Knowledge Synthesis, Transfer and Exchange in Agri-Food Public Health:

A Handbook for Science-to-Policy Professionals

Andrijana Rajić and Ian Young
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**Disclaimer:**
Both authors completed this work while affiliated with the Department of Population Medicine, University of Guelph. Andrijana currently works with the Food and Agriculture Organization of the United Nations and Ian with the Public Health Agency of Canada. The views and statements expressed in this handbook are those of the authors and do not necessarily reflect the views of the organizations noted above. The mention of specific companies or products in this handbook does not imply their endorsement or recommendation by the authors or the organizations listed above.

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An idea to write this handbook has grown for many years. In many ways, it is result of our joint interests and close collaboration over the past several years and our different but unique academic and government insights and experiences that we have gained over the 20 and six years of our respective careers and that we hopefully bring to this handbook.

This book was largely written in our spare time while balancing our regular work commitments, numerous concurrent projects and activities between Rome and Guelph. For this reason, we would like first to acknowledge our respective families and friends for their patience and support. Andrijana dedicates the handbook to her sister and best friend, Vesna Rajić. She would also like to thank two close friends, Sadeta Stanivuk and Dr. Silvana Micic, for their tremendous support over the past 12 months. Ian would like to especially thank Robin Mosseri for her constant support and inspiration.

We would like to acknowledge all individuals and organizations with whom we have collaborated over the past 10 years. Lisa Waddell, Dr. Scott McEwen and Dr. Barbara Wilhelm deserve to be mentioned as our longest and the most consistent and instrumental collaborators. We are also grateful to all graduate and undergraduate students and research assistants who have contributed to different research projects and many other collaborators who inspired us in many ways.

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What Others Have Said About This Handbook

“The handbook is a superb resource for those interested in supporting the use of research evidence in agri-food public health. It puts in one place all of the key evidence and insights needed to work in this domain, and it contextualizes the material for the sector using appropriate examples. I congratulate the authors for this significant contribution to their field.”

John N. Lavis, MD, PhD, Director of the McMaster Health Forum, Associate Director of the Centre for Health Economics and Policy Analysis, and Professor, McMaster University

“The worldwide application of methods from Rajić and Young’s handbook could leverage billions of additional dollars in value from current and future knowledge. Such application would also better prioritize the allocation of resources to programs and research. During my 32 years of professional experience I have observed many people (including myself), being misdirected or ‘reinventing-wheels’, due to a lack of tools that ensure decisions are based on all applicable knowledge. This handbook provides those tools. The handbook systematically and succinctly describes methods and example exercises for the synthesis, transfer, dissemination, exchange, application and evaluation of knowledge. Many links and references are provided for additional information. This handbook should be mandatory reading for all agri-food and public health decision-makers, policy-analysts, researchers and students. Furthermore, evidence of application of the techniques should be a prerequisite for the development and funding of all policies, programs and research projects.”

W. Bruce McNab, DVM, PhD, Lead Veterinarian - Planning & Preparedness, Animal Health and Welfare Branch, Ontario Ministry of Agriculture and Food

“Although publications are available from other disciplines, this is the first book I found written specifically for the agri-food and public health interface. This allows for much more focus and provides a significant advantage over more general texts! The authors start at the beginning with the definitions, without making it too theoretical, allowing a wide range of readers to access and understand the topic. The practical exercises at the end of each chapter are particularly useful - a great way to review and test knowledge in the face of real scenarios. The authors clearly demonstrate their practical experience. The additional references are an asset if more detailed information on a specific topic is required. I found many points that are relevant for the projects I am currently involved in and will recommend this book to future partners. A must have and read for professionals in this area!”

Katharina D.C. Stärk, Dr. med. vet., PhD, Dipl ECVPH, Professor, Royal Veterinary College and Safe Food Solutions Inc.
“It was with great pleasure that I read the handbook developed by Dr. Rajić and Dr. Young about knowledge synthesis, transfer and exchange in agri-food public health. Its utility to public health professionals working in this sector is invaluable. This handbook offers a clear methodological description of knowledge transfer interventions and processes. In my area of work, in foodborne diseases and zoonoses, it is absolutely mandatory turn research into practice and policy. However, there is a considerable gap in country’s capacities between research and practice. The handbook is designed to close this gap by providing a detailed description of the processes involved in knowledge transfer and exchange applied among others to veterinary public health, food safety, zoonoses. Managers and directors working in food safety and zoonoses in the Americas will find in this handbook an excellent resource to inform policy- and decision-making.”

*Enrique Pérez Gutiérrez, DVM, MMV, MVPM, PhD, Senior Advisor Foodborne Diseases and Zoonosis, Communicable Diseases and Health Analysis (CHA), Pan American Health Organization/World Health Organization-PAHO/WHO*
Preface

Handbook purpose and structure

Several knowledge transfer and exchange (KTE) resources, guidelines and toolkits currently exist about this topic (e.g. Lavis et al., 2009a; Bennett and Jessani, 2011; National Collaborating Centre for Methods and Tools, 2013), but they were all developed primarily in the context of the healthcare, health services, and broader public health sectors. This handbook focuses specifically on the unique application of these methods and practices to the agri-food public health sector.

We hope that this handbook will serve well those working in the area of KTE and science-to-policy in Canada and globally. Although the focus of this handbook is on the agri-food public health sector, denoted as a field of activity characterized by the overlap of veterinary public health, food safety and “One Health”, many of the principles should also be applicable to broader agri-food contexts (e.g. food production and security) and other sectors. We hope that with this handbook we will help to raise awareness about KTE in the agri-food public health sector and other related fields and we hope it will assist science-to-policy professionals (in a broad sense, including managers, policymakers, and those who support them) on how to ensure that relevant and credible research is generated and utilized to inform policy- and decision-making in times of increasingly scarce resources and when the value and utility of knowledge is increasingly recognized.

This handbook begins with a broad overview of KTE and science-to-policy methods and practices and their potential applicability to the agri-food public health context (Chapter 1). We then describe detailed methods and practices related to knowledge synthesis (Chapter 2), knowledge transfer and dissemination (Chapter 3), knowledge exchange and stakeholder engagement (Chapter 4), and knowledge application and evaluation (Chapter 5). Throughout each chapter we provide unique and illustrative examples and insights within the agri-food public health context. Each chapter also includes a practical exercise to apply the concepts on an agri-food public health issue and key methodological references applicable across sectors.

Target audience

This handbook is intended primarily for science-to-policy professionals (e.g. policy and research analysts, program officers and technical specialists, and knowledge brokers and mobilizers) and policy and practice decision-makers (e.g. practitioners, managers and directors) working in various levels of government (local, provincial, national/federal, and international), industry and non-profit organizations. However, many of the principles and practices in this handbook are also applicable to academic and non-academic researchers, training instructors, technical consultants and funding agency administrators. While there is a focus on the Ontario and Canadian context, this
handbook should also be useful and applicable to users in other communities, countries, and internationally.

**Key definitions**

Within the context of this handbook, we use the term **agri-food public health** to denote a field of activity characterized by the overlap of veterinary public health, food safety and “One Health”, but many of the principles discussed should also be applicable to broader agri-food contexts (e.g. plants, fisheries, nutrition, agri-food production, nutrition-sensitive security) and other sectors (Sargeant et al., 2006a; Rajić et al., 2013).

We refer to **end-users** as any potential user of knowledge for decision-making. This includes practitioners, policy-makers, and research or policy analysts that use knowledge to inform policy and practice decision-making.

We refer to **knowledge** as all potential sources of research-derived knowledge (e.g. peer-reviewed journal articles, government and organizational reports, and unpublished surveillance or field data). While we focus on knowledge synthesis as key initial step of KTE to inform policy- and decision-making, we realize that in practice KTE does not always include synthesis, and specifically not formal knowledge synthesis.

We adapt the CIHR (Canadian Institutes of Health Research, 2013) definition of knowledge translation and use the term **knowledge transfer and exchange (KTE)** to refer to the dynamic and iterative process of synthesis, dissemination, exchange and ethically-sound application of agri-food public health knowledge to inform policy and practice in this sector. While we use the term KTE in this handbook for brevity and consistency reasons, in practice we prefer the term knowledge synthesis, transfer and exchange (KSTE) to describe the complete KTE process defined above.

We also use the following definitions of key KTE terms throughout this handbook:

- **Knowledge synthesis** is the identification, appraisal and integration of findings from multiple individual studies and other sources into the global knowledge base about a topic (Grimshaw, 2010)

- **Knowledge transfer and dissemination** refers to the planned and structured process of moving knowledge into agri-food public health policy and practice

- **Knowledge exchange** refers to the process of interaction and engagement between researchers, policy-makers, research and policy analysts and advisors, practitioners, and other stakeholders to support evidence-informed policy and practice decision-making
• **Knowledge application** refers to “user-pull” efforts among policy-makers, practitioners, and other end-users to support their application and uptake of knowledge to inform policy and practice decision-making

• **Knowledge evaluation** refers to the process of monitoring the effectiveness and impact of knowledge to inform policy and practice decision-making

We define **policy** as any course of action or inaction chosen by governments or organizations to address a given problem or set of problems (Pal, 2010).

We define **practice** as the daily work and implementation of agri-food public health policies and procedures (e.g. veterinary, agri-food public health, and public health practice).

We refer to **evidence-informed policy-making** as the structured and transparent process of ensuring that the best available knowledge is used to inform government and organizational policy-making (Lavis et al., 2009a).
List of abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Term</th>
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<tbody>
<tr>
<td>AAFC</td>
<td>Agriculture and Agri-Food Canada</td>
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<td>AMR</td>
<td>Antimicrobial resistance</td>
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<td>AMU</td>
<td>Antimicrobial use</td>
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<td>CE</td>
<td>Competitive exclusion</td>
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<tr>
<td>CFHI</td>
<td>Canadian Foundation for Healthcare Improvement</td>
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<td>CFIA</td>
<td>Canadian Food Inspection Agency</td>
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<td>CADTH</td>
<td>Canadian Agency for Drugs and Technologies in Health</td>
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<td>CIPARS</td>
<td>Canadian Integrated Program for Antimicrobial Resistance Surveillance</td>
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<tr>
<td>CoP</td>
<td>Community of practice</td>
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<tr>
<td>EFSA</td>
<td>European Food Safety Authority</td>
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<td>FAO</td>
<td>Food and Agriculture Organization</td>
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<tr>
<td>GRADE</td>
<td>Grading of Recommendations, Assessment, Development and Evaluation</td>
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<tr>
<td>KS</td>
<td>Knowledge synthesis</td>
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<td>KTE</td>
<td>Knowledge transfer and exchange</td>
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<td>LFZ</td>
<td>Laboratory of Foodborne Diseases</td>
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<td>MA</td>
<td>Meta-analysis</td>
</tr>
<tr>
<td>MC</td>
<td>Memorandum to Cabinet</td>
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<td>ODI</td>
<td>Overseas Development Institute</td>
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<tr>
<td>OMAF</td>
<td>Ontario Ministry of Agriculture and Food</td>
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<tr>
<td>PHAC</td>
<td>Public Health Agency of Canada</td>
</tr>
<tr>
<td>PICOS</td>
<td>Population, intervention (exposure), comparison, outcome, and study design</td>
</tr>
<tr>
<td>rbST</td>
<td>Recombinant bovine somatotropin</td>
</tr>
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<td>SR</td>
<td>Systematic review</td>
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<td>STEC</td>
<td>Shiga-toxin producing E. coli</td>
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<tr>
<td>USCDC</td>
<td>United States Centers for Disease Control and Prevention</td>
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<td>WHO</td>
<td>World Health Organization</td>
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1 NOTE: Abbreviations are spelled out fully during their first use within each chapter.
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1. Introduction to knowledge transfer and exchange

Chapter summary:

- **Knowledge transfer and exchange (KTE)** improves knowledge utilization and ensures that the best available knowledge is used to inform policy and practice.
- **Key principles for improved knowledge utilization** are: 1) relevant and credible research; 2) ongoing interactions between researchers and end-users; 3) organizational support and culture; and 4) monitoring and evaluation. 5) To inform policy-making, the contextual factors of the process must also be addressed.
- **A wide range of KTE methods and practices are used** to synthesize (e.g., systematic review), disseminate (e.g., evidence summaries) and exchange (e.g., stakeholder dialogues) knowledge.
- **Strategic integration of KTE principles and methods in the agri-food public health sector** (e.g., a collaboratively-derived science-to-policy research agenda) would improve evidence-informed policy- and decision-making in this sector.

1.1. Introduction

Research knowledge, herein referred to as “knowledge”, is generally underutilized in policy and practice decision-making across many sectors (World Health Organization [WHO], 2004; Graham et al., 2006). A wider use of specific knowledge transfer and exchange (KTE) principles and methods is endorsed in health and other sectors to improve the uptake of knowledge and improve evidence-informed policy and practice decision-making (WHO, 2004; Lavis et al., 2005; Graham et al., 2006).

**Agri-food public health**

Many agri-food public health issues are truly cross-cutting, trans-disciplinary and multi-sectoral. Antimicrobial use (AMU) and antimicrobial resistance (AMR), prevention and management of biological and chemical hazards in the food chain and emerging infectious diseases are three of many examples. The involvement and collaboration among various stakeholders (e.g., industry, government and academia) is necessary for effective prevention, response and management of these issues. To appropriately address these issues, knowledge from diverse sources needs to be identified, critically appraised, and synthesized in a format that is suitable for different end-users. Key messages and implications have to be transferred and exchanged in a timely manner among relevant stakeholders. Frequently, these messages have to be further evaluated within different contexts.

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2 This chapter is a an adapted version of Rajić et al. (2013)
The KTE field offers some promising and bridging principles, methods and practices for addressing considerable challenges that arise from the science-to-policy interface in the agri-food public health sector. Given the increasing need to show the impact and relevance of applied agri-food public health research and for government and industry organizations in this sector to justify their policy decisions and allocation of scarce resources, it is imperative for all agri-food public health stakeholders to ensure that the best available knowledge is well utilized to inform their practices and policies.

1.2. Knowledge transfer and exchange (KTE)

**KTE principles**

During a comprehensive review of the KTE literature, Rajić et al. (2013) identified five key principles for facilitating the conduct of KTE. They found that researchers reported and discussed these five KTE principles within two main contexts:

1. To improve the general utilization of agri-food public health research among various end-users, and
2. To inform public and government policy-making contexts.

An overview of the KTE process, key principles and characteristics are shown in Figure 1.1.

In summary, relevant and credible research must be synthesized and disseminated. Interactions among researchers, intermediaries and end-users must occur throughout each stage, and monitoring and evaluation of the impact of KTE must occur to measure knowledge application and use. Each of these processes requires organizational capacity and a supportive culture, as well as the implementation of effective and appropriate KTE methods and practices (Rajić et al., 2013). Throughout this chapter and handbook we elaborate on each of these key principles, while the last chapter focuses more specifically on monitoring and evaluation (Chapter 5).

**KTE methods and practices**

Many KTE methods and practices are used formally or informally across various sectors on a regular basis to support policy and practice decision-making. In their review of the literature, Rajić et al. (2013) identified 23 distinct KTE methods and practices and grouped them into three categories based on their primary function: synthesis (n=6 methods), dissemination (n=9) and exchange (n=8). A brief description of each of these methods along with their primary end-users (e.g. practitioners or policy-makers) and contextual agri-food public health examples are shown in Tables 1.1-1.3. This list highlights the major types of KTE methods that are used and recommended in the literature, but it is not meant to be exhaustive of all KTE methods and practices.
1.3. Relevant and credible research

In a recent focus group study, more than 30 agri-food public health policy-makers and policy and research analysts from federal and provincial government agencies and the private industry in Ontario, Canada, consistently agreed that knowledge to support policy-making should be both credible and reliable (Young et al., 2013). Formal knowledge synthesis (KS) methods (e.g. systematic review-meta-analysis [SR-MA]) are frequently identified as the most credible and reliable methods to inform policy- and decision-making because they have greater statistical power (if MA is used), a lower risk of bias of the results, and increased contextual applicability than individual studies and expert opinion (Mulrow, 1994; Sheldon, 2005; Rajić et al., 2013). An overview of the main KS methods, including a brief description of the methods, primary end-users and contextual agri-food public health examples are shown in Table 1.1.

Other sources of credible knowledge are also frequently used to support decision-making in the agri-food public health sector. For example, in the focus group study mentioned above, participants indicated they that rely on a wide variety of research sources, including primary research studies, industry and think-tank reports, government reports, surveillance and field data, and expert opinion (Young et al., 2013).
Table 1.1: A summary of key KS methods that could be used to increase the utilization of relevant and credible knowledge to support evidence-informed policy- and decision-making in agri-food public health

<table>
<thead>
<tr>
<th>Method</th>
<th>Brief description</th>
<th>Primary end-users</th>
<th>Agri-food public health example</th>
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</thead>
<tbody>
<tr>
<td>Knowledge mapping</td>
<td>• Process of creating maps of associations between items of information to understand and illustrate knowledge flows, sources, assets and gaps at the organization, community or policy level</td>
<td>Policy-makers, practitioners</td>
<td>Mapping the key actors in the retail food safety policy community in Ontario, Canada (Papadopoulos, 2011)</td>
</tr>
<tr>
<td>KS for public policies</td>
<td>• Method of synthesizing public policies that considers multiple effectiveness and contextual aspects, and integrates data from logic modelling, literature reviews and deliberative processes</td>
<td>Policy-makers</td>
<td>Analysis of public policies on nutrition labelling of foods in Canada and other industrialized countries (National Collaborating Centre for Healthy Public Policy, 2010)</td>
</tr>
<tr>
<td>Scoping reviews</td>
<td>• Review of a broad research question to map rapidly the key characteristics of a knowledge area and the main sources and types of information available</td>
<td>Researchers, policy-makers</td>
<td>Identifying and characterizing primary research about microbial hazards in leafy green vegetables (Ilic et al., 2012)</td>
</tr>
</tbody>
</table>
| SR-MA                               | • The SR process addresses a clearly defined question and uses replicable and explicit methods to identify, select, critically appraise, extract and analyze data from primary research  
  • MA is the statistical combination of data from multiple, similar primary research studies | Researchers, policy-makers, practitioners | Determining the efficacy of chilling interventions to reduce Salmonella contamination on broiler chicken carcasses during processing (Bucher et al., 2012a) |
| Rapid reviews                       | • Accelerated and streamlined SRs conducted within a short timeframe or with limited resources and that feed directly into decision-making | Policy-makers, practitioners               | Rapid review (four months) of public attitudes towards emerging food technologies for the UK Food Standards Agency (Lyndhurst, 2009) |
| Mixed-method and qualitative reviews| • Modified SRs that includes qualitative and quantitative evidence from a broad range of research and non-research sources  
  • Many variations exist, including realist, integrative and meta-ethnography reviews | Researchers, policy-makers, practitioners | A mixed-method review of key KTE principles and methods and their application to the agri-food public health sector (Rajić et al., 2013) |
1.4. Communication and collaboration

Ensuring credible knowledge is not sufficient to guarantee its uptake and utilization. Effective and targeted communication of evidence is necessary to improve the uptake of knowledge and to reduce its potential misinterpretation among policy-makers and those that support them (Rajić et al., 2013; Young et al., 2013). A summary of some dissemination methods including their brief description, primary end-users and contextual agri-food public health examples is shown in Table 1.2. Knowledge transfer and dissemination is covered in detail in Chapter 3 of this handbook.

