consulted a systematic review to inform your work?

- none
- 1
- 2
- 3
- 4
- Greater than 5 occasions

12. Over the past 6 months, did you ever wish there was a systematic review you could have consulted to inform your work (given that a systematic review was not available for that topic)?

- Yes
- No

13. Looking into the future, would you ever consider funding or commissioning a systematic review?

- Yes
- No
- Not applicable

14. In your opinion, should government agencies be routinely doing the activities listed below to inform policy decisions?

a) Conducting systematic reviews?  □ Yes  □ No

b) Commissioning or funding systematic reviews?  □ Yes  □ No

**Part C: User experience**

Please review the documents that you received and answer the following questions to the best of your ability.
15. Overall, how would you rate the ease or difficulty in interpreting the evidence from each of the formats?

<table>
<thead>
<tr>
<th></th>
<th>Very easy to interpret</th>
<th>Somewhat easy to interpret</th>
<th>Neither easy nor difficult to interpret</th>
<th>Somewhat difficult to interpret</th>
<th>Very difficult to interpret</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematic review</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Summary-of-findings table</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1-page summary sheet</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3-page contextual summary</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

16. How would you rate the trustworthiness of evidence from each format?

<table>
<thead>
<tr>
<th></th>
<th>Highly trustworthy</th>
<th>Trustworthy</th>
<th>Untrustworthy</th>
<th>Highly untrustworthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematic review</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Summary-of-findings table</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1-page summary sheet</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3-page contextual summary</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

17. For your day-to-day work, how would you rate the amount of detail presented in each of the formats?

<table>
<thead>
<tr>
<th></th>
<th>Not enough detail</th>
<th>Enough detail</th>
<th>Too much detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematic review</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Summary-of-findings table</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1-page summary sheet</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3-page contextual summary</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

18. In your position, how useful would each format be in informing a policy decision?

<table>
<thead>
<tr>
<th></th>
<th>Very useful</th>
<th>Useful</th>
<th>Somewhat useful</th>
<th>Not useful</th>
<th>Not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematic review</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Summary-of-findings table</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1-page summary sheet</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
19. Scenario: You are asked to attend a meeting to consult on an important policy decision. Each of the four documents listed below are available for the matter on which you are consulting. Which ONE of the following documents would you be most likely to take with you to this meeting?

- Systematic review paper
- Summary-of-findings table
- 1-page summary sheet
- 3-page contextual summary

20. Overall, do you think that evidence from systematic reviews can be useful to inform policy decisions in your organization?

- Yes
- No

21. Have you read the enclosed systematic review article in full (i.e., from introduction to conclusion)?

- Yes
- No

22. How would you rate the usefulness of the following components of the systematic review manuscript for informing policy decisions?

<table>
<thead>
<tr>
<th>Component</th>
<th>Very useful</th>
<th>Useful</th>
<th>Somewhat useful</th>
<th>Not useful</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Introduction</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Materials and methods</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Figure 1 - Flowchart of number of studies screened, assessed for eligibility, excluded and included</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Table 2 - Summary of characteristics of included studies</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Forest plots of the effect of various treatments (Figures 2, 3, 4)</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Results</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Discussion</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Conclusions</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
ii) Summary-of-findings (SoF) table

23. Have you read the enclosed summary-of-findings table in full?
   - Yes
   - No

24. In your opinion, did the “Summary of Findings” table adequately summarize the main findings of the systematic review?
   - Yes
   - No

25. How would you rate the usefulness of the following sections of the SoF table for informing policy decisions?

<table>
<thead>
<tr>
<th>Section</th>
<th>Very useful</th>
<th>Useful</th>
<th>Somewhat useful</th>
<th>Not useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of population, intervention, comparison, outcome</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Study design</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Illustrated comparative risks</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Evaluation of efficacy</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Relative effect (95% CI)</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Number of observations/trials/studies</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Weight of evidence (GRADE)</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Comments</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Footnotes (below table)</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

iv) 1-page summary sheet

26. Have you read the enclosed 1-page summary sheet in full?
   - Yes
   - No

27. In your opinion, did the 1-page summary sheet adequately summarize the main findings of the systematic review?
   - Yes
   - No

28. How would you rate the usefulness of the following sections in the 1-page summary sheet for informing policy decisions?
iii) 3-page contextual summary

29. Have you read the enclosed 3-page contextual summary in full?
   - Yes
   - No

30. In your opinion, did the 3-page contextual summary adequately summarize the main findings of the systematic review?
   - Yes
   - No

31. How would you rate the usefulness of the following information in the 3-page contextual summary for informing policy decisions?