Table 1.2: A summary of some knowledge transfer and dissemination methods that could be used to support evidence-informed policy-making in agri-food public health

<table>
<thead>
<tr>
<th>Method</th>
<th>Brief description</th>
<th>Primary end-users</th>
<th>Agri-food public health example</th>
</tr>
</thead>
</table>
| Scientific journal articles | • Publishing of research in peer-reviewed scientific journals  
• Captures the completeness of a scientific study                                                                 | Researchers        | N/a (example not provided for this method because it is a widely established practice) |
| Conference presentations | • Oral and poster presentations of research and key messages  
• Should convince audience to seek more information about the study                                              | Researchers        | N/a (example not provided for this method because it is a widely established practice) |
| Popular print media | • Use of press releases, newspaper articles and editorials, newsletters or brochures to reach a wide audience, generate public debate or to educate the public about research | General public     | Newspaper article interview to disseminate results of an AMR surveillance program (Shore, 2011) |
| Cartoons and images | • Can be used to illustrate the nuances and key messages of a research study  
• Useful to reach less literate audiences                                                                      | General public     | Educational cartoons and images about food safety for a cross-cultural scientific exchange in China (New Mexico State University, 2010) |
| Multimedia | • Use of video (e.g. online video abstract) or audio (e.g. Podcasts or radio spots) to present research in a more appealing format for faster, easier, clearer and better retention of information | General public     | YouTube video to highlight a report about strengthening animal health risk assessment in Canada (Council of Canadian Academies, 2011) |
### Table 1.2 Continued

<table>
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<th>Method</th>
<th>Brief description</th>
<th>Primary end-users</th>
<th>Agri-food public health example</th>
</tr>
</thead>
</table>
| **Websites and email**      | • Websites can profile research and knowledge and can act as a newsletter, repository and interactive forum  
• Email dissemination strategies (e.g. listservs) can actively disseminate knowledge to multiple end-users | Researchers, policy-makers, practitioners, general public | University of Guelph and Ontario Ministry of Agriculture and Food KTE website that highlights agri-food research through videos, plain language summaries and other information (University of Guelph, 2012) |
| **Social media**            | • Use of blogs and social networking sites (e.g. Facebook, Twitter, LinkedIn) for rapid and interactive dissemination of knowledge | Researchers, policy-makers, practitioners, general public | Worms and Germs Blog: an educational blog about zoonotic diseases (University of Guelph Centre for Public Health and Zoonoses, 2013) |
| **Evidence briefs for policy** | • Concise reports that describe a problem and discuss different policy options and implementation considerations  
• Should address high-priority issues and be context-specific | Policy-makers | Food and Agriculture Organization evidence brief about food security (Food and Agriculture Organization, 2006) |
| **Evidence summaries**      | • Presentation of knowledge in a graded-entry and user-friendly format  
• Recommended format includes one page of key messages and a three-page executive summary | Policy-makers, practitioners | One- and three-page evidence and contextual summaries about the effectiveness of interventions to control *Salmonella* in chickens on farm and at processing (Kerr et al., 2012) |

The creation and maintenance of relationships, networks and linkages between policy and research communities has been identified as a valuable avenue to foster evidence-informed policy- and decision-making in the agri-food public health sector (Young et al., 2013). Direct contact and interactions between researchers and end-users is one of the most important factors facilitating the use of knowledge in policy and practice decision-making (Innvær et al., 2002). Engagement of end-users before and during the conduct of a KS project or research study can help to ensure that the topic is relevant and applicable to them, and it can increase the likelihood that the results will be used to inform decision-making (Keown et al., 2008; Pentland et al., 2011). For example, in an interactive scoping review on the role of wildlife in the transmission of pathogenic bacteria and AMR in the food chain, industry experts and end-users are being engaged in an advisory group to actively guide the direction and scope of study and the
dissemination and exchange of its key findings (Greig et al., 2012a). A summary of various methods that can be used to support knowledge exchange between researchers, intermediaries, and end-users is shown in Table 1.3. Knowledge exchange and stakeholder engagement is covered in detail in Chapter 4 of this handbook.

Table 1.3: A summary of some knowledge exchange methods that could be used to support evidence-informed policy-making in agri-food public health

<table>
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<tr>
<th>Method</th>
<th>Brief description</th>
<th>Primary end-users</th>
<th>Agri-food public health example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural extension services</td>
<td>• Interactive and participatory process of knowledge-extension-producer linkage and exchange, education and problem-solving to enhance agricultural capacity and use of promising practices</td>
<td>Practitioners, producers</td>
<td>USA university extension services that provide information, resources and training about animal health and food safety for producers (The Pennsylvania State University, 2013)</td>
</tr>
</tbody>
</table>
| Consulting                    | • Process of transferring knowledge or expertise from the consultant (e.g. researcher) to the client (e.g. end-user) to provide help or solve problems  
                                     • Parameters are described in a contract and the client pays the consultant                                                                                                                                                                                                                                                                  | Policy-makers, practitioners                   | The Guelph Food Technology Centre consulting service transfers expertise and solves food safety problems for clients (Guelph Food Technology Centre, 2013) |
| Communities of practice       | • Groups of individuals with shared interests who interact on an ongoing basis to deepen their expertise in a topic or area  
                                     • Based on the assumption that knowledge acquisition is a social process                                                                                                                                                                                                                                           | Researchers, policy-makers, practitioners, general public | eXtension is a multi-institutional, multi-state and multi-disciplinary network of communities of practice about agricultural, health and other issues (eXtension, 2013) |
| Educational meetings and workshops | • Meetings and workshops of various formats to increase end-user knowledge awareness and use of promising practices  
                                     • Mixed interactive and didactic sessions with high participation are more effective                                                                                                                                                                                                                         | Researchers, policy-makers, Practitioners    | European Food Safety Authority (EFSA) workshop on the application of SR methods to food and feed safety assessments (EFSA, 2010) |
| Journal clubs                 | • Groups of individuals who meet regularly to discuss and critique journal articles to make sense of the potential applicability of knowledge for practice                                                                                                                                                                                                                   | Researchers, practitioners                    | Epidemiology journal club to review research and exchange ideas about emerging infectious diseases (M’ikanatha et al., 2009) |
**Table 1.3 Continued**

<table>
<thead>
<tr>
<th>Method</th>
<th>Brief description</th>
<th>Primary end-users</th>
<th>Agri-food public health example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge brokering</td>
<td>• An intermediary individual, agency or group that promotes and facilitates interaction between researchers and end-users and develops KTE capacity</td>
<td>Researchers, policy-makers, practitioners</td>
<td>The Scottish Agricultural College is an organization dedicated to agri-food knowledge exchange and brokering (Scottish Agricultural College, 2013)</td>
</tr>
<tr>
<td>Stakeholder dialogues</td>
<td>• Interactive forums where research is considered with the views, experiences and tacit knowledge of those involved in or affected by future decisions about high-priority issues</td>
<td>Researchers, policy-makers, practitioners, general public</td>
<td>Stakeholder dialogue between policy-makers and researchers to prioritize food safety issues and research in Canada (Read et al., 2008)</td>
</tr>
</tbody>
</table>
| Stakeholder engagement     | • Ongoing and planned interaction between researchers and end-users before, during or after a research project to increase relevance, clarity, awareness and dissemination of results  
• Engagement of stakeholders in decision-making to encourage a participative democracy, accountability and transparency | Researchers, policy-makers, practitioners, general public | Interactive scoping review about the role of wildlife in the transmission of pathogenic bacteria and AMR in the food chain (Greig et al., 2012a) |

### 1.5. Organizational support and culture

Another important component of effective KTE is to ensure a supportive organizational culture and sufficient capacity for researchers and end-users to engage in KTE activities (Mitton et al., 2007; Pentland et al., 2011). For example, the academic promotion and reward process needs to appropriately recognize researcher KTE efforts (Hanney et al., 2003), and end-users must have the appropriate skills and training to identify, critically evaluate and apply knowledge to inform policy and practice decision-making (Rundall et al., 2007).

In the focus group study described above, participants consistently agreed that there is a need for a “paradigm shift” in agri-food public health organizations to a culture that supports evidence-informed policy- and decision-making (Young et al., 2013). Frequent changes in organizational mandates and priorities, staff turnover, a lack of consistent documentation of the use of knowledge to inform policy decisions, fiscal limitations, and communication restrictions were identified as key barriers to evidence-informed policy-making in this study (Young et al., 2013). The importance of providing additional training for researchers and policy stakeholders to be able to engage in KTE and evidence-
informed policy-making activities was strongly recommended (Young et al., 2013). It was noted that policy-makers and analysts often don’t have a scientific or practical background in agri-food public health, and there is a need to improve their capacity to identify, interpret and understand complex knowledge in this sector (Young et al., 2013).

1.6. Monitoring and evaluation

Measuring the impact of KTE is as important as supporting the use of knowledge in decision-making (Lavis et al., 2003a). There are various methods and indicators that can be used to measure the impact of KTE in different contexts (Hanney et al., 2003; Hovland, 2007; Boaz et al., 2009), and these are covered in detail in Chapter 5.

1.7. Evidence-informed policy-making

Policy-making is a complex, value-laden and negotiated process (Mitton et al., 2007; Nutley et al., 2007; Greenhalgh and Russell, 2009). It involves the consideration of multiple, competing influences and forces, including knowledge, stakeholder views and experiences, institutional constraints, and socio-economic factors (Figure 1.2). Evidence-informed policy-making refers to the process of ensuring that the best available knowledge is used to support policy-making by enhancing its accountability and transparency.

Figure 1.2. An overview of the evidence-informed policy-making process.
Policy-makers make decisions based on multiple factors that attempt to influence the policy process (Figure 1.2). In some cases, these factors can outweigh research-derived knowledge, particularly when the issue is polarizing or controversial among different stakeholder groups (Head, 2010). For example, consider the agri-food issue of AMR and AMU in food animal production in North America, where action on proposed bans of the use of medically important antimicrobials on farms was delayed despite growing evidence of links between AMU on farms and AMR in bacteria isolated from retail meat products and humans (Webster, 2011).

Researcher and policy-maker interactions and a favourable policy window or environment can facilitate the influence of knowledge in policy-making (Figure 1.2). For example, a window for policy change often occurs following a high-profile disease outbreak when public pressure and political will is high. However, knowledge should continue to be provided to policy-makers even without an apparent policy window, because it can affect how they understand and view the issue and it ensures that knowledge is more accurately evaluated and interpreted (Lavis et al., 2005; Mitton et al., 2007).

### 1.8. KTE in agri-food public health: Implications

The majority of KTE literature comes from the health sector, which has primarily influenced the overall direction of KTE research over the last several years. However, the agri-food public health sector has a long history and tradition of KTE in the form of agricultural extension services, which aims to link knowledge users in the field (e.g. producers and practitioners) with researchers and academics (Klerkx and Leeuwis, 2009). The use of other KTE methods and practices is still relatively limited in this sector. For example, KS methods such as SR-MA have only recently been endorsed and adopted in agri-food public health contexts (Sargeant et al., 2006a; EFSA, 2010).

Limited findings of explicitly labelled or characterized KTE approaches in agri-food public health were noted in a review of the literature by Rajić et al. (2013). Frequently, different terminology is used to refer to KTE concepts across sectors and as a formal and recognized approach it is still evolving in the agri-food public health sector (Rajić et al., 2013). For example, risk assessment has a long history of application in agri-food public health and incorporates various KS and KTE aspects. Canadian researchers have recently begun to formally link the use of rigorous KS methods (e.g. scoping reviews and SR-MAs) with risk assessments and multi-criteria decision analysis to inform food safety decision-making (Bucher et al., 2012b; Wilhelm et al., 2012; Smadi and Sargeant, 2013; personal communication, Dr. Sarah Parker). In addition, EFSA has formally adopted SR-MA as a structured and transparent method to inform their food and feed safety assessments (EFSA, 2010).
The risk analysis paradigm that is officially endorsed globally in agri-food public health includes the key components of risk assessment, risk management and risk communication (Codex Alimentarius Commission, 1999). Many of the KTE principles, methods and practices discussed in this handbook could considerably contribute to or at least support a more robust and stronger uptake of this and other science-to-policy paradigms in agri-food public health internationally.

It is important to recognize that not all research can or should have a direct impact or influence on policy and practice and that it is unrealistic and unnecessary for all research to conform to each of these principles. For example, many KTE principles and methods would not be relevant to proof-of-concept research such as in vitro and laboratory pathogen transmission and challenge studies. However, with an increasing need for governments and funding agencies to ensure accountability of their research and to allocate resources in a way that enhances applied value, we believe that a greater awareness and adoption of these concepts is advantageous for all researchers and end-users in this sector.

It is also important to note that there is still a lack of evidence on the overall effectiveness and reliability of some of the KTE methods (e.g. rapid reviews and knowledge brokering) discussed in this handbook (Ward et al., 2009; Ganann et al., 2010). Their effectiveness and utility might vary depending on the specific context and situation of use, and there is a need to develop and evaluate these methods further in agri-food public health contexts.
1.9. Practical exercise – Developing strategic KTE improvements in agri-food public health

Scenario:

Your research unit is part of a federal government health department that has a long tradition in agri-food public health research and surveillance. The scope of the work is very broad, and includes everything that could be labelled as agri-food public health. The main asset of your organization is ‘scientists’. Over 50 scientists perform a wide range of fundamental, applied food safety research and surveillance to inform agri-food public health policy and practice. Many of the applied research scientists are productive and disseminate their knowledge via peer-reviewed journals and at research conferences. The surveillance teams are also productive and generate long, technical annual and other reports. There is an ongoing criticism towards the organization regarding the actual value and impact of their main product: ‘agri-food public health knowledge’.

A new director of the organization is under a lot of pressure to justify their existence to the top budget-holders and policy-makers within the broader health portfolio. Her main challenge is that agri-food public health is a relatively limited priority within the broader health portfolio, which has many competing priorities. To save the organization, she has appointed a group of research and policy analysts to assist her with the KTE component of her larger plan to justify the need and relevance for the agri-food public health research and surveillance group.

For this scenario, you (sitting around the table) are in this group. Many of you are ‘out of the box’ thinkers and there is a unique opportunity that you change things. Your task is to develop an innovative and concise concept note (1-3 pages) and propose an effective and sustainable plan for improving the uptake of knowledge generated within the organization primarily within the context of evidence-informed agri-food public health policy and practice. The focus can be at the community, country, or global level, and it is up to you to define it, if at all.

Your director provided a short guide (in practice this does not happen frequently) for developing the concept note and indicated there is some flexibility around it.

A short guide:

The main product of our organization is agri-food public health knowledge. It includes laboratory (30%), epidemiological/other (30%) and surveillance (40%) knowledge.

1. How can we improve the utilization of our knowledge?
2. How can we prove or demonstrate the impact of our knowledge?

3. How can we better contribute to evidence-informed policy-making in agri-food public health?

4. Should we allocate specific resources (manpower and funding) towards KTE? Should this be an *ad hoc* initiative or should KTE be considered as a routine business function? Why or why not?

The group should develop and report a concise concept note using plain language. It should be short and explicit as you already know that you will have only 5-10 minutes to communicate the note to your director. If it works, you might have some time for discussion and chat.

**Concept Note:**

1)

2)

3)

4)
1.10. Key references and suggested readings

Bennett, G., Jessani, N. (Eds.), 2011. The knowledge translation toolkit. SAGE Publications India Pvt Ltd, New Delhi, India.


2. Knowledge synthesis

Chapter summary:

- **Knowledge synthesis (KS)** is a critical initial step of the knowledge transfer and exchange process, and refers to the identification, appraisal and integration of findings from multiple individual studies and other sources into the global knowledge base about a topic.
- **Systematic review-meta-analysis (SR-MA), scoping reviews and structured rapid reviews** are three frequently used KS methods, each differing in their methodological rigour and contextual application.
- **PICOS** (population, intervention/exposure, comparison, outcome, and study design) is a useful approach for framing focused SR-MA questions.
- **SR-MA is used to generate knowledge inputs for risk and decision models** and improves their transparency and robustness.
- **Agri-food stakeholders** (government, academia, and industry) at the country and international levels should endorse a wider adoption of KS methods, including investing in KS capacity development for research and policy professionals.

2.1. Introduction

Knowledge synthesis (KS) refers to the identification, appraisal and integration of findings from multiple individual studies and other sources into the global knowledge base about a topic (Grimshaw, 2010). It is considered a critical initial step of the knowledge transfer and exchange (KTE) process. The formal use of KS, primarily the use of systematic reviews (SR) and meta-analysis (MA), has a long history in the health and social sciences, and has a relatively more recent and widespread application in agri-food public health sector (Sargeant et al., 2006a; Rajić et al., 2013). KS methods are widely adopted and implemented by several international organizations, including the Cochrane Collaboration for healthcare interventions (and more recently for public health interventions), the Campbell Collaboration for social interventions, and the Joanna Briggs Institute for reviews of interest to healthcare professionals (Higgins and Green, 2011; The Campbell Collaboration, 2013; The Joanna Briggs Institute, 2013). A key recent development by these and other KS organizations is in the provision of plain language and user-friendly summaries of KS results to help guide practitioners, consumers, researchers and policy-makers in their decision-making (Lavis, 2009; Higgins and Green, 2011; Rosenbaum et al., 2011).

2.2. KS in agri-food public health

The use of KS methods is still relatively limited in the agri-food public health sector. This is somewhat surprising given that SR-MA was effectively used by an expert panel in late...
1990’s to inform policy-making in Canada on the potential approval of recombinant bovine somatotropin (rbST) for use in dairy cattle production (Health Canada, 1998; Dohoo et al., 2003a; Dohoo et al., 2003b). Based on the SR-MA findings, the panel concluded that there were several animal health and welfare concerns associated with rbST and this contributed to the subsequent decision not to approve rbST in Canada (Health Canada, 1998; Dohoo et al., 2003a; Dohoo et al., 2003b).

An overview of the main KS methods that could be used to increase the utilization of relevant and credible knowledge in support of evidence-informed policy- and decision-making in agri-food public health, their brief descriptions, primary end-users and contextual agri-food public health examples are highlight in Chapter 1 (Table 1.1).

Global KS momentum has been observed in the agri-food public health sector since 2005, which might be associated with the establishment of a ‘KS and KTE’ team at the Laboratory of Foodborne Diseases (LFZ), Public Health Agency of Canada (PHAC), in Guelph, Canada. This team published the first international guide to the use of SR methods in this sector (Sargeant et al., 2005; Sargeant et al., 2006a), which initially included a close collaboration between LFZ and McMaster University, one of the leading global institutions in the evidence-based medicine movement and KS and KTE fields (Read et al., 2005).

Over the past decade, there has been a gradual increase in the use of SR-MA and other KS methods in this sector. These methods have been applied to investigate questions of intervention efficacy, risk factors for disease, prevalence or concentration of pathogen occurrence, and diagnostic test accuracy. For example, SR-MA was used to evaluate the efficacy of different interventions to reduce Salmonella contamination in broiler chickens from farm-to-secondary processing (Bucher et al., 2012a; Totton et al., 2012); swine, pork and pork products as potential sources of zoonotic hepatitis E virus infection in humans (Wilhelm et al., 2011); and the accuracy of bacterial culture and PCR to detect Salmonella in swine (Wilkins et al., 2010). Although KS methods such as SR-MAs have been endorsed and adopted by some regional agri-food public health authorities (European Food Safety Authority, 2010), their use in this sector has still not reached full potential in Canada and internationally. There is a need to increase the use of these methods to address the above and other types of policy-relevant questions (Mays et al., 2005; Lavis, 2009), such as “How and why interventions might work in practice?” and “What are stakeholders’ views and experiences with a problem and options to address it?”.

2.3. Systematic reviews (SR)

SRs are the most frequently used and applied KS method. SRs are used to answer a clearly defined and focused research question using structured and replicable methods to identify, select, critically appraise, extract and analyze data from relevant primary research studies (Sargeant et al., 2006a; Higgins and Green, 2011). An overview of the
key steps in the SR process is shown in Figure 2.1. The steps are briefly described below and are illustrated in Box 2.1 on the agri-food public health topic of competitive exclusion (CE) to control *Salmonella* in broiler chickens on farms.

**Figure 2.1: Overview of the SR process.**

**Box 2.1: A SR-MA of the effect of selected CE products on *Salmonella* prevalence and concentration in broiler chickens**

**Background and rationale:**
*Salmonella* is a major global food safety challenge for the agri-food industry and agri-food public health authorities. A considerable amount of research has been conducted investigating the effects of various interventions from farm-to-retail, including various CE products, with often different and contradictory recommendations by specialists. The KS and translation team of the LFZ, PHAC, in collaboration with researchers from University of Guelph, were tasked to investigate the effectiveness of CE using SR-MA methodology.
Multidisciplinary expertise and stakeholder engagement:
Individuals with expertise in poultry production and management, extension services, epidemiology, microbiology, KS, and KTE were part of an interactive advisory group that consulted the core team throughout the review implementation.

Review question:
What is the effectiveness of the on-farm use of various CE products on *Salmonella* prevalence and concentration in broiler chickens from farm-to-secondary processing?

PICOS:
Population (P) = commercial broiler chickens
Intervention (I) = undefined and defined commercial CE products
Comparison (C) = untreated broiler chickens / chickens treated with other interventions
Outcome (O) = *Salmonella* prevalence or concentration
Study design (S) = controlled trials, challenge trials and cohort studies

Search strategy:
Electronic searches in six online databases were conducted. Search verification included checking the reference lists of three relevant literature reviews and selected book chapters, and direct consultation with five external topic experts.

Exclusion criteria:
Literature reviews, studies dealing with serovars of no relevance to public health (Pullorum and Gallinarum), *in vitro* experiments, and studies measuring the outcome (*Salmonella*) in environmental/blood samples were excluded.

Risk-of-bias assessment:
This step included 28 *a priori* developed questions reflecting the study settings, populations, sampling and testing methods, outcome measurements and reporting of results. Two of these questions were used as additional exclusion criteria, including: failure to use an appropriate control group and failure to report data and measures of variability in a sufficient format.

Data analysis:
The SR included a descriptive analysis and summary of relevant studies and trials, which was evaluated to identify biologically sensible data subsets for MA. A random-effects MA was conducted for each CE type (data subset) where estimates were available from two or more trials measuring the same type of outcome, and meta-regression was used to evaluate sources of heterogeneity across study trial outcomes.

Summary of findings:
The SR identified 159 relevant studies that reported 2,883 unique trials that measured
Box 2.1 Continued

Salmonella outcome as either prevalence (n=2,492 trials) or concentration (n=603 trials). MA was conducted on 66 of these studies that met pre-specified reporting and inclusion criteria. Results indicated that a number of CE products reduce Salmonella colonization in broiler chickens, the most effective one being Preempt™ (formerly known as CF-3). Meta-regression indicated that five study characteristics (publication year, CE type, CE route, sample origin, and Salmonella serovar administered/recovered) and three risk-of-bias criteria (treatment assignment and intervention and laboratory methods descriptions) were significant sources of heterogeneity across trials. The authors indicated that the results of this study could be useful to inform decision-making about on-farm use of CE products in broiler chickens and as inputs for risk assessment models.

For more information:

Review team

The process should begin with the establishment of a multi-disciplinary review team that consists of collaborators with topic/issue, methodological and librarian expertise (Higgins and Green, 2011). The next and most important step is to formulate a clear and concise review question (Sargeant et al., 2006a). For SRs of interventions, the PICOS approach (specifying the target population, intervention, comparison, outcome, and study design) is effective for guiding question development and refinement. PICOS can be modified for reviews of other questions (e.g. by replacing “intervention” with “exposure” for risk factor questions).

Review protocol

A detailed review protocol is a standard and important component of SRs to ensure the process can be replicated. It is a key feature that distinguishes SRs from traditional narrative, expert-based reviews. The protocols should be initiated early in the development of the review and are used to guide, explain and document each step of the review (Sargeant et al., 2006a).

Search strategy

The search strategy should be based on the research question and developed in consultation with a skilled librarian. It should include pre-testing in selected electronic
databases and searching of multiple bibliographic databases (e.g. PubMed/MEDLINE, Scopus, CAB Abstracts). The electronic search should be coupled searches for grey literature (e.g. simple and targeted Google searches for reports and dissertations) and hand-searches of the reference lists of relevant articles (Higgins and Green, 2011; Horsley et al., 2011). In addition, relevant organizations or individuals working on the review topic and related areas should be contacted to review the list of relevant references and to confirm that none are missed or to indicate the potential availability of additional, unpublished data.

Eligibility criteria, risk-of-bias assessment and data extraction

Review eligibility criteria (e.g. study designs) should be clearly specified and justified in the protocol. Identified citations should be screened for relevance at the abstract level and confirmed at the full article level. Relevant articles should be assessed for risk of bias (methodological soundness of study design and reporting) and relevant data should be extracted (e.g. study methods, outcomes, and independent and confounding variables of interest) using a priori developed and pre-tested forms. These two steps are usually conducted concurrently by two independent reviewers to minimize errors.

SR summary and MA

All SRs should end with descriptive analysis and narrative summary of the included studies (Moher et al., 2009). Whenever possible (preferably with >10 studies), a MA should be attempted. MA is the statistical combination of results of multiple individual studies (Higgins and Green, 2011). **A SR should always precede MA.**

The subject of MA is beyond the scope of this introductory handbook. Those interested in this method are advised to consult book chapters and reviews covering this methodology in detail (Borenstein et al., 2009; Dohoo et al., 2010; Higgins and Green, 2011). In summary, the objective of a traditional MA is to combine the results of homogenous studies using the effect estimate and uncertainty from each study to produce a weighted mean or overall measure of effect (Borenstein et al., 2009; Higgins and Green, 2011). While exploring the possibility and suitability of conducting a MA is always strongly recommended, the team conducting a SR should determine whether the use of this statistical technique is possible and appropriate given the amount and nature of the data and the objectives of the review.

MA should be considered if there are groups of studies that are evaluating the same effect in similar settings and populations. Any potential sources of variation or heterogeneity in the outcome measures should be predicted and defined before conducting a MA, which justifies the biological basis for combining studies. Use of MA to calculate pooled effect estimates might not be suitable and could be misleading when the included studies have a high risk of bias, when there are serious publication or reporting biases, or when there is significant and unexplained heterogeneity (e.g., the
studies are too diverse to be meaningfully combined) (Higgins and Green, 2011). Forest plots are a typical graphical format to display MA results. Specifically, they are used to visually evaluate trends and heterogeneity in the direction of effect estimates from individual studies and the strength and significance of pooled effect estimates.

For illustration purposes, a forest plot based on the example in Box 2.1 is shown in Figure 2.2. The estimate of CE intervention efficacy (odds ratio) from each individual trial within each study is represented as a unique row or observation, with the horizontal line representing its 95% confidence interval. The size of the box surrounding each estimate of intervention efficacy represents the relative weight of that trial in producing the overall pooled effect estimate, which is indicated by the diamond at the bottom of the figure. The vertical line in the center of the figure represents the level of no efficacy (odds ratio=1), while estimates to the left of this line indicate a protective (beneficial) effect of the CE treatment and those to the right of this line indicate a negative effect.

### 2.4. Scoping reviews

Scoping reviews are a KS method that is used to map out the distribution and characteristics of a broad knowledge area and to identify key knowledge gaps and needs for future research (Arksey and O’Malley, 2005). They typically include all types of research study designs (experimental, observational and qualitative) and may also include other types of knowledge such as reviews, commentaries and reports. They are frequently conducted as a preliminary step to SR-MA to help guide the prioritization of focused questions for further analysis. In contrast to a SR, scoping reviews usually focus on broader and more complex research questions that are often policy-driven and they typically do not include a risk-of-bias assessment step (Arksey and O’Malley, 2005; Anderson et al., 2008). The scoping review process, as defined by Arksey and O’Malley (2005), is shown in Figure 2.3.

Pham et al. (2013) reviewed >340 scoping reviews published from 1999-2012 to identify and describe their purpose, methodological process and rigour, and quality of reporting (Figure 2.4). Over 70% were conducted in the health sector (Pham et al., 2013). Study implementation varied from two weeks to 20 months, and >50% utilized a published methodological scoping review framework. Risk-of-bias assessment of included studies was infrequently performed (<25%). Engagement of stakeholders in the process was reported in nearly 40% of the scoping reviews. The authors reported considerable momentum in the use of scoping review methods for mapping broad public health (including agri-food) topics (Figure 2.4).
Figure 2.2: Random-effects MA of challenge trials reporting the odds of *Salmonella* colonization in broilers receiving Preempt™ (CF-3), from Kerr et al. (2013). Trials are stratified by age of birds at final sampling.

<table>
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<td>Corrier, D.E.</td>
<td>1998</td>
<td>0.08 (0.02, 0.37)</td>
<td>5.67</td>
</tr>
<tr>
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<td>1996</td>
<td>0.12 (0.01, 2.45)</td>
<td>1.61</td>
</tr>
<tr>
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<td>0.06 (0.00, 1.24)</td>
<td>1.67</td>
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<tr>
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<tr>
<td>Hume, M.E.</td>
<td>1996</td>
<td>0.24 (0.05, 1.13)</td>
<td>5.76</td>
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</table>

Subtotal (I-squared = 11.7%, p = 0.279)  
4.5e-05 1 24373

> 42 days
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<thead>
<tr>
<th>First Author</th>
<th>Publication Date</th>
<th>OR (95% CI)</th>
<th>% Weight</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.04 (0.00, 0.73)</td>
<td>1.84</td>
</tr>
<tr>
<td>Corrier, D.E.</td>
<td>1998</td>
<td>0.07 (0.00, 1.29)</td>
<td>1.79</td>
</tr>
</tbody>
</table>

Subtotal (I-squared = 0.0%, p = 0.798)  
0.06 (0.01, 0.42) 3.63

Overall (I-squared = 6.4%, p = 0.362)  
0.04 (0.03, 0.06) 100.00

NOTE: Weights are from random effects analysis.

Agri-food public health example

An example of the use of scoping review methods to investigate the prevalence of zoonotic bacteria in wild and farmed aquatic species and seafood requiring is shown in Box 2.2.
Box 2.2: A scoping review of the prevalence of zoonotic bacteria in wild and farmed aquatic species and seafood

**Background and rationale:**
A scoping review was conducted to inform the Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) of the LFZ, PHAC, about the available knowledge pertaining to antimicrobial resistance (AMR), antimicrobial use (AMU), and
Box 2.2 Continued

drug residues and dyes in aquatic species and seafood from farm-to-fork. The scoping review was used to map out the distribution and characteristics of this broad research field, to identify key knowledge gaps and needs for future research, to inform policy and program development, and to function as a preliminary step to guide prioritization of focused questions feasible for SR-MAs.

**Multidisciplinary expertise and stakeholder engagement:**
A steering committee, which included members of CIPARS and academic experts from Canada, the United States of America and Europe, was consulted throughout the review to ensure that the needs of the key stakeholders (CIPARS) were met.

**Review scope:**
The review included any research investigating the prevalence, risk factors or interventions for eight selected zoonotic bacteria (Vibrio spp., Aeromonas spp., Salmonella spp., generic E. coli, Campylobacter spp., Edwardsiella spp., Erysipelothrix rhusiopathiae, and Streptococcus iniae), AMR, AMU, antimicrobial drug residues and dyes in various aquatic species, aquaculture production, seafood products, seafood imports and exports, and seafood-related consumption or disease in humans.

**Search strategy:**
Six electronic databases were searched using comprehensive search algorithms. Search verification included hand-searching reference lists from five relevant literature reviews.

**Relevance screening and exclusion criteria:**
Two screening levels were conducted: the first to rapidly exclude irrelevant research, and a second to confirm the relevance of full articles and characterize them by key variables (e.g. type of bacteria investigated, location of sampling, antimicrobial drug/dye investigated). Further exclusion restrictions were applied at this stage (e.g. articles that investigated only diseased fish/shellfish or did not reflect field conditions).

**Data charting:**
Key article characteristics were tabulated and evaluated through interactive discussions with the steering committee to identify knowledge gaps, research needs, and to prioritize focused questions potentially suitable for SR-MA. The framing of a focused question for rigorous SR-MA was guided by the review findings and data charts, current global food safety and zoonotic public health trends, and stakeholder needs.

**Summary of results:**
The scoping review results indicated that the majority of published research was in the area of farm-level prevalence and intervention research for Vibrio spp. and Aeromonas spp. AMU and the association between AMU and AMR were rarely investigated. The authors also reported a lack of published research both for domestic and imported
products to Canada and recommended more primary research within the Canadian context. Results were used to prioritize SR-MAs on pathogen-seafood product combinations where sufficient knowledge was identified and that were relevant within the Canadian context; these addressed the prevalence or concentration of *Vibrio* spp., *Aeromonas* spp., *E. coli*, and *Salmonella* spp. in ready-to-eat and retail salmon, tilapia, shrimp, clams, mussels, and oysters.

**For more information:**

**Figure 2.5** (Figure 1 from Tuševljak et al., 2012) illustrates the key scoping review steps as described in the example in Box 2.2. It also indicates when and how this process is followed with the aim of framing and prioritizing potential focused questions for SR-MA.

**Figure 2.6** (Figure 2 from Tuševljak et al., 2012) illustrates one of many data charts that were generated and evaluated in the scoping review as highlighted in the example in Box 2.2. The charts were used to summarize the breadth, distribution and depth of publicly available knowledge on this agri-food public health topic.

### 2.5. Rapid structured reviews

Policy- and decision-makers often require knowledge to be presented in a short timeframe, which conflicts with the long periods (months or even years) it takes to conduct rigorous scoping reviews or SR-MAs under research-setting conditions (Lavis et al., 2005; Ganann et al., 2010; Tuševljak et al., 2012). Structured rapid reviews are a relatively new method of KS that are streamlined and accelerated to provide more timely evidence to inform decision-making for policy and practice (Ganann et al., 2010). There is no consistent approach to conducting rapid reviews, although various methods have been proposed to shorten the SR timeframe, including search strategy limitations (e.g. publication years, language and number of databases) and use of only one reviewer for relevance screening, risk-of-bias assessment or data extraction (Ganann et al., 2010). Such restrictions could impact the risk of bias and credibility of the review findings (Ganann et al., 2010). Therefore, rapid reviews should include detailed descriptions of their modified methods and explicitly highlight their potential limitations. An example of a structured rapid review investigating an agri-food public health topic is highlighted in Box 2.3.
Figure 2.5: Scoping review process flow-chart from Tuševljak et al., 2012.
Box 2.3: A structured rapid review of the prevalence and concentration of various microbial hazards in low-moisture foods and potential mitigation strategies

**Background and rationale:**
An international authority has contracted a consultant to conduct a combination of scoping reviews and structured rapid reviews of the current state of knowledge about microbial hazards in low-moisture foods and potential mitigation strategies from farm-to-processing. This information will be used to guide the next step of their project: risk ranking of various hazard-food combinations. The review timeline is <4 months.

**Multidisciplinary expertise and stakeholder engagement:**
The team includes three individuals, two professionals from the international authority.
Box 2.3 Continued

(the primary stakeholder) and the consultant, with expertise in microbiology, food production, epidemiology, risk ranking and prioritization, KS, and KTE.

Review questions:
The review started with a broad question that was refined into three more specific questions: 1) What is the frequency of contamination and/or concentration of various foodborne pathogens in low-moisture foods? 2) What is the burden of illness in humans associated with various foodborne pathogens that contaminate low-moisture foods? 3) What are the existing interventions (beginning at primary production) to mitigate these pathogens in ready-to-eat low-moisture foods?

Rapid preliminary assessment:
A rapid search of PubMed and preliminary screening of 10 relevant primary research articles, seven literature reviews and two recently published technical reports addressing this topic was conducted by the consultant to rapidly evaluate the overall breadth and depth of relevant literature. Based on this evaluation, the project team restricted the review to the 12 most frequently investigated and reported categories of low-moisture foods: dehydrated fruits and vegetables, dried fruits, peanut butter and peanut-based products, cereals, dry protein products, confections, snacks, tree nuts, seeds for consumption, spices and dried aromatic plants, lipid-based supplementary foods, and desiccated coconuts.

Search strategy:
Search strings were developed and pre-tested through a documented trial-and-error process to ensure that an efficient and pragmatic number of potentially relevant citations were identified. Final search strings were implemented in two broad bibliographic databases (PubMed and Scopus) and in Google (restricted to 200 hits). The reference lists of relevant articles identified in the preliminary assessment were checked to identify any additional potentially relevant citations.

Relevance screening and risk-of-bias assessment:
Citations were excluded during relevance screening if none of the three specific questions (indicated under ‘Review questions’ above) were investigated. The full articles of relevant citations were evaluated to characterize their overall distribution (e.g. by region, time period, spice-food combinations) for each of the three review questions. Basic risk-of-bias assessment criteria included: failure to use appropriate control group (experiments), failure to report sufficient intervention/laboratory protocols to allow study replication, and failure to sufficiently report results. Studies that did not meet these criteria were excluded at this stage.

Data charting and prioritization:
The breadth and depth of studies across the three questions was evaluated to
determine the next steps under short timelines. The review team prioritized prevalence studies for SR and potential MA. Data extraction of results was conducted on prioritized articles and results about the burden of illness (Question 2) and intervention efficacy (Question 3) were summarized in a narrative format due to timeline restrictions. All forms used for different steps of the review were developed a priori and pre-tested by the project team. The screening and assessment steps were conducted by one reviewer.

**Preliminary results:**
At the time of writing this case study, the review was in the final stages of implementation. A total of 4,245 citations were identified in the search, of which 513 were found to be potentially relevant. Nine controlled trials were excluded due to risk-of-bias criteria and seven articles were not retrievable. Of the 497 relevant articles, 125 investigated the burden of illness, 270 investigated prevalence and risk factors, and 102 investigated interventions.

The three most common pathogen-food combinations identified were *Salmonella* spp. and spices and dried aromatic plants (n=15 articles), *Listeria monocytogenes* and dried protein products (n=14), and *Bacillus cereus* and spices and dried aromatic plants (n=13). For intervention studies, the most common pathogen-food combination investigated was *Salmonella* spp. in almonds (n=11 articles), and studies assessed the efficacy of a variety of treatments such as pasteurization, sanitization, roasting, and irradiation. The most commonly investigated interventions against *Salmonella* spp. in almonds were steam pasteurization (n=2), fumigation (n=2), and hot water treatment (n=2), all of which were found to be effective in laboratory-scale settings.

**Preliminary lessons learned:**
The process to-date took approximately six months with one consultant, recently trained in KS, conducting most steps on a part-time basis. The two other team members primarily guided the consultant in the review activities. In future rapid reviews, having one additional reviewer would be recommended. A simple spreadsheet was used for all steps of the review. However, the use of specialized software (e.g. DistillerSR) would have helped to save time and facilitate this process. Overall, the rapid review format was found to be useful for streamlining scoping and SRs; however, it might be more beneficial to address very focused questions. For questions with a broader scope, a full scoping review and longer time period (e.g. >6 months) would be more ideal. This experience suggests that even under challenging conditions (e.g. only one reviewer) and short timelines, application of transparent and robust KS is possible for answering targeted, policy-relevant questions.

**Source:**
Dysart, L., Cahill, S., Rajić, A. Personal communication. (NOTE: This example reflects unpublished information from an in-progress rapid review).
2.6. Stakeholder engagement in KS

It is increasingly recommended to include relevant stakeholders and research end-users (e.g. policy-makers and practitioners) throughout the process of KS and KTE to increase the relevance, practicality and utilization of the results (Lavis et al., 2005; Keown et al., 2008). Stakeholders can be engaged through a variety of processes, including via input meetings and consultations (e.g. to provide input on the review topic, scope or results dissemination), interactive steering committees, or as a full team member throughout each step of the review (Keown et al., 2008). Benefits of this approach include a research scope and question that is of increased relevance to end-users, improved clarity and applicability of the methods and results, and increased appreciation for the results. There are also some challenges to consider with this approach, such as additional time and resources, required flexibility in the review framework, and the potential for introduction of bias into the process (Keown et al., 2008).

2.7. KS logistics and timeframes

Agri-food public health researchers have reported that takes between 12-18 months to complete a scoping review of large, broad fields and complex topics in this sector (Farrar, 2009; Ilic et al., 2012). It is important to note that frequently scoping reviews and SR-MA in this sector are completed by graduate students as part of their dissertation requirements under direct or indirect guidance of their research advisors. Realistically, the timeframe for completion of a scoping review or SR-MA is likely much more variable depending on the complexity and nature of the review question and topic, experience of the review team, and availability of reviewers and senior, experienced advisors to guide the process. Based on our experience conducting KS, we believe that a small team of five well-trained and experienced individuals specialized in KS and KTE methods should be able to complete, on an annual basis, several KS projects of various timeframes and urgencies to help guide decision-making.

The main differences between the three KS methods discussed in this chapter, as well as traditional narrative reviews, are shown in Table 2.1. While it makes practical and logistical sense to develop and utilize structured rapid reviews to inform policy- and decision-makers under short and urgent timeframes, more robust and credible KS methods (e.g. SR-MA) are recommended whenever possible.

2.8. KS to support evidence-informed policy-making and risk analysis

As indicated in Chapter 1, policy-makers, research and policy analysts, practitioners, and other decision-makers in the agri-food public health sector frequently need to deal with important, complex and cross-cutting issues. These end-users should be informed with the best available knowledge in order to demonstrate the transparency and accountability of their actions and decisions. In practice, decision-makers are often
provided with evidence summaries or risk profiles based on an informal synthesis of the evidence conducted by experts or research and policy analysts that work with them.

Table 2.1: Comparison of the key characteristics of traditional narrative reviews, scoping reviews, SRs and structured rapid reviews

<table>
<thead>
<tr>
<th>Review method characteristics</th>
<th>Narrative review</th>
<th>Scoping review</th>
<th>Rapid review</th>
<th>SR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multidisciplinary team</td>
<td>No/rarely</td>
<td>Recommended</td>
<td>Recommended</td>
<td>Recommended</td>
</tr>
<tr>
<td>Stakeholder engagement</td>
<td>No/rarely</td>
<td>Recommended</td>
<td>Recommended</td>
<td>Recommended</td>
</tr>
<tr>
<td>Preliminary assessment of the breadth/depth of available literature</td>
<td>Expert(s)</td>
<td>Recommended</td>
<td>Yes/critical</td>
<td>Recommended</td>
</tr>
<tr>
<td>Pre-specified protocol</td>
<td>No/not reported</td>
<td>Yes/not always</td>
<td>Yes/less a priori</td>
<td>Yes/a priori</td>
</tr>
<tr>
<td>Question formulation</td>
<td>Rarely</td>
<td>Yes/broad</td>
<td>Yes</td>
<td>Yes/focused</td>
</tr>
<tr>
<td>Inclusion/exclusion criteria</td>
<td>No/rarely specified</td>
<td>Not always</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Relevance screening</td>
<td>Experts/not reported</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Multiple relevance screening steps</td>
<td>No</td>
<td>Frequently</td>
<td>Rarely</td>
<td>Rarely</td>
</tr>
<tr>
<td>Structured risk-of-bias assessment</td>
<td>No/rarely specified</td>
<td>No/limited</td>
<td>No/limited</td>
<td>Yes</td>
</tr>
<tr>
<td>Formal data extraction</td>
<td>No/rarely specified</td>
<td>Yes/partial extraction</td>
<td>Yes/variable extraction</td>
<td>Yes/full extraction</td>
</tr>
<tr>
<td>Data analysis</td>
<td>Descriptive</td>
<td>Descriptive (charting)/ qualitative</td>
<td>Descriptive</td>
<td>Descriptive/MA/meta-regression</td>
</tr>
<tr>
<td>Number of reviewers</td>
<td>Variable (often only one)</td>
<td>Variable</td>
<td>Variable (often only one)</td>
<td>≥2 for each abstract/article</td>
</tr>
<tr>
<td>Timelines</td>
<td>Not applicable</td>
<td>6-12 months</td>
<td>1-≤3 months</td>
<td>3-18 months (depending on team expertise)</td>
</tr>
</tbody>
</table>

KS methods, SR-MAs in particular, should form the foundation for successful KTE and evidence-informed policy-making because they increase decision-maker confidence in the credibility of knowledge (Grimshaw, 2010). Well-executed SR-MAs provide a more accurate overall assessment of the evidence than individual studies and are more transparent, credible and reliable than traditional expert-driven reviews and expert
opinion (Lavis et al., 2005; Sargeant et al., 2006b; Waddell et al., 2009). In this chapter we have highlight three key KS methods (SR-MAs, scoping reviews and structured rapid reviews) that could be selected to address the majority of agri-food research and policy questions, depending on the time constraints and/or rigour needed (Table 2.1). The utility of KS methods assumes that there is at least some publicly available information about the topic of interest, but even for data scarce topics these methods can still be useful to identify knowledge gaps and priority areas to guide future research.

In practice, policy-makers, practitioners and other decision-makers are also frequently provided with a short summary or list of potential options to help guide their actions and decisions. This is frequently done using different forms of risk analysis, such as qualitative or quantitative risk assessments and decision analysis (e.g. multi-criteria decision analysis) (Codex Alimentarius Commission, 1999; Fazil et al., 2008). The quality of these risk analysis outputs and summaries can be affected by the amount of available data and their quality. For this reason, the use of formal KS methods is recommended to support risk analysis to ensure more transparent and robust evidence-informed policy and decision-making in the agri-food public health sector.

This aspect is illustrated by Bucher et al. (2012b), who conducted a scoping review to select priority farm and processing interventions to inform a quantitative exposure assessment to evaluate their effect on controlling *Salmonella* in broiler chickens. These and other authors have also used SR-MA estimates as inputs to inform: the same quantitative exposure assessment described above (Bucher et al., 2012b); a quantitative risk assessment of human salmonellosis due to consumption of Canadian broiler chicken meat (Smadi and Sargeant, 2013); and a decision-making model to prioritize selected on-farm interventions to control *Salmonella* in swine using different criteria (Wilhelm et al., 2012; personal communication, Dr. Sarah Parker). A comprehensive discussion of the use of KS methods to inform risk- and decision-analysis (including risk profiles and risk assessments) is beyond of the scope of this introductory handbook and is mentioned only for illustrative reasons.

KS has gained global momentum in the agri-food public health sector, but there is still a need for agri-food public health organizations and authorities in Canada and internationally to enhance and build capacity in this area. For example, there is a need to train policy and research officers, analysts and other professionals working with policy- and decision-makers in introductory and advanced KS and KTE competencies. Such efforts might be needed across sectors at the interface of human, animal/wildlife, plant, agri-food chain and eco-health (e.g. within the “One Health” context). This could be accomplished through targeted government-industry-academic partnerships at multiple levels (local, provincial, national, and international), and would complement equivalent initiatives that have been in place for several years in other sectors (e.g. healthcare, public health and social science).
2.9. KS: Some challenges and practical tips

Where should I start?
Before starting your first KS project, always consult with experienced KS and KTE scientists. They should help you to select the right method and to establish a pragmatic approach in terms of rigour. They could also assist you in designing your preliminary protocol and analysis, and could provide advice on where to acquire training and whether you could acquire support from specialized professionals (e.g. a librarian, SR-MA trained epidemiologists, and statisticians).

When should I start developing a protocol?
As soon as your preliminary assessment of the literature is completed and you determine that there is a need for a new KS (e.g. there are no previous KS projects on the topic or previous reviews are outdated or address a different question or focus). It should be noted that KS projects have important value even when no evidence exists on a topic to help inform decision-makers and guide future research. You can start implementing your review before the protocol is fully completed – e.g., using preliminary versions of risk-of-bias and data extraction forms. We recommend that you consider asking experienced KS scientists to review your protocol before its actual implementation.

Do I have the right question?
This is one of the most critical aspects of any KS project. You might benefit from using the PICOS approach and by consulting with experienced KS scientists. In addition, you should ensure that the end-users of your review are in agreement with the question(s).

How much literature is enough to search?
There is always a possibility that a relevant study might be missed. To reduce it, we recommend a comprehensive search and search verification strategy to identify publicly available literature. Electronic searches in multiple bibliographic databases and targeted grey literature web searches (e.g. in Google) are recommended followed by a comprehensive search verification strategy (e.g. hand-searching reference lists of relevant articles and contacting key experts in the area). There may be a significant amount of data in agri-food industries that is unpublished and of proprietary nature. We recommend approaching these organizations to explore the possibly of obtaining these data. All efforts to reduce language bias should be taken, and authors should attempt to secure a sufficient number of reviewers proficient in various languages to avoid or at least minimize this bias.

How should I pre-test forms? Who should review the literature using the forms?
Generally, forms are pre-tested using 20-30 (truly relevant and irrelevant) abstracts and 5-10 relevant articles for relevance screening and risk-of-bias assessment/data extraction, respectively, until a kappa agreement >0.8 is achieved across multiple pairs of the reviewers. Relevance screening can be conducted by anybody who has been
trained in KS and has some very basic understanding of the research topic. Risk-of-bias assessment should be conducted by trained epidemiologists (or those trained in study design and research methods) and data extraction should be conducted under their guidance.

**Are there guidelines to facilitate the reporting of KS methods?**
The existing PRISMA (Preferred Reporting Items for SRs and MA) guidelines provide sufficient details for how to report SR-MAs and should be followed when conducting, reporting and commissioning SR-MAs in the agri-food public health sector (Moher et al., 2009). Table 2.1 of this chapter provides some details for modifying these guidelines if KS methods other than SR-MA are conducted or commissioned.

**How can I facilitate the management of the KS process?**
Electronic review management can be conducted in a simple spreadsheet or reference management program, but a specialized web-based platform such as DistillerSR (Evidence Partners, Ottawa, Canada) or other comparable software is preferable for those that plan to do more than one review. Such platforms allow better quality control, review management (e.g. automated citation processing), and allow descriptive statistics.

**How can I communicate the results of a KS?**
KS authors should have a KTE plan to facilitate the uptake and utilization of their results by targeted end-users. The plan should include multiple and audience-specific formats for dissemination of the results. One example is short (e.g. 1-3 page), plain language, and user-friendly evidence summaries which highlight the ‘take home’ messages and key results and implications from a KS for decision-makers and other end-users (see additional details in Section 3.3). Readers should refer to Chapters 3-5 of this handbook for detailed information and insights on how to use various methods to facilitate the dissemination, exchange, application and evaluation of KS evidence to inform policy and practice decision-making.
2.10. Practical exercise – Using KS to address agri-food public health policy and practice questions

Scenario:

Salmonellosis is an important foodborne disease globally and foods of animal origin are a major source of human infection. Geographically, approaches to reduce the incidence of foodborne salmonellosis differ. In the European Union, interventions are in place to reduce salmonellosis from farm to processing, in the United States of America interventions are primarily applied at the processing level, as the efficacy of interventions to reduce the farm-level prevalence of Salmonella continues to be debated (Rajic et al., 2007). The Canadian Pork Council has approached a recently established KS and KTE team at an agri-food public health department and asked them to evaluate the evidence on the efficacy of various on-farm interventions for reducing Salmonella shedding or sero-positivity in pigs. The results of this KS project might be used in the next steps of the larger initiative to compare different interventions using multiple criteria and potentially to recommend some options for adoption as part of on-farm food safety programs for this commodity. You were given six months to complete this work and to deliver a technical report.

Questions:

1) How will you start the project?

2) How will you develop a list of potential interventions?

3) Which KS method(s) will your team select to understand the overall breadth and depth of information underpinning those interventions?

4) How will you form a multidisciplinary team and engage stakeholders?

5) Briefly describe key search terms and their potential groupings, electronic databases and a search verification strategy.

6) Briefly list key inclusion/exclusion criteria (for relevance screening and risk-of-bias assessment)

7) Your initial results identify 11 potential interventions and in consultations with the Pork Council you pose the following review scope restrictions and assumptions:

*Swine in the grow-finish phase, roughly 60 days or older. Specific settings include commercial farms and research farms. Specific intervention categories include organic acids in feed or water, use of antimicrobials, feeding management strategies,*
biosecurity, and vaccination. You will focus on studies that report bacteriological culture or serology to identify exposure to Salmonella spp. of public health importance, with no restriction on physical sample type (e.g. blood, feces, lymph node) or sampling point (e.g. farm, abattoir). Assumptions were made on a variety of culture techniques and serological tests across studies, and for purposes of this review all results were assumed to be equally accurate as reported.

Develop a focused question for at least one of the above listed interventions using a PICOS approach (Population, Intervention, Comparison, Outcome, Study Design).

P=

I=

C=

O=

S= 
Optional/advanced questions

The table below, adapted from (Wilhelm et al., 2012), shows some key characteristics of intervention studies investigating the effectiveness of organic acids, feed texture, and vaccination to control *Salmonella* in swine.

<table>
<thead>
<tr>
<th>Study parameter</th>
<th>Study parameter options</th>
<th>No. of studies for each intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Organic acids (n= 14)</td>
</tr>
<tr>
<td>General study type</td>
<td>Observational</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Experimental</td>
<td>14</td>
</tr>
<tr>
<td>Setting</td>
<td>Commercial farm</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Research farm</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Pilot Plant</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Abattoir</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Laboratory</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>0</td>
</tr>
<tr>
<td>Outcome measured</td>
<td>Culture</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Serology</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>0</td>
</tr>
<tr>
<td>Age-group sampled</td>
<td>Grow-finish</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Carcass</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Suckling</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Nursery</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Sows</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Not reported</td>
<td>1</td>
</tr>
</tbody>
</table>

8) Based on the above table, should you consider doing MA? If you choose so, what are the reasons (based on this table summary) that might worry you about the robustness of your analysis? If you could ‘magically’ create a preferable dataset, what would be different?

9) Your team is part of a government agri-food authority that has been funding primary research for many years. What would you advise them?
2.11. Key references and suggested readings


3. Knowledge transfer and dissemination

Chapter summary:

- **Knowledge transfer and dissemination** is facilitated by following five key questions: What should be transferred? To whom? By whom? How? With what effect?
- **Social media** can be used to facilitate more timely and rapid knowledge dissemination and to engage with and build networks with diverse stakeholders.
- **User-friendly evidence summaries** are concise plain-language formats that describe the key messages and considerations of knowledge for end-users.
- **Evidence briefs for policy** are short reports about high-priority and policy-relevant issues that describe the problem, alternative policy options, and policy implementation considerations.

3.1. Introduction

Knowledge transfer and dissemination is the process of moving knowledge into agri-food public health policy and practice. It should be a planned and structured process that involves consideration of the target issue, end-users and context of knowledge use (Ward et al., 2010; Wilson et al., 2010). The process should be facilitated through interactions and communication among researchers, policy-makers and other stakeholders, which is described further in Chapter 4.

A recent systematic review in the health sector identified 33 different frameworks and guidelines that can be used to support the process of knowledge dissemination (Wilson et al., 2010). To illustrate the key principles of this process, we highlight the framework proposed by Lavis et al. (2003a), who describe five key questions to consider:

1) What should be transferred? *(The message)*
2) To whom? *(The target end-users)*
3) By whom? *(The messenger)*
4) How? *(The strategies and methods)*
5) With what effect? *(Evaluation)*

**What should be transferred? (The message)**

When providing knowledge to inform policy- and decision-making, it is important to remember that agri-food public health decision-makers (Food and Agriculture Organization [FAO], 2011):

- *Have limited time* to read research reports or summaries
• Have many demands and conflicting sources of information to consider
• Are usually not specialists in the issue or topic area

Knowledge should be transferred to policy-makers, practitioners and other end-users in a language and format that they will understand and find appealing. Only information that is necessary and relevant to them should be provided. Therefore, dissemination formats should highlight the key implications of the knowledge and the “take-home” messages (Lavis et al., 2003a; Draper et al., 2009). Table 3.1 describes some tips for creating clear, concise and effective plain language messages (Bennett and Jessani, 2011; FAO, 2011). Additional tips include:

• Put the most important information at the beginning of the document
• Tell the audience how the knowledge will benefit them
• Focus on only one idea at a time
• Ensure that the document is visually appealing (e.g. ensure sufficient white space and break up the text into columns and short bullet lists)
• Use effective storytelling (e.g. interesting narratives, stories and imagery)

The AIDA acronym is also helpful to consider when creating plain-language messages:

A – attract attention among the audience
I – raise interest in the message
D – create a desire to act on the message
A – prompt action

Table 3.1. Tips for clear, concise and effective plain-language writing.

<table>
<thead>
<tr>
<th>Tip</th>
<th>Example</th>
<th>Better alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid colloquialisms</td>
<td>For the purpose of...</td>
<td>To...</td>
</tr>
<tr>
<td></td>
<td>Obtain estimates of...</td>
<td>Estimate...</td>
</tr>
<tr>
<td>Use verbs instead of nouns and</td>
<td>Quality assessment of articles was conducted.</td>
<td>The reviewers assessed articles for quality.</td>
</tr>
<tr>
<td>avoid nominalizations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use the active voice</td>
<td>The sample was obtained by the technician.</td>
<td>The technician obtained the sample.</td>
</tr>
<tr>
<td>Use short and simple sentences</td>
<td>The publication of the evidence summary for use by policy-makers will enable better decision-making.</td>
<td>Policy-makers will use the evidence summary to make better decisions.</td>
</tr>
<tr>
<td>(Keep the subject, verb and its</td>
<td></td>
<td></td>
</tr>
<tr>
<td>object close together)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avoid technical jargon and</td>
<td>Two different model parameterizations were</td>
<td>The authors tested two forms of the model.</td>
</tr>
<tr>
<td>scientific language</td>
<td>tested.</td>
<td></td>
</tr>
<tr>
<td>Avoid excessive use of acronyms</td>
<td>GPP’s are an important component of OFFS</td>
<td>Good production practices are an important component of on-farm food safety programs for producers</td>
</tr>
<tr>
<td></td>
<td>programs for producers</td>
<td></td>
</tr>
</tbody>
</table>
To whom? (The audience)

The primary audience must be clearly identified and the dissemination strategy should be formatted and tailored according to their needs and the decision-making context (Lavis et al., 2003a; Bennett and Jessani, 2011). Therefore, multiple messages should be developed to address each unique target audience. Policy-makers are the primary end-user for knowledge to inform policy-making, but they do not make decisions in isolation. It is also important to target individuals and organizations that inform and provide advice to policy-makers or that can directly or indirectly influence their decisions (Lavis et al., 2003a). Examples could include:

- Policy analysts and advisors in various government departments
- Researchers and research analysts in government departments or academia
- Private industry, non-profit organizations and lobbyists
- Practitioners (e.g. veterinarians) and producers
- The media
- The general public

By whom? (The messenger)

Knowledge should be transferred to the target audience by credible and trustworthy messengers (Lavis et al., 2003a; Mitton et al., 2007). Researchers are the ideal source to translate their knowledge and transfer it to target end-users because of their credibility and familiarity with the research (Lavis et al., 2003a). However, they might lack the time, incentive or skills to engage in these activities effectively. In policy-making contexts, messengers could also include government research and policy officers, analysts and advisors who are trusted sources to provide briefings to policy-makers about key issues. Other potential knowledge dissemination messengers could include (Draper et al., 2009):

- **Knowledge brokers** – intermediary individuals or groups that transfer knowledge and facilitate interactions between research and policy stakeholders (see Section 4.1)
- **Opinion leaders** – influential people that others look to for advice
- **Champions** – motivated advocates of ideas or issues with strong enthusiasm and connections
- **Change agents** – individuals that work with others to change their behaviours

How? (The KTE strategies and methods)

Relevant and audience-specific knowledge dissemination formats are needed to transfer knowledge to policy-makers, practitioners and other end-users (Pentland et al., 2011). These formats need to be provided to end-users in an easily accessible and timely way
(Mitton et al., 2007; Pentland et al., 2011). In addition, proactive mechanisms are needed for interactive knowledge exchange and sharing between researchers and various end-users (Mitton et al., 2007; Lavis, 2009).

In a comprehensive review of the KTE literature, Rajić et al. (2013) identified a number of different dissemination and exchange strategies and methods and outlined their potential applicability to agri-food public health contexts (see Chapter 1, Tables 1.2-1.3). We provide additional details on three of these dissemination methods in this chapter: social media tools (Section 3.2), user-friendly evidence summaries (Section 3.3), and evidence briefs for policy (Section 3.4). A detailed overview of four knowledge exchange approaches is provided in Chapter 4: knowledge brokering (Section 4.1), stakeholder engagement (Section 4.2), communities of practice (Section 4.3), and stakeholder dialogues (Section 4.4). Readers should refer to Lavis (2009) for a summary of additional KTE approaches such as providing ‘personalized briefings’ of knowledge to end-users.

**With what effect? (Evaluation)**

The dissemination strategy should be evaluated to determine the impact of knowledge on policy- and decision-making. This process can help to identify barriers to knowledge use and can be used to improve the future strategy for knowledge dissemination and exchange. Evaluation methods and criteria are discussed in Chapter 5.

### 3.2. Social media

Social media, or Web 2.0, is a term used to refer to web-based tools for exchanging information and connecting with individuals worldwide (United States Centers for Disease Control and Prevention [USCDC], 2011; FAO, 2011). In focus groups with policy-makers and those who support them in the agri-food public health sector, Young et al. (2013) found that there is increasing interest among these stakeholders in the potential use of social media tools to facilitate knowledge translation and exchange (KTE) and evidence-informed policy-making initiatives due to their innovative nature and increasing global popularity and adoption. Potential benefits of social media tools for KTE include (USCDC, 2011):

- **More rapid and timely dissemination** of knowledge
- **More interaction and engagement** between researchers and end-users
- **Improved access to networks** of broad and diverse audiences, including potential intermediaries and end-users

There are a variety of social media tools that could be used to support KTE and evidence-informed policy-making. Three of these tools are highlighted below:

1) E-newsletters and news feeds
2) Blogs and microblogs
3) Social networking sites

E-newsletters and news feeds

E-newsletters can be used to transfer and promote knowledge via email to a list of subscribers. News feeds (e.g. RSS and XML) are used to immediately notify subscribers of updates or new information that is posted to a website, blog or other online source (USCDC, 2011). For example, policy analysts could subscribe to news feeds of online registries of knowledge synthesis (KS) evidence (e.g. Health Evidence) that cover topics of relevance and interest to them, which would ensure that they are rapidly notified of new synthesized knowledge as it becomes available. Online registries such as Heath Evidence are described in more detail in Section 5.2.

Blogs and microblogs

Blogs, or “web logs”, are regularly updated webpages that are used to share text, images and multimedia in a chronological format. They are a form of an online journal entry and can be used by individuals or organizations to share new knowledge about different topics. They often include a space for public comments and links or news feeds to other, related websites (FAO, 2011). Microblogs such as Twitter can be used to post and receive short text updates of up to 140 characters, which can be shared with subscribers or followers (FAO, 2011). Either of these interactive tools could be used to enhance collaborations with potential audiences and improve knowledge uptake through easy-to-read and informal writing formats (Hovland, 2005).

Two notable agri-food public health examples are illustrated below:

- The *Worms and Germs Blog* is an excellent example of an educational blog that covers topics related to zoonotic diseases and safe pet ownership: [http://www.wormsandgermsblog.com/](http://www.wormsandgermsblog.com/)

- *Barfblog* is another good example of an informative blog that disseminates news (e.g. outbreak reports), research (including KS), and other knowledge about food safety: [http://barfblog.com/](http://barfblog.com/)

Social networking sites

Facebook, one of the largest social networking sites, is an online community that allows people to connect and interact with friends and family. In contrast, LinkedIn is a social networking site that is targeted towards professionals: [http://www.linkedin.com/](http://www.linkedin.com/). It can be used to create a personal or organizational profile, share knowledge, and build networks with colleagues and other professionals. For example, LinkedIn could be used by researchers to promote their research profiles and results and to connect with
potential end-users such as policy-makers and analysts. Similarly, policy-makers and other end-users could use this tool to identify and connect with researchers and experts on specific topics.

3.3. User-friendly evidence summaries

Policy-makers, practitioners and other end-users prefer to receive knowledge in plain language and in an easy-to-understand format that addresses their informational needs (Lavis et al., 2005; Lavis, 2009; Canadian Foundation for Healthcare Improvement [CFHI], 2010). Several user-friendly formats have been developed to summarize primary research and KS evidence in order to allow end-users to quickly identify the take-home messages and implications, and occasionally, to supplement the evidence with additional contextual information (e.g. costs and local applicability) of importance to end-users (Lavis, 2009). One general format (the CFHI 1:3:25 approach) for summarising knowledge, one format for primary research, and two formats developed specifically for KS (e.g. systematic reviews-meta-analyses [SR-MAs]) are described below:

1) CFHI 1:3:25 format
2) ResearchImpact summaries of primary research
3) SUPPORT summaries
4) One- and three-page KS summaries in agri-food public health

CHFI 1:3:25 format

The CFHI graded-entry format is a generally recommended approach to summarize and describe research studies and KS evidence. It includes three layers of summaries to enhance knowledge uptake and use among end-users: a one-page summary of key messages, three-page executive summary and 25-page full report (CFHI, 2010). A brief description of this format is outlined below:

- **One-page summary** – should highlight the main messages, lessons learnt, and considerations for policy
- **Three-page summary** – a concise and plain-language summary that focuses on the research highlights and context rather than technical details and methods
- **Full report** (25 pages) – provides all technical details and information related to the research, including background, methods, results and conclusions

ResearchImpact summaries

A similar knowledge dissemination format was developed by ResearchImpact, a multi-university collaborative KTE network in Canada (ResearchImpact, 2013). This format uses plain-language writing to summarize primary research studies in two pages under the following sub-headings:
One additional aspect that should be considered in future ResearchImpact summaries is how the primary research fits within the larger body of knowledge on the topic, including any related or previously conducted KS on the same or similar topics.

The Institute for Community Engaged Scholarship at the University of Guelph has adopted the ResearchImpact format to summarize primary research about agri-food issues, and several examples are available online: http://www.uoguelph.ca/omafra_partnership/ktt/en/aboutourresearch/clearlanguage_agri_food_rural.asp.

**SUPPORT summaries**

SUPPORT (Supporting Policy-relevant Reviews and Trials) summaries were developed by an international collaborative network of low- and middle-income countries and Canadian and European researchers and policy-makers in the health sector (Lavis, 2009; Rosenbaum et al., 2011). The network develops SUPPORT summaries, along with offering other training and support, to improve the access to and uptake of KS evidence about the effects of interventions in the area of child and maternal health for policy-makers in low- and middle-income countries (Rosenbaum et al., 2011). The SUPPORT collaboration systematically searches for KS evidence addressing these topics and assesses identified reviews for their risk-of-bias and overall quality of evidence using the Cochrane Collaboration’s GRADE (Grading of Recommendations, Assessment, Development and Evaluation) approach (Rosenbaum et al., 2011). The following is a description of the format used in SUPPORT summaries (Rosenbaum et al., 2011):

- Key background information about the topic
- A summary of the review methods and results
- A detailed summary of the key findings of the review and risk-of-bias and GRADE assessment
- An assessment of the relevance of the KS to low- and middle-income countries through a consideration of contextual information: local applicability, equity, economics, and monitoring and evaluation needs
- References for additional information
One- and three-page KS summaries in agri-food public health

A KS dissemination format similar to SUPPORT summaries is currently being adapted to KS evidence (e.g. SR-MAs) addressing various agri-food public health questions (Kerr et al., 2012). The format includes one- and three-page summaries of KS evidence as well as additional contextual information of interest to policy-makers, practitioners and other end-users (e.g. cost and local applicability). The format also incorporates the Cochrane Collaboration’s GRADE quality-of-evidence approach and a “summary-of-findings” table format for summarizing the quantitative MA results in a more user-friendly layout (Rosenbaum et al., 2010; Guyatt et al., 2011).

The one-page summary uses the following layout:

- **What does this mean?** and **Next steps** – a box to highlight the key implications and recommendations
- **Background** – summarizes the issue in key bullet points
- **Findings** – bullet points of the key findings, and when applicable, a summary-of-findings table of the most important study features and SR-MA results

The three-page summary has a more flexible layout that depends on the nature of the issue and availability and quality of the supporting contextual information. The following is a layout used for reviews addressing intervention questions:

- **Introduction** – background on the issue or intervention
- **What is the intervention?** – description of the intervention that was investigated
- **How effective is the intervention?** – summary of the SR-MA results in a bullet list, and when applicable, a summary-of-findings table format
- One or more of the following contextual sections:
  - **What is the intervention availability?**
  - **What are the costs?**
  - **Is it practical?**
  - **Are there any additional concerns or considerations?**

Contextual information for these summaries is identified through a targeted combination of peer-reviewed and grey literature searches and interviews with industry and topic experts.

An example of a one-page summary of a SR-MA that investigated the efficacy of vaccination as an on-farm intervention against *Salmonella* in chickens is shown in Figure 3.1, and the corresponding three-page summary is shown in Appendix B.
Figure 3.1. One-page summary of a SR-MA of the efficacy of vaccination to control *Salmonella* in broiler chickens.

Can vaccines reduce *Salmonella* in broiler chickens?

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

**Background:**
- Broiler chickens are an important source of human salmonellosis outbreaks.
- *Salmonella* bacteria are common in poultry production and survive in a range of environments. Vaccines are sometimes used to minimize bacteria levels on farms.
- Nine commercial *Salmonella* vaccines are licensed for use in the Canadian broiler chicken industry.
- Available vaccines are made with either live or killed *Salmonella* serovars, which affects how the vaccine is given and how it works.

**Findings:**
- Research in layer breeds of chickens was excluded from this systematic reviewμ.
- We analyzed 22 studies investigating live and killed *Salmonella* vaccines in broiler chickens. All studies were done in research settings outside of Canada and used small trial sizes.
- Of the 22 studies, nine studies were comparable. Findings of these nine studies are summarized in Table 1.
- This review did not capture vaccines that are commercially available in Canada.

**Table 1.** Findings of studies examining vaccines for *Salmonella* in broiler chickens.

<table>
<thead>
<tr>
<th>Serovar used for vaccine</th>
<th>Type of vaccine</th>
<th># studies that looked at this vaccine</th>
<th>% carcasses contaminated with <em>Salmonella</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No vaccine</td>
<td>With vaccine (pooled)</td>
</tr>
<tr>
<td><em>S.</em> Typhimurium</td>
<td>Live</td>
<td>4 studies/5 trials</td>
<td>24%</td>
</tr>
<tr>
<td><em>S.</em> Enteritidis</td>
<td>Live</td>
<td>1 study/1 trial</td>
<td>81%</td>
</tr>
<tr>
<td><em>S.</em> Enteritidis/Typhimurium (combined)</td>
<td>Live</td>
<td>1 study/3 trials</td>
<td>78% (35 – 76%)</td>
</tr>
<tr>
<td><em>S.</em> Typhimurium</td>
<td>Killed</td>
<td>1 study/1 trial</td>
<td>No decrease predicted</td>
</tr>
<tr>
<td><em>S.</em> Enteritidis</td>
<td>Killed</td>
<td>2 study/3 trials</td>
<td></td>
</tr>
</tbody>
</table>

*Data abstracted from meta-analysis.


SR-MA. Systematic Review and Meta-analysis

Systematic Review: a transparent process used to analyze all published studies on a specific area of knowledge or intervention.

Meta-analysis: a statistical method for combining results of many studies into a single finding.
3.4. Evidence briefs for policy

Evidence briefs are concise reports about high-priority and urgent issues. They should be succinct, understandable and appealing for the target audience – which is primarily policy-makers and others who create or influence policy. Evidence briefs for policy should clearly identify the issue and why it is important, and then summarize the key implications and messages from supporting research, ideally KS, as well as other knowledge (Bennett and Jessani, 2011).

The briefs do not cover all possible details and knowledge about an issue, but should attempt to engage the policy-makers and compel them to learn more about the issue. They can also be used as background documents to inform stakeholder dialogues (see Section 4.4) or other forums of stakeholder engagement and debate about a specific issue (McMaster Health Forum, 2013a). They should be presented in a graded-entry format, with one page of the key messages and a longer 20-25 page version to provide more details (Bennett and Jessani, 2011). The standard format for an evidence brief is as follows:

1) Title – should be short, catchy and compelling
2) Key messages – One page of “take-home” bullet points from each of following sections
3) Background and statement of the problem
4) Policy options
5) Implementation considerations

Background and statement of the problem

The evidence brief should address an issue or problem that is a high priority for policy-makers or other stakeholders. This section of the brief should clearly indicate why the problem is considered a high-priority and it should inform the policy-maker that the problem requires urgent action. This could include a discussion of the background and context of the issue and how it affects the health and well-being of people, animals, the food chain, or the agri-food environment.

Policy options

This section of the evidence brief should provide knowledge about at least two competing policy options within the context of existing policies and past actions. Ideally the knowledge should come from one or more knowledge syntheses (e.g. SR-MAs). This section should highlight the potential advantages and disadvantages of each policy option (e.g. effectiveness, degree of uncertainty, costs, stakeholder views and expectations) and any potential trade-offs involved in selecting one option over another (Lavis et al., 2009b).
Implementation considerations

This section should summarize the potential barriers to implementation of the policy options and potential strategies to address them (McMaster Health Forum, 2013a). Barriers should be identified for different stakeholders and levels of the policy implementation (e.g. receivers of the policy, individual providers or implementers of the policy, groups or organizations administering the policy, and systems required for implementation). Knowledge in this section should also ideally be obtained from one or more KS reviews (e.g. SR-MAs). Evidence briefs should not contain specific recommendations for policy, which would require authors to make judgements based on their personal values and preferences and which could pre-empt important deliberations about the role of various stakeholder values and preferences in making such judgments (McMaster Health Forum, 2013a).

Agri-food public health example

A summary of an evidence brief from the Overseas Development Institute (ODI) about rising food prices is shown in Box 3.1. One limitation of this example is that the content is not informed by SR-MAs or knowledge syntheses (ODI, 2008). For additional examples of evidence briefs addressing global agri-food issues, readers can refer to the Economic and Social Development Department of the FAO: http://www.fao.org/economic/es-policybriefs/en/.

Government formats

Evidence briefs for policy should be differentiated from briefing notes and memoranda to cabinet (MCs). In Canada, briefing notes are similar in structure and content to evidence briefs, but their primary purpose is to inform ministers or senior officials about key issues that they are responsible for. MCs are more detailed documents that are prepared at the request of Cabinet to inform ministers and Cabinet members about policies and proposed policy actions related to high-priority issues. Most governments have official and formal guidelines for preparing briefing notes and MCs, while evidence briefs for policy can be prepared by government and non-governmental organizations, have a more flexible structure, and aim to base their information and content on SR-MAs and other knowledge syntheses.

Box 3.1: Evidence brief for policy about rising food prices

| Title: |
| “Rising food prices: Cause for concern” |

| Key messages: |
| A one-paragraph summary is provided on the first page, followed by a box that outlines five policy conclusions in bullet points (e.g. “prompt assistance is needed for countries...” |
Box 3.1 Continued

facing surging food and energy import bills and for low-income households”).

Statement of the problem:
The high-priority nature of the problem is described in an introduction section. The reasons for recent food price increases are described and projected economic and social impacts are discussed. For example, it is noted that rising food prices threaten to reverse recent gains in poverty reduction and will have impacts on the growth, development and health of low-income countries (e.g. through reduced income available for uses other than food and reduced food consumption).

Policy options:
Potential policy options are discussed in a section called “what can policy-makers do about this?” Potential advantages, disadvantages and challenges are noted for the different policy options (e.g. cash or food transfers to the poor, subsidizing food prices, reducing tariffs on imported grains, and limiting or taxing exports of grains). The brief concludes with a discussion of lessons learned from the recent food price increases and key issues that need to be addressed.

For more information:
### 3.5. Practical exercise – Developing an evidence brief for policy

**Scenario:**

*Escherichia coli* are usually harmless bacteria that colonize the intestinal tracts of humans and other mammalian species. However, a small proportion of these bacteria produce virulent toxins that can cause infection and illness in humans. These strains of *E. coli* are sometimes referred to as Shiga-toxin producing *E. coli* (STEC), and they can cause infections that lead to serious conditions such as hemorrhagic colitis and hemolytic uremic syndrome. One of the most well-known and characterized strains is *E. coli* 0157:H7, which caused seven deaths and over 2300 illnesses in a notable outbreak in Walkerton, Ontario, in 2000, when the municipal drinking water supply was contaminated via manure runoff from a nearby farm.

STEC are commonly found in cattle and other farms species, and in contrast to humans, they usually do not cause disease in animals. Transmission to humans usually occurs by ingestion of contaminated food or water or by direct contact with animals or other infected individuals. Contaminated beef products (e.g. undercooked ground beef and hamburgers) are a frequent source of infection, and are estimated to be a source of over one third (37%) of *E. coli*-related human infections in Canada. Therefore, interventions are frequently targeted towards reducing the shedding of STEC on farms and reducing contamination of beef carcasses during processing.

Processing plants in Canada and other countries must implement various interventions at different stages of processing (e.g. pre-evisceration, final wash and carcass chilling) as part of standard Hazard Analysis and Critical Control Point (HACCP) plans. However, it is not known which interventions are more effective than others and whether additional approaches should be used by processing plants to improve their control of *E. coli*. Therefore, a SR-MA was conducted to investigate the efficacy of various interventions that could be applied during processing to reduce *E. coli* contamination of beef carcasses (Greig et al., 2012b). The review identified 44 different interventions that could be applied at nine different stages of processing. The review found that several interventions were effective, including final carcass washing, pasteurization and carcass chilling. Combining these interventions with disinfectants (e.g. lactic acid) and using multiple interventions together typically resulted in greater reductions in *E. coli* contamination.

For this scenario, you are policy analyst working on the federal government’s national food safety strategy. Your manager is participating in a multidisciplinary and multi-stakeholder working group tasked with determining recommendations for enhanced STEC control in processing plants across the country. You have been asked by your manager to provide an objective analysis of three potential interventions that could be used by processing plants to improve their control of *E. coli*. For this exercise, the three interventions to consider are noted in the table below:
## Pooled estimate of effect (odds ratio and 95% CI) on E. coli prevalence outcome

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Estimated frequency of use in Canada</th>
<th>Pooled estimate of effect (odds ratio and 95% CI) on E. coli prevalence outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final carcass wash using potable water at a temperature of &lt;50°C</td>
<td>Always (baseline/minimal requirement for processors in Canada)</td>
<td>OR = 0.56 (0.41 – 0.77)</td>
</tr>
<tr>
<td>Hot water pasteurization at a temperature of ≥85°C for 8-15s</td>
<td>Frequently</td>
<td>OR = 0.09 (0.05 – 0.15)</td>
</tr>
<tr>
<td>Steam pasteurization followed by a 2% lactic acid spray</td>
<td>Sometimes</td>
<td>OR = 0.01 (0.00 – 0.04)</td>
</tr>
</tbody>
</table>

**Question:**

You decide to prepare an evidence brief to present to your manager and inform the working group. To begin, use the information provided above to brainstorm some potential considerations of the three policy options. *NOTE: In practice you would first attempt to identify this information from a SR-MA or other KS.*

| Contextual factors | **Option 1:** Final carcass wash using potable water | **Option 2:** Hot water pasteurization | **Option 3:** Steam pasteurization followed by a 2% lactic acid spray |
|--------------------|-----------------------------------------------------|---------------------------------------|________________________________________________________________|
| **Benefits**       |                                                     |                                       |                                                                    |
| **Limitations or barriers** |                                               |                                       |                                                                    |
| **Costs**          |                                                     |                                       |                                                                    |
| **Stakeholder views and perspectives** |                                               |                                       |                                                                    |
3.6. Key references and suggested readings

Bennett, G., Jessani, N. (Eds.), 2011. The knowledge translation toolkit. SAGE Publications India Pvt Ltd, New Delhi, India.


4. Knowledge exchange

Chapter summary:

- **Active relationships and interactions** are needed between researchers and end-users to support evidence-informed policy and practice decision-making
- **Knowledge brokers** are organizations or individuals that promote and facilitate interactions and knowledge exchange between researchers, policy-makers, practitioners, and other end-users
- **Stakeholder engagement** in the policy-making process is necessary to ensure that decisions are transparent, accountable and reflect the best available knowledge as well as stakeholder views and perspectives
- **Communities of practice** are informal groups of interested individuals that meet regularly to discuss, learn and share knowledge about an issue
- **Stakeholder dialogues** are interactive forums where stakeholders discuss different types of knowledge – including research, stakeholder views and perspectives, and local applicability – to support policy-making about high-priority issues

4.1. Introduction

Knowledge exchange refers to the process of interaction and engagement between researchers, policy-makers and those who support them (e.g. analysts and advisors), practitioners, and other stakeholders to support evidence-informed policy and practice decision-making. Traditionally, researchers have not sufficiently engaged with end-users about their research findings, and policy-makers and those who support them have not sufficiently involved researchers and other stakeholders in the policy-making process. Improving these relationships and the exchange of knowledge among these different stakeholders is one of the most important activities to support knowledge transfer and exchange (KTE) and evidence-informed policy-making initiatives (Innvaer et al., 2002; Pentland et al., 2011).

**Agri-food public health sector**

Knowledge exchange has an important history in agri-food public health in the form of agricultural extension services (Aflakpui, 2007; Klerkx and Leeuwis, 2009). The traditional role of agricultural extension personnel and organizations was to transfer knowledge and promising practices from researchers to end-users in the field (e.g. producers and practitioners). However, this “one-way” transfer of information is an outdated model of exchange. The agricultural extension role has recently been redefined, according to the principles of knowledge brokering as described below, to include facilitating networks, linkages and the exchange of knowledge and issues between multiple agricultural stakeholders (Klerkx and Leeuwis, 2009).
Knowledge brokers

The agricultural extension brokers discussed above can be considered a specific type of knowledge broker relevant to the agri-food public health sector. Knowledge brokering is a more general term that is used to refer to intermediaries that facilitate collaboration and exchange among diverse groups of stakeholders, including researchers, policy-makers and practitioners (Dobbins et al., 2009; Ward et al., 2009). Knowledge brokers can be individuals, groups or entire organizations. One example of a brokering organization in the health sector is the Canadian Foundation for Healthcare Improvement. Examples in the agri-food public health sector include the Agri-Food and Rural Link Program in Canada and the Scottish Agricultural College in Scotland. The specific roles of a knowledge broker vary, but could include (Dobbins et al., 2009; Ward et al., 2009):

- **Promoting interactions** between researchers, policy-makers, practitioners and other stakeholders
- **Creating networks and partnerships** among stakeholders from different communities (e.g. research and policy)
- **Mediating relationships and dialogues** between diverse stakeholders
- **Building organizational and individual capacity** for KTE and evidence-informed policy-making
- **Facilitating knowledge exchange, access and interpretation** from research and other sources

Knowledge brokers are usually experts in the issue that they are facilitating or mediating, and they should be trustworthy, credible and politically neutral to all involved stakeholders (Dobbins et al., 2009; Ward et al., 2009). However, there is still limited evidence on the overall effectiveness of knowledge brokers for improving KTE and evidence-informed policy-making in different contexts (Ward et al., 2009).

Knowledge brokering spectrum

A recent initiative called K* (KStar), which is a collective term used to refer to all of the KTE principles and processes in various sectors, has outlined a continuum of knowledge brokering roles that have different exchange functions depending on the specific context and situation (Shaxson et al., 2012):

- **Information intermediaries or “infomediaries”** – enable end-user access to knowledge from one or more sources
- **Knowledge translators** – facilitate end-user interpretation and application of knowledge
- **Knowledge brokers** – bridge and foster networks, linkages and collaborations to improve the use of knowledge for decision-making
• **Innovation brokers or “system-level enablers”** – influence the wider context, systems and processes to enable KTE innovation and organizational capacity

Each of these brokering roles is interrelated and the specific context will guide the most appropriate approach. For example, the brokering role can be shaped by the political context, key stakeholders involved, types of knowledge considered, and nature of the demand for and supply of knowledge to inform decision-making (Shaxson et al., 2012). For a more complete discussion of this concept please refer to Shaxson et al. (2012).

The remainder of this chapter highlights three specific methods that can be used to improve interactions and relationships in the agri-food public health sector among research, policy and practice communities: stakeholder engagement (section 4.2), communities of practice (CoPs) (section 4.3), and stakeholder dialogues (section 4.4).

**4.2. Stakeholder engagement**

Effective stakeholder engagement is needed to create transparent and accountable public policies (Riege and Lindsay, 2006). Stakeholder engagement is also a cost-effective way to ensure that policies are informed by the best available knowledge, which should include research-based evidence as well as unique stakeholder experiences and perspectives. Stakeholders can be defined as any individual or organization that might be positively or negatively affected by a policy decision (Hovland, 2005; Riege and Lindsay, 2006). This could include:

- Government departments and agencies
- Industry organizations (e.g. agri-food commodity groups, processors and retailers)
- Non-profit and professional organizations
- Researchers and academia
- Community groups and authorities
- Media
- Private practitioners
- Producers
- General public
- International governments and agencies

**Stakeholder analysis**

The purpose of stakeholder analysis is to define and map out the different actors involved in or potentially affected by a policy issue. The first step is to create an exhaustive list of all potential stakeholders, which can be organized into a table with different categories (e.g. public sector vs. private sector stakeholders) (Hovland, 2005). Once all stakeholders are identified, they can then be assessed for their potential to
influence the policy-making process and their level of interest in the issue in an “influence vs. interest” matrix as noted in Figure 4.1 (Bryson, 2004; Hovland, 2005; Riege and Lindsay, 2006). The matrix results in four categories of stakeholders:

- **Players** – have strong interests and levels of influence
- **Subjects** – have strong interests but little influence
- **Context setters** – have strong influences but little direct interest in the issue
- **Crowd** – have little interest and influence in the issue

This analysis can help governments and others organizations to determine which stakeholder groups must be engaged in the decision-making process to appropriately address the issue and which stakeholder collaborations and coalitions should potentially be encouraged or discouraged as part of the process (Bryson, 2004).

**Figure 4.1. Stakeholder influence vs. interest matrix. Adapted from Bryson (2004).**

Policy network analysis is another tool that can be used to (Bennett and Jessani, 2011):

- **Determine the actors** involved in different steps of the policy-making process
- **Determine the relationships** between key actors in the process and how they can be accessed and influenced
- **Differentiate the lines of authority** between different stakeholders

An example of a stakeholder analysis for food safety policy of pathogenic *E. coli* in ground beef in Canada is illustrated in Box 4.1.
Stakeholder management

Engagement of diverse stakeholder groups will result in the need to manage conflicting or opposing views and perspectives (Riege and Lindsay, 2006). Stakeholder conflict could result from many different issues, including economic competition or different societal values (e.g. public health vs. food production and trade). These different perspectives need to be given equal representation and they should be managed carefully. Formal and facilitated forums such as stakeholder dialogues (Section 4.4) can be used to bring together multiple stakeholders with competing and differing interests to constructively deliberate on a key policy issue (Lavis et al., 2009c).

Box 4.1: Analysis of stakeholders involved in food safety policy for pathogenic E. coli in ground beef in Canada

Stakeholder analysis:
In 2011, a division of the Public Health Agency of Canada (PHAC) conducted a stakeholder analysis of key actors involved in food safety policy for pathogenic E. coli in ground beef in Canada. The purpose of this analysis was to enhance stakeholder engagement to improve the application and uptake of the division’s research and surveillance data. For this analysis stakeholders were defined as any organization that met at least one of the following three criteria:

1) Has legislated responsibility for food safety
2) Food safety is one of the main priorities or functions
3) Demonstrates activity in food safety through position papers, research or other forms of publication and public communication

Stakeholders were classified into the following groups: international; federal government; provincial and local governments; universities and research institutes; and professional, non-profit and private organizations. Stakeholders were organized in tables according to their classification and key food safety related activities. A brief example is shown below:

<table>
<thead>
<tr>
<th>Classification</th>
<th>Organization</th>
<th>Example of related activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>International</td>
<td>World Health Organization Department of Food Safety and Zoonoses</td>
<td>Provides leadership in global efforts to lower the burden of foodborne disease</td>
</tr>
<tr>
<td>Federal</td>
<td>Agriculture and Agri-Food Canada (AAFC)</td>
<td>Leads the Canadian Integrated Food Safety Initiative</td>
</tr>
<tr>
<td>Provincial</td>
<td>Ontario Ministry of Agriculture and Food (OMAF)</td>
<td>Responsible for managing food safety from farm to processing in Ontario</td>
</tr>
<tr>
<td>Non-profit</td>
<td>Canada Beef Inc.</td>
<td>Provides information to the public about beef issues in Canada</td>
</tr>
</tbody>
</table>
Stakeholder mapping:
A policy network map was created to illustrate the relationship between these stakeholder groups in two areas: sub-government and attentive public. Policy-making occurs in the sub-government by a core group of key actors, while stakeholders in the attentive public influence the policy process via lobbying and other activities. A modified and abbreviated version of this map is shown below:

AAFC, Agriculture and Agri-Food Canada; CFIA; Canadian Food Inspection Agency; CIPHI, Canadian Institute of Public Health Inspectors; COFFSWG, Canadian On-Farm Food Safety Working Group; EHFC, Environmental Health Foundation of Canada; MOHLTC, Ontario Ministry of Health and Long-Term Care; OMAF, Ontario Ministry of Agriculture and Food; PHAC, Public Health Agency of Canada.

Source:
Centre for Foodborne, Environmental and Zoonotic Infectious Diseases, PHAC, 2011. Knowledge translation: Connecting research with food safety policy needs. CFEZID-Guelph, Internal report.

Levels of stakeholder engagement

Different levels of stakeholder engagement in the policy process provide different opportunities for participation and control. For example, public participation in government policy-making can be described on a four-step continuum (Figure 4.2) (Sheedy, 2008; Canadian Food Inspection Agency [CFIA], 2012):
• **Informing** – government makes information about policies and decisions available but there is no opportunity for input or engagement

• **Consultation** – government requests stakeholder input on the policy-making process, but still makes the final decision

• **Engagement** – government and relevant stakeholders are engaged in a deliberative process that equally considers each participant’s perspective and interests to come up with a joint solution or decision

• **Empowering** – government delegates decision-making authority to other stakeholder groups

**Figure 4.2. Levels of participation in the government policy-making process.**

A higher level of involvement (e.g. engagement or empowering) is best suited to addressing high-priority, highly impactful and controversial issues (Riege and Lindsay, 2006). This could include policy-making about issues such as genetically modified foods or food irradiation, which could have important and broad societal implications. A lower level of involvement (e.g. consultation) might be more appropriate for potentially less polarizing issues such as changes to the policies and programs of government agri-food public health departments.

For high-priority issues, deliberative processes for engagement help to ensure a more transparent process and more sustainable solutions (Riege and Lindsay, 2006). Examples of active engagement processes could include stakeholder working groups and panels, interactive workshops, consensus conferences, deliberative polls, and stakeholder dialogues (Sheedy, 2008; Oxman et al., 2009). Among these methods, stakeholder dialogues (Section 4.4) are unique in that they use synthesized evidence (e.g. from systematic reviews) as a basis to inform the deliberation about the state of knowledge on the issue among diverse stakeholder groups (Lavis et al., 2009c).

An example of stakeholder engagement approaches currently used by the CFIA (2011) in federal food safety policy-making in Canada is noted below:

• **Consumer association roundtable** – provides dialogue between the federal government and consumer associations
• **Value chain roundtables** – are industry-specific and bring together representatives from multiple industry groups (e.g. suppliers, producers, processors and retailers) and provincial and federal government policy-makers
• **Expert advisory committee** – provides technical and scientific advice on government policies
• **Ministerial advisory board** – advises the Minister on relevant issues and responsibilities

**Critical factors in stakeholder engagement**

The following key principles and factors should be considered when planning for and developing stakeholder engagement approaches within the context of evidence-informed decision-making (Smith, 2003):

- Stakeholders should understand the context of the engagement process and why it is being conducted
- The engagement process should be guided by clear objectives that are expressed to all stakeholders in writing
- Clarity is needed in the roles and responsibilities of all stakeholders in the process, including who has the final decision-making authority
- The engagement process should be inclusive, with clear criteria for stakeholder selection and equal and fair representation among the different groups
- The process should be open and transparent to establish trust and constructive relationships and participation among the involved groups
- As noted above, more active and deliberative processes such as stakeholder dialogues (Section 4.4.) are needed for high-priority issues to ensure more transparent, sustainable and evidence-informed solutions

**4.3. Communities of practice (CoPs)**

CoPs are groups of individuals with a common interest and passion about an issue that come together on an ongoing basis to exchange knowledge, expertise and experiences (Wenger, 2000; Bentley et al., 2010). CoPs are based on the assumption that learning is a social process and that knowledge is best shared and exchanged within communities (Wenger, 2000; Bennett and Jessani, 2011). They were developed in the business sector as a theory for how practitioners learn in a social environment, and they later evolved into a management tool to promote knowledgeable workers (Li et al., 2009a). CoPs have more recently been applied in the health and other sectors as a method to:

- Create and foster relationships and social interaction
- Discuss common interests and issues
- Stimulate learning and creative problem solving
- Create new knowledge and expertise
- Share knowledge, experiences and best practices

CoPs have four main characteristics (Li et al., 2009a):

1) Domain
2) Community
3) Practice
4) Leader and facilitator

Domain

CoPs should be organized around a single issue or domain. The CoP should bring together participants with diverse backgrounds that have some overlapping expertise and interest in a central issue (Bentley et al., 2010). CoPs are formed for a number of reasons, such as in response to environmental or societal changes, or spontaneously by a set of interested and proactive individuals (Wenger, 2000). Participation in CoPs is voluntary and they have a self-organizing, informal and flexible structure (Bentley et al., 2010). For example, CoPs do not need to have an explicit agenda for a given meeting, and even if they do, the agenda might not be closely followed or used (Wenger, 2000).

Community

The community in a CoP can include any number of participants, but it usually has a core set of passionate individuals that provide “intellectual and social leadership” to the group (Wenger, 2000). CoPs can occur in multiple formats, including in-person (e.g. over lunch) or via email, teleconference, videoconference or online networks and forums. Large CoPs can be subdivided into smaller groups based on geographic region, subject matter or other characteristics.

Practice

The CoP practice refers to the knowledge that the group shares, creates and sustains (Bentley et al., 2010). Participants in a CoP learn from each other to develop and improve their knowledge and expertise about the topic. Participants also learn through practicing and applying new knowledge in the field, which is why participants are also referred to as practitioners (Bentley et al., 2010). The knowledge that is exchanged or discussed in CoPs includes research and other sources of knowledge (e.g. experiences, attitudes, values and perspectives) (Bentley et al., 2010).

Leader and facilitator

CoPs should have a leader or champion that helps the group to sustain itself over time (Wenger, 2000; Li et al., 2009a). The leader can support the recruitment of new members, promote the CoP to others, and can ensure that sufficient resources and
infrastructure (e.g. meeting space and audio-visual equipment) are available for group meetings and activities (Li et al., 2009a). The facilitator is another CoP role that is responsible for the group’s day-to-day activities, but both functions can be conducted by the same individual (Li et al., 2009a).

Limitations

One of the major limitations of CoPs is that there is a lack of consistent evidence on their overall effectiveness to improve KTE and evidence-informed policy-making in different contexts (Li et al., 2009b). In addition, Bentley et al. (2010) and Li et al. (2009a; 2009b) identified the following potential limitations of CoPs:

- Prone to group-thinking and reproducing the status quo
- Could be affected or dominated by cliques or individuals with strong interests or positions of power
- Can become dormant or unproductive with failure to recruit new members or accommodate change and variation
- The concept and structure is vague, lacks clarity and is not consistent
- Virtual CoPs may be a barrier for some individuals due to privacy, user-friendliness and technological issues

Agri-food public health example

A good example of a multidisciplinary CoP is the Canadian KTE CoP: [http://www.ktecop.ca](http://www.ktecop.ca). It is a network of practitioners and researchers from multiple disciplines that share promising practices and experiences in KTE, develop and build relationships, and exchange information about upcoming events and other KTE activities (Canadian KTE CoP, 2012). The group is connected via a website and listserv, but structured group meetings also take place four to six times a year (Canadian KTE CoP, 2012). A similar CoP was created in 2011 in Guelph, Ontario, Canada, to discuss and exchange information about KTE within the agri-food public health context (Agri-Food and Rural Link, 2012). This CoP is highlighted in Box 4.2.

**Box 4.2: Guelph KTE CoP**

**Domain:**
The Guelph KTE CoP is organized around the KTE issue and related concepts (e.g. science-to-policy). It was formed in 2011 in response to growing KTE momentum in the agri-food public health sector, which followed initiation of a Knowledge Translation and Transfer Funding Program in 2010 by the University of Guelph and Ontario Ministry of Agriculture and Food (OMAF) “Agri-Food and Rural Link” Partnership. The CoP has an informal structure and membership.
Box 4.2 Continued

Community:
The CoP community includes a varied and diverse core group of participants from the University of Guelph, Centre for Public Health and Zoonoses (CPHAZ), OMAF, Public Health Agency of Canada, Agri-food for Healthy Aging (A-HA), and Schlegel-University of Waterloo Research Institute for Aging. Participating individuals include researchers, practitioners, knowledge brokers and policy analysts or decision-makers with an interest in the topic. The group meets monthly at a rotating location that is hosted by one of the participating organizations. Attendance at any given meeting ranges from approximately 6-12 individuals.

Practice:
The CoP meetings are usually organized around a specific KTE strategy, application, activities or research project, which can include a short informal presentation and discussions. The meetings are also used to discuss KTE concepts, ideas and promising practices and to develop new collaborations and relationships. In addition, the CoP recently organized a one-day workshop about science-to-policy perspectives in the area of food and health, which was held in June 2012.

Leader and facilitator:
The CoP is led by KTE staff at the Agri-Food and Rural Link Partnership. However, each meeting is facilitated and organized by participants from the host organization for the given month, which is selected on an alternating and voluntary basis.

For more information:
http://www.uoguelph.ca/omafra_partnership/ktt/en/agrifoodrurallink/communitiesofpractice.asp

4.4. Stakeholder dialogues

Stakeholder dialogues, also known as policy dialogues, are interactive forums to promote evidence-informed policy-making. The participants in a stakeholder dialogue discuss the various sources of knowledge and contextual factors that inform the decision-making process, including research, political interests, local applicability, and stakeholder beliefs, views, values and experiences (Culyer and Lomas, 2006; Lavis et al., 2009c). The starting point for these discussions is usually in the form of an evidence brief (Section 3.4) that summarizes the current state of knowledge about the issue from knowledge syntheses (e.g. systematic reviews) (Lavis et al., 2009c; McMaster Health Forum, 2013b).
The purpose of a stakeholder dialogue is to consider the advantages and disadvantages of different policy options and to help guide policy decisions about a high-priority issue (Culyer and Lomas, 2006). Stakeholder dialogues should promote constructive interactions between participants, and they should not be used to debate or critique the validity of conflicting viewpoints (Lavis et al., 2009c). Some potential benefits of stakeholder dialogues include (Culyer and Lomas, 2006):

- Enhanced appreciation and knowledge of different policy options and their supporting evidence among stakeholders
- Enhanced relationships among the participating researchers, policy-makers and other stakeholders
- Improved transparency and ownership of the deliberative process and subsequent policy decisions
- Identification of research priorities through discussion of different sources and types of knowledge

When planning a stakeholder dialogue, the following elements should be considered:

1) Issue
2) Participation
3) Format
4) Facilitation
5) Outcomes

Issue

Stakeholder dialogues should be organized to address a high-priority policy issue (Lavis et al., 2009c). This will help to ensure that the discussion has a greater chance to influence the policy-making process. In addition, they are a useful approach in the following situations (Culyer and Lomas, 2006):

- The issue is complex and multidisciplinary
- Stakeholders have competing interests
- Knowledge is controversial and incomplete
- Knowledge needs to be adapted to a new situation or context
- There are economic, social, cultural or other contextual factors that have not been addressed by the available knowledge

Participation

Stakeholder dialogues should engage a diverse range of stakeholders that have an interest in or are affected by the issue. This could include:
• Policy-makers and those who support them (e.g. policy analysts and advisors) from multiple government levels (e.g. national and regional) and disciplines (e.g. agriculture, environment and health)
• Decision-makers from non-governmental and industry organizations
• Researchers and research analysts from academia, government and other institutions
• Practitioners (e.g. veterinarians), producers, and other members of the public

Each of the participants should have fair and equal representation in the stakeholder dialogue (Lavis et al., 2009c). Lavis et al. (2009c) describe two key criteria that can be used to help select targeted individuals from the stakeholder groups mentioned above:

1) Their ability to effectively communicate the views and perspectives of their community and to constructively engage in dialogue with other stakeholders
2) Their ability to be “champions” and advocates in addressing the issue once the dialogue is completed

The number of participants to invite to a dialogue depends on the nature of the issue, and it should be determined by the need to balance representation from diverse stakeholder groups (Lavis et al., 2009c).

Format

The dialogue should follow a format that is similar to evidence briefs for policy (Section 3.4) (Lavis et al., 2009c). They should begin with an introduction and background to the issue and then discuss alternative policy options, implementation considerations and potential strategies to overcome any barriers to implementation (Lavis et al., 2009c; McMaster Health Forum, 2013b). The discussion should consider a diverse range of supporting knowledge, including research, politics, economics, social implications, local applicability, and stakeholder beliefs, views and experiences. This discussion should ideally be supported by complementary evidence briefs or other user-friendly evidence summaries that highlight the state of knowledge from systematic reviews or other knowledge syntheses and that are circulated to all participants before the forum (Lavis et al., 2009c).

Facilitation

Stakeholder dialogues should be facilitated by an experienced professional that is impartial to the issue being discussed (Culyer and Lomas, 2006; Lavis et al., 2009c). The facilitator needs to keep the dialogue focused and to ensure that each of the participants has an equal opportunity to provide input into the discussion. It is recommended that facilitators have at least a basic background understanding of the issue and the local context so that they can effectively manage the discussion.
Outcomes

The stakeholder dialogue should lead to tangible follow-up activities for the participants to support action on the policy issue. Dialogues could be followed by a summary report and personalized briefings to all participants and stakeholder groups (Lavis et al., 2009c). For example, the McMaster Health Forum holds stakeholder dialogues on various healthcare, health services and public health topics, and after completion of a dialogue they provide a summary report and customized post-event briefings to all participants (McMaster Health Forum, 2013b). They also provide a year-long evidence service that identifies and highlights any new pertinent research that could be used to facilitate action or that might suggest a need for change in direction to address the issue (McMaster Health Forum, 2013b). Follow-up summaries, briefings and actions from a stakeholder dialogue should conform to the Chatham House Rule, which states that participants can use the information received in the discussion but should not reveal the identity or affiliations of other participants (Lavis et al., 2009c; Chatham House, 2013).

Ensuring success

The following is a summary of key characteristics for a successful stakeholder dialogue (Culyer and Lomas, 2006):

- Process is open and transparent
- Diverse stakeholder groups are fairly represented
- Stakeholders are willing and able to openly discuss their values and opinions
- Sufficient time to review background documents (e.g. evidence briefs)
- Sufficient time and equal opportunity for deliberations and reflection
- Dialogue is moderated by a skilled facilitator
- Follow-up activities encourage participants to take action on the issue

Agri-food public health example

An example of a stakeholder dialogue within the agri-food public health context is described in Box 4.3. While the dialogue in this example was not informed by formal evidence briefs based on knowledge synthesis evidence, it was informed by preliminary literature reviews and in-depth stakeholder interviews (Cronin et al., 2012).

Box 4.3: Stakeholder dialogue about future food technologies in New Zealand

<table>
<thead>
<tr>
<th>Issue:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A stakeholder dialogue was organized as part of a four-year initiative in New Zealand to engage government, science, business and community stakeholders about the potential implications and impacts of future food technologies and to help achieve more sustainable decision-making about this issue (Cronin et al., 2012).</td>
</tr>
</tbody>
</table>
Box 4.3 Continued

**Participation:**
The dialogue engaged four diverse stakeholder groups: science, industry, government, and community interest groups. A database of stakeholders from each of these groups was developed using a snowball sampling approach and participants were selected to represent a range of backgrounds and interests on the issue. A total of 39 participants were recruited for three half-day workshops held at three locations across New Zealand.

**Format:**
The dialogue included several components: preliminary literature reviews, in-depth qualitative interviews, and stakeholder workshops. The literature reviews were conducted to identify key future food technology examples and case studies for discussion in the interviews and workshops, and the interviews were conducted with all participants beforehand to solicit individual preferences and views toward future food technology policy options. Interview results were analyzed graphically and used to inform the workshops.

Each workshop began with a welcome, outline and ‘ground rules’ for the day. This was followed by an ice-breaker introduction exercise. The first part of the workshops included discussions from each stakeholder about their views and interests on the topic. The second part included a presentation of the interview results followed by smaller group discussions. The workshop concluded with a discussion on potential food technologies most acceptable for New Zealand and key issues that need to be considered when creating or developing policies about these technologies.

**Facilitation:**
The workshops were professionally facilitated and were structured by a ‘guided conversation’ script that included exercises and general discussion questions.

**Outcomes:**
Debriefs were held after each workshop with team members and evaluation surveys were conducted with all participants. A summary report was produced and results presented at a stakeholder symposium to gather feedback and additional comments on the issue. Targeted stakeholder briefings were also provided to multiple stakeholder organizations that participated in the process.

**For more information:**
4.5. Practical exercise – Planning a stakeholder dialogue

Scenario:

*Mycobacterium avium* spp. *paratuberculosis* (MAP) is the causative agent of Johne’s disease, a chronic, production-limiting disease that is found globally in ruminant populations (e.g. cattle, sheep and goats). Apparently healthy cattle can be infected for many years before the onset of clinical symptoms, which include sudden weight loss and diarrhea and often results in emergency slaughter and high costs for farmers. In Canada, the National Voluntary Johne’s Disease Control Program is a collaborative effort for on-farm prevention and control of this disease. However, control of Johne’s disease in cattle remains difficult due to low sensitivity of diagnostic methods to identify MAP infection (e.g. subclinical Johne’s cases).

Crohn’s disease is a chronic, debilitating disease that affects the gastrointestinal tract in humans. This disease typically occurs in young adults and major symptoms include frequent episodes of diarrhea and chronic pain, which affects overall quality of life. Approximately 74% of patients require surgery. The average prevalence of Crohn’s disease in Canada is 234 cases/100,000 of the population, and the average incidence rate is 13.4/100,000 per year, but these rates vary geographically. This high prevalence of Crohn’s disease is comparable with northern European countries. A higher prevalence is reported in Caucasians and in urban areas.

There are several theories that exist to explain potential causes of Crohn’s disease (e.g. genetics, nutrition and infectious disease), but none is universally accepted by the global scientific community. The zoonotic potential of MAP has been debated for almost a century due to apparent clinical and pathological similarities between Johne’s disease in cattle and Crohn’s disease in humans, but the link is controversial. Several systematic reviews have been published to investigate this link, and they have concluded that some groups of studies show evidence of an association. However, there are a high proportion of inconclusive and conflicting results. It is still unknown what role MAP may play in the initiation or propagation of Crohn’s disease.

There are many routes through which humans could be exposed to MAP. Dairy products have been most commonly investigated, and some studies have detected low levels of MAP in pasteurized dairy products. Recent investigations have focused on water, meat and potential environmental exposures. The results show that MAP can be found in all of these sources; however, the potential implications and risk of human exposure has not been evaluated.

The Canadian government continues to monitor the scientific evidence on this issue and has an expert panel engaged to continuously evaluate whether changes in policy action or recommendations are required to mitigate the potential transmission of MAP from animals to humans. Interventions targeting food products and agriculture have been
investigated. However, no specific actions are currently recommended or enforced by the federal government, although agriculture and related food industries have begun to develop voluntary control programs and adopt novel good production practices. There are a number of advocacy groups that believe MAP is one of the important causes of Crohn’s disease in humans. Thus, there is an ongoing discussion about whether the government should take a more precautionary and proactive approach to protect public health and reduce potential human exposures to MAP.

Questions:

You have been tasked by the government expert panel on MAP to hold a stakeholder dialogue to engage stakeholders on this issue and to help guide the panel’s future recommendations for policy action. Specifically, the dialogue will focus on the potential transmission of MAP from animals to humans and what policy actions (if any) are needed to address this issue.

1. What stakeholders would you invite to the dialogue? From which organizations?

2. What is the relative level of influence and interest in the issue?

3. How would you ensure equal stakeholder representation in the dialogue?

4. What follow-up activities would you conduct after completion of the dialogue? How would you encourage participants to take action on the issue?
4.6. Key references and suggested readings


5. Knowledge application and evaluation

Chapter summary:

- **Knowledge application** refers to “user-pull” efforts among policy-makers, practitioners and other end-users to support their use of knowledge to inform policy and practice decision-making.
- **Multiple strategies and resources** can be used to facilitate user pull of knowledge, including online registries and databases, rapid-response units, self-assessment tools and prompts, and skill-development programs.
- **Monitoring and evaluation** of the impact of knowledge to inform decision-making is important to ensure accountability and transparency in the process and to justify and prioritize research funding.
- **Multiple evaluation methods** can be used to measure knowledge impact, including questionnaires, qualitative interviews, case studies, document analysis, the logical framework approach, outcome mapping and rapid outcome assessments.
- **Direct, indirect and symbolic measures** can be used to determine how knowledge is used by various end-users.

5.1. Introduction

Two of the most important stages in the knowledge transfer and exchange (KTE) process include (Lavis et al., 2003b; Lavis et al., 2006; Mitton et al., 2007):

1. *Facilitating the application and uptake* of knowledge among end-users, and
2. *Monitoring and evaluating the effectiveness* and impact of this process

The first of these stages refers to efforts to support “user pull” of knowledge among various end-users such as policy-makers, policy and research analysts, and practitioners (Lavis et al., 2006). This stage involves various methods, strategies and resources that end-users can access and use to facilitate their application of knowledge to inform decision-making. These efforts are best suited to situations when end-users have already identified a key information gap and need to investigate the state of knowledge on a clearly defined question or issue in order to respond and inform decision-making in a timely way (Lavis et al., 2006).

The second stage described above refers to the need to monitor and evaluate the extent that knowledge impacts and influences various policy and practice outcomes (Lavis et al., 2003b). These efforts are of increasing interest to both researchers and funding agencies. In addition, monitoring and evaluation is beneficial for policy-makers and those who support them because it can improve the transparency and accountability of
the policy-making process and it encourages a culture of “evidence-informed” management (Segone, 2008). Monitoring and evaluation can also be useful to (Hanney et al., 2003):

- *Justify spending or funding* on knowledge synthesis (KS) and primary research of policy-relevant and timely issues
- *Prioritize resource allocation and funding* for future research
- *Identify gaps, opportunities and lessons learnt* to improve the likelihood that knowledge will be used to inform future policy and practice decision-making successfully

This chapter provides an overview of knowledge application (user-pull) and evaluation strategies to support KTE and evidence-informed policy and decision-making.

### 5.2. Knowledge application strategies and resources

Decision-makers often do not have the time or ability to search the scientific literature to identify, critically appraise and evaluate KS and primary research evidence. Numerous web-based resources (e.g. registries or databases) have been developed to facilitate end-user access to and interpretation of this knowledge. These resources catalogue and index KS evidence such as systematic reviews (SRs) and they often provide their own critical appraisals and user-friendly summaries for end-users. Other efforts that can help to facilitate the application of knowledge among end-users include rapid-response units, self-assessment tools and prompts, and skill-development programs and resources (Lavis et al., 2006).

**Online databases and registries**

A recent scoping review in the health sector identified 20 different web-based resources that can be used by end-users to support their application of KS evidence in decision-making (Chambers et al., 2011). However, these resources primarily focus on cataloguing and indexing SRs of the effects of healthcare interventions and most are not likely to include evidence on agri-food public health issues. Three relevant resources that could be useful for policy-makers and those who support them, practitioners, and other end-users in this sector are noted below:

- **Health Evidence** ([http://healthevidence.org](http://healthevidence.org)) – Online registry of KS and SR evidence and guidelines about public health interventions. Their staff provide a critical assessment report scored from 1 (low quality) to 10 (high quality) along with a summary of the key characteristics of the included reviews. This resource has begun to include evidence on agri-food public health topics under the “environmental health”, “communicable disease/infection” and “food safety and inspection” classifications.
- **Health Systems Evidence** ([http://www.healthsystemsevidence.org/](http://www.healthsystemsevidence.org/)) – Online registry of SRs and other knowledge syntheses in the area of health services and health systems. Includes quality ratings (on a scale from 1-9) for many included SRs based on the validated AMSTAR tool and includes one-page summaries of indexed reviews. Content is primarily focused on health, but also contains some evidence in the broader areas of public health and food security. Also contains many complementary resources to assist end-users about how to search for, appraise and use knowledge to inform decision-making.

- **FoodRisk.org** ([http://foodrisk.org/](http://foodrisk.org/)) – Initiative of the Joint Institute for Food Safety and Applied Nutrition and Centre for Food Safety and Applied Nutrition (United States Food and Drug Administration). A comprehensive website that primarily indexes and provides resources for risk assessments and other risk-based tools to support risk management and decision-making, but also includes KS evidence (e.g. SRs and meta-analyses [MA]) that addresses agri-food public health issues.

### Rapid-response units

Some funding, research and intermediary organizations have developed and adopted rapid-response units to provide immediate policy- and decision-making advice for urgent requests and issues (Lavis et al., 2006). These have largely been developed in the healthcare and health services sectors. One example is the Canadian Agency for Drugs and Technologies in Health’s (CADTH) Rapid Response Service. This service provides a range of KS activities of various levels of robustness depending on various timelines (Canadian Agency for Drugs and Technologies in Health, 2013). Services vary from provision of a reference list of available evidence in a 5-10 day turnaround to a full SR-MA in a 4-5 month timeframe (CADTH, 2013).

In the agri-food public health sector, the European Food Safety Authority (EFSA) has adopted a KS framework to support their routine food and feed safety risk assessments (EFSA, 2010). These activities are designed to provide scientific advice and policy support of various timelines to European Union Member Countries about food and feed safety issues. However, specific KS “rapid response” services have not yet been developed to provide evidence for various urgent timeframes (EFSA, 2010).

### Self-assessment tools and prompts

Self-assessment tools can be used by policy-makers, practitioners, and other end-users to evaluate their organizational strengths, needs, gaps and opportunities to conduct evidence-informed policy- and decision-making activities (Lavis et al., 2006). One example is the Self-Assessment Tool developed by the Canadian Foundation for Healthcare Improvement (2013). This tool can be used by organizations to evaluate their capacity to:
- **Acquire evidence** – e.g. access to library services
- **Assess evidence** – e.g. in-house training in critical assessment
- **Adapt its format** – e.g. use of plain-language summary templates
- **Apply it in decisions** – e.g. supportive organizational culture and leadership

The tool can be freely accessed online: [http://www.cfhi-fcass.ca/PublicationsAndResources/ResourcesandTools/SelfAssessmentTool.aspx](http://www.cfhi-fcass.ca/PublicationsAndResources/ResourcesandTools/SelfAssessmentTool.aspx)

Prompts and reminders can also be used to promote and foster a culture of evidence-informed policy- and decision-making in governments and organizations. For example, prompts can be embedded in an organization’s routine procedures to verify the use and consideration of knowledge to inform policy briefings, reports and other documents. The Ontario Ministry of Health and Long-Term has adopted this approach by developing a Research Evidence Tool that public servants are required to complete as part of all cabinet submissions. The tool requires a description of the following information:

- **Key findings from knowledge sources** used to inform the policy submission
- **The types of knowledge sources** used (e.g. primary research, grey literature, SRs)
- **The national and international jurisdictions** consulted

The tool is meant to increase the transparency and accountability on the use of knowledge to support policy-making in this organization.

**Skill-development programs and tools**

Most policy-makers, policy analysts and advisors, and practitioners are not formally trained and educated in how to properly identify, evaluate, synthesize and interpret complex knowledge, and they typically have very diverse backgrounds. Similarly, researchers and research analysts typically do not have formal training and education in how to present and communicate their findings in user-friendly and plain-language formats. These skills can be developed and enhanced through specialized training programs and resources.

Two examples of skill-development programs in the health sector, one targeted at end-users and one at researchers, are outlined below:

- **Executive Training for Research Application (EXTRA) Program** ([http://www.cfhi-fcass.ca/WhatWeDo/EducationandTraining/EXTRA.aspx](http://www.cfhi-fcass.ca/WhatWeDo/EducationandTraining/EXTRA.aspx)) – This program aims to develop capacity and leadership in the area of KTE and evidence-informed policy-making among managers and executives in the Canadian health system. It is a 14-month fellowship that includes residency sessions, curriculum modules, network-building and intervention projects.
• **Canadian Science Policy Fellowship Program** ([http://www.cihr-irsc.gc.ca/e/43553.html](http://www.cihr-irsc.gc.ca/e/43553.html)) – A six-month training program administered by the Canadian Institutes of Health Research for researchers to gain experience and build networks by working in a policy setting.

In addition to the above programs, several resources and toolkits have been developed to provide guidance for end-users on how to effectively engage and conduct KTE and evidence-informed policy- and decision-making activities (a list of relevant resources is noted in Appendix A). This handbook complements these existing resources by providing a specific focus on the application of KTE methods and practices to the agri-food public health sector.

### 5.3. Knowledge evaluation methods

Evaluation of the impact of knowledge to inform policy and practice decision-making requires methods beyond the conventional academic approaches of counting the number of journal publications and conference presentations (Hovland, 2007). It requires an analysis of changes to policies and practices, changes to networks and relationships, and changes to the knowledge, attitudes and behaviours of policy-makers, practitioners, and other end-users. This section provides a brief overview of different methods, indicators and measures that can be used to evaluate the impact of knowledge to inform policy and practice decision-making.

The choice of evaluation methods will vary depending on many factors, including the purpose of the evaluation, the specific context, the types of impacts and outcomes considered, and practical and logistical constraints (Hanney et al., 2003; Boaz et al., 2009). Seven different methods are described below:

1) Questionnaires  
2) Qualitative interviews  
3) Qualitative case studies  
4) Document analysis  
5) Logical framework approach  
6) Outcome mapping  
7) Rapid outcome assessment

There are many additional methods and approaches that can be used to evaluate the impact of knowledge in policy and practice contexts, such as most significant change, innovation histories (similar to case studies), episode studies, bibliometric analysis, and social network analysis, but these are beyond the scope of this handbook (Hovland, 2007; Boaz et al., 2009; Stanwick et al., 2009). For additional details about these methods and other aspects of knowledge evaluation, readers should refer to Hovland (2007), Boaz et al. (2009) and Stanwick et al. (2009). In general, it is recommended to use a mixed-method approach and a combination of different quantitative and
qualitative research methods and indicators in knowledge evaluation (Boaz et al., 2009; Mansfield and Grunewald, 2013).

**Questionnaires**

Questionnaires can be used to gather attitudes, knowledge and self-reported behaviours and practices regarding the use of knowledge to inform decision-making. Two recent SRs summarized existing questionnaires and other instruments that have been used in the health and other sectors to measure the impact and use of knowledge for policy and practice. Both reviews identified some promising instruments for use in the evaluation of KTE implementation and impact in different contexts (Van Eerd et al., 2011; Chaudoir et al., 2013). Van Eerd et al. (2011) identified 54 relevant articles containing one or more instruments for KTE evaluation, but most measured knowledge use by practitioners (e.g. clinicians and teachers), with only 3% targeted towards policy-makers, and only 9% were developed in an agri-food context. Similarly, Chaudoir et al. (2013) identified a total of 62 instruments that measured various structural, organizational, provider, patient and innovation factors, mostly within healthcare-related and clinical settings (76%). Authors of both of these reviews found that many instruments did not report essential measurement properties (e.g. validity and reliability) and were created for specific situations and contexts, which limits their potential generalizability (Van Eerd et al., 2011; Chaudoir et al., 2013).

**Qualitative interviews**

In contrast to questionnaires, semi-structured qualitative interviews are a more appropriate method to determine the use of knowledge in situations with multiple and complex nuances (e.g. social and political influences). They also allow greater flexibility than quantitative questionnaires to tailor the questions and probe participants based on the nature of previous responses (Hanney et al., 2003; Boaz et al., 2009). They are also used to collect information about end-user attitudes, knowledge and behaviours, but they allow a more in-depth investigation and analysis of the level of knowledge impact while also exploring contextual differences among participants and situations (Hanney et al., 2003).

**Qualitative case studies**

Case studies are a qualitative method that can be used in knowledge evaluation and they are a particularly strong choice when a holistic, in-depth analysis is needed (Boaz et al., 2009; Engel and Nicolai, 2012). They provide a contextual understanding of the causal mechanisms for how knowledge impacts policy or practice outcomes (Engel and Nicolai, 2012). Some of the disadvantages of this method include difficulty in selecting the most appropriate cases, potential lack of representativeness of the selected cases, and its relative resource- and time-intensive approach (Boaz et al., 2009; Engel and Nicolai, 2012). Many international development agencies use the case study approach,
including the International Food Policy Research Institute, based in Washington, DC, to articulate, measure and document the impacts of their policy research (Hovland, 2007; Engel and Nicolai, 2012).

**Document analysis**

This qualitative method is often used in combination with questionnaires and interviews and as part of case studies to measure the consistency or agreement between knowledge and policy and practice outcomes (Hanney et al., 2003; Boaz et al., 2009). It can also be used to determine the extent that policy-makers, practitioners, and other end-users referred to or were informed by different sources of knowledge in speeches, statements and reports. Depending on availability, potential sources for document analysis could include: research publications and reports; legislation and regulations; guidelines and protocols; policy statements, speeches and articles; and meeting reports or minutes (Hanney et al., 2003).

**Logical framework approach**

The logical framework approach, also referred to as “logframe”, is one of the most common approaches to monitoring and evaluation in international development. The primary output of the approach is a logframe matrix, which is a tabular summary of the project goals, purpose, inputs, outputs, activities, assumptions, stakeholders, monitoring indicators, and evaluation plan (Hovland, 2007; Bennett and Jessani, 2011). Logframes are mostly used as a planning and management tool for international development projects, but they can also be used to guide the evaluation of knowledge impact on policy and practice outcomes (Hovland, 2007; Bennett and Jessani, 2011). However, their effectiveness as an evaluation approach has been criticized due to its narrow focus on pre-specified and expected measurement indicators and its inability to account for unanticipated impacts (Hovland, 2007).

**Outcome mapping**

This method was developed by the International Development Research Centre in Canada (Hovland, 2007). It focuses on evaluating the contribution of projects – or knowledge – to lead to specific and tangible outcomes such as changes in behaviours, relationships or actions of those involved in or affected by the issue (Hovland, 2007; Jones and Hearn, 2009). Outcome mapping is a participatory approach and it is particularly useful when attempting to promote knowledge uptake and influence policy for complex issues (Jones and Hearn, 2009). It has three main stages (Bennett and Jessani, 2011):

1) *Intentional design* – determine consensus on the most important macro-level changes or outcomes
2) **Outcome and performance monitoring** – determine the specific methods that will be used to monitor the changes and outcomes

3) **Evaluation planning** – determine an evaluation plan and priorities

**Rapid outcome assessment**

This method of evaluation was developed by the Overseas Development Institute’s Research and Policy in Development program (Bennett and Jessani, 2011). Rapid outcome assessment is a visual method that can be used to assess the contribution of knowledge to specific changes in policy or the policy environment (Hovland, 2007). The process involves mapping of the policy environment before and after knowledge is used, identifying the key stakeholders and policy actors, describing and mapping changes in their behaviours, and determining the internal and external influences on the policy environment and behaviours of key actors (Hovland, 2007).

**Agri-food public health example**

An example of a mixed-method approach to evaluating the use of a KTE method to impact dairy producer attitudes, knowledge and practices is noted in **Box 5.1**.

**Box 5.1: Evaluating knowledge uptake among Canadian dairy producers**

**Project summary:**
Roche et al. (2012) used a mixed-method approach to evaluate the effect of participatory dairy producer groups to increase knowledge and on-farm good production practices for prevention and control of Johne’s Disease among producers. Called the “focus farm approach”, the KTE strategy includes small groups of 10-15 producers that meet across Ontario, Canada, four or more times a year to discuss Johne’s Disease prevention and control practices and knowledge about dairy cattle health management. The KTE evaluation plan includes an assessment of group facilitators, pre- and post-surveys with participating producers, focus groups with participants, and a pre- and post-evaluation of on-farm risk management practices for control of Johne’s Disease. Outcome indicators comprise direct and indirect measures, including producer knowledge, attitudes and practices related to Johne’s Disease and cattle management. Preliminary results indicate that the focus farm approach is positively reviewed among producers and impacts their knowledge and practices towards Johne’s Disease control.

**For more information:**

http://suite.esolutionsgroup.ca/Module/Calendar/Document/Download/70348773-3052-4db5-b03b-46ce46d7412a
5.4. Knowledge evaluation measures and indicators

It is important to measure not only whether knowledge is used but also how it is used and for what purpose (Lavis et al., 2003b). There are three general forms of knowledge use among end-users:

1) Direct
2) Indirect
3) Symbolic

Direct use

Direct, or instrumental, knowledge use refers to changes in the behaviour of end-users or direct actions that are taken based on the knowledge. This could include changes in policies, procedures or programs. As described in Chapter 1, an example of direct knowledge use in agri-food public health was during 1998-1999, when an expert panel was established by Health Canada to conduct a SR-MA of the animal health and production impacts of recombinant bovine somatotropin (rbST) in dairy cattle (Health Canada, 1998; Dohoo et al., 2003a; Dohoo et al., 2003b). The review concluded that there were several animal welfare concerns associated with rbST and the results were used to inform Health Canada’s subsequent decision not to approve its sale in Canada (Health Canada, 1998; Dohoo et al., 2003a; Dohoo et al., 2003b).

Indirect use

Indirect, or conceptual, knowledge use refers to changes in the awareness and understanding of the issue among end-users based on the knowledge. Although it does not result directly in specific actions or policy changes, indirect knowledge use can provide end-users with new insights into the issue and situation, such as the strengths and weaknesses of different policy options, and can influence how they subsequently approach potential actions on the issue (Segone, 2008).

Symbolic use

The use of knowledge to support a position already held or to defend a decision that is already made is referred to as symbolic – or political – knowledge use. This type of knowledge use is often apparent among lobbyist groups that seek out confirming evidence to support their particular position on an issue.

It should be noted that these three forms of use do not necessarily equate to different levels of knowledge impact. For example, providing knowledge to enhance end-user understanding of and attitudes toward the issue (indirect use) can be as useful and impactful as direct use depending on the specific context.
Outcomes and indicators of use

Numerous indicators can be used to assess the use and impact of knowledge in policy and practice decision-making (Mansfield and Grunewald, 2013). Broad indicators such as changes in health status (e.g. reduction in the incidence of foodborne illness) are not practical to measure because they are complex and confounded by many factors (Lavis et al., 2003b). Instead, tangible criteria should be used, which can be categorized based on whether they measure processes (e.g. number of evidence summaries published and distributed) or outcomes (e.g. direct use of knowledge to inform policy changes). A