<table>
<thead>
<tr>
<th>Section</th>
<th>Very useful</th>
<th>Useful</th>
<th>Somewhat useful</th>
<th>Not useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Findings (bulleted text)</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Findings (table)</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>What does this mean?</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Next steps</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Footnotes</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Part D: Additional comments

32. Please make any additional comments regarding the systematic review manuscript, summary sheet or this study below:
We are extending an invitation to all survey participants to share their responses in further detail in a follow-up interview. The interview will take 15-30 minutes and can be conducted over the phone or in-person at the participant's convenience.

33. Would you be interested in discussing your survey responses in further detail in a follow-up interview? The interview will take 15-30 minutes and can be conducted over the phone or in-person at your convenience.

☐ Yes
☐ No

[If answer to Q30 is “Yes”] Please enter your contact information in the space provided below.

<table>
<thead>
<tr>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail address:</td>
</tr>
<tr>
<td>Phone number:</td>
</tr>
</tbody>
</table>

You will be contacted within 1-2 business days to arrange a date and time for the interview.

Thank you for taking the time to complete this survey.

As a small token of appreciation for taking part in this survey, we are offering a $20 gift card (Chapters, Second Cup or Rona).

34. Would you like to receive compensation for taking part in this survey?

☐ Yes
☐ No

[If response to Q30 is “Yes”] Please select one of the following gift cards:

☐ $20 Canadian Tire gift card
☐ $20 Second Cup gift card
☐ $20 Chapters Indigo gift card

[If response to Q30 is “Yes”] Please enter your name and mailing address below:

| Name:          |
Thank you again for taking the time to complete this survey.
Appendix 4.5: Semi-structured interview guide for survey follow-up

I want to thank you for agreeing to take time for this interview today. The purpose of this interview is to discuss how you use synthesis evidence to inform policy decisions in your organization. There are no “right” or “wrong” answers, and I encourage you to give your answers in as much detail as you can. This interview is being audio recorded to ensure that we accurately capture your responses. At any time during the interview, you may request to have the recorder turned off. Your participation in this study is voluntary and all comments made during this interview are strictly confidential. No identifying information will be included in any presentation or publication resulting from this research. You may choose to withdraw from participating in this study at time, without penalty or consequences. Do you have questions before we begin?

[NB: Questions asked will depend on responses from online survey (Appendix 4.4)]

Part B: Familiarity with synthesis research

1a. [If participant selected “Very familiar” or “Familiar” for survey question 5 (familiarity with knowledge synthesis methods) and “No” for Q6 (Have you ever read a systematic review before participating in this study?)] In the survey, you responded that you had not read a systematic review before participating in this study, why do you think that is?

Probes:
- If there was a relevant SR published, would you be aware that it exists?
- Do you know how to access published SR manuscripts?
- Are there time constraints to reading an SR paper?
- Are they difficult to interpret?

OR

1b. [If participant selected “Very familiar” or “Familiar” for survey question 5 (familiarity with knowledge synthesis methods) and “0 times” for Q10 (use of SR in past 6 mos)] In your opinion, what are the main reasons that you have not consulted a SR to inform your work in the last 6 months?

Probes:
- Is it because relevant SRs were not available?
- Is it because you were not aware of any relevant SRs being available?
- Is it because of time constraints?

2. [If participant selected “Unfamiliar” or “Very unfamiliar” with Q5 (familiarity with knowledge synthesis methods)] Now that you are more familiar with knowledge synthesis methods, do you think they could be useful in informing a policy decision in your organization?

Probes:
- Why or why not?
- Which format(s) do you think would be most useful? Why is that?
3. [If participant only selected “Executive summary or abstract” or “Background/introduction” from Q9 (sections of an article generally read)] When you are reading a knowledge synthesis paper or other journal article, what are your main reasons for only reading the [sections selected by participant in survey]?

*Probes:*
- Is it because of time constraints?
- Is it because the sections have all the information needed?
- Is it because the other sections are difficult to interpret or read?

4. [If participant selected “no” to Q12 (would you ever consider funding or commissioning a systematic review in the future?)] In the survey, you responded that you would not consider funding or commissioning a systematic review in the future. What are your main reasons for that?

5. [If participant selected “no” to either Q13a or Q13b (whether government agencies should be routinely conducting systematic reviews (a) or commissioning or funding systematic reviews (b))]

In your opinion, why should government agencies not be routinely:
- conducting systematic reviews?
- commissioning or funding systematic reviews?

*Probes:*
- Who do you think should be routinely conducting these activities?

**Part C: User experience**

6. In the survey, you were given a scenario (Q18) in which you were to consult on an important policy decision and could only take one of the four document options (SR, SoF table, 1-page summary sheet, 3-page contextual summary) into the meeting with you. What were your main reasons for selecting [option selected by participant in survey]?

*Probes:*
- What are the specific reasons that you didn’t select the other formats?
- Are there any situations where you would prefer to use of the other formats?

7. In the survey, you responded that evidence from systematic reviews can/cannot [depending on response to Q19] be useful to inform policy decisions in your organization. Why is that?

**Systematic review**

8. [If participant selected “No” to Q20 (Have you read the enclosed SR-MA article in full?)] In the survey, you responded that you did not read the SR-MA article in full. To what extent did you read or look over the SR-MA?

*Probes:*
- Were there any sections that you skipped over? Why?
• What were your mains reasons for only looking at those sections?

9. In the survey, you rated systematic reviews as [rating by participant for ease or difficulty in interpret evidence from the systematic review manuscript]. In your opinion, what aspects of the systematic review were easy/difficult to interpret?

10. What are some of the barriers towards using evidence from systematic reviews to inform a policy decision in your organization?

Probes:
• Would you be aware that a relevant SR exists?
• Do you know how to access published SR manuscripts?
• Are there time constraints to reading an SR paper?
• Are they too difficult or technical to interpret?
• Are there any aspects of the systematic review that would be useful or not useful for informing a decision, policy or practice?

11. What do you think is the most important change, if any, that could be made to the overall presentation of the systematic review to improve its usefulness for informing policy?

SoF table

12. [If participant selected “No” to Q22 (“In your opinion, did the “Summary of Findings” table adequately summarize the main findings of the systematic review?”)] In the survey, you responded that SoF table did not adequate summarize the main findings of the systematic review. Can you elaborate on why?

13. Is there any additional information that should be included in the SoF table?

14. What do you think is the most important change, if any, that can be made to the overall presentation of the SoF table to improve its usefulness for informing policy?

1-page summary sheet

15. [If participant selected “No” to Q24 (“In your opinion, did the 1-page summary sheet adequately summarize the main findings of the systematic review?”)] In the survey, you responded that the 1-page summary sheet did not adequate summarize the main findings of the systematic review. Can you elaborate on why?

16. In your opinion, is there any additional information that should be included in the summary sheet?

17. What do you think is the most important change, if any, that could be made to the overall presentation of the summary sheet to improve its usefulness for informing policy?
3-page contextual summary

18. [If participant selected “No” to Q27 (Did the 3-page contextual summary adequately summarize the main findings of the SR?)] In the survey, you responded that the 3-page contextual summary did not adequately summarize the main findings of the systematic review. Can you elaborate on why?

19. In your opinion, is there any additional information that should be included in the 3-page contextual summary?

20. What do you think is the most important change, if any, that could be made to the overall presentation of the 3-page contextual summary to improve its usefulness for informing policy?

Conclusion:

That concludes the interview. Thank you for your time and participation. I will be in contact with you again at the conclusion of the study to share a copy of the results and to get feedback from you about our interpretation of the study findings. Please feel free to contact me if you have any subsequent questions or concerns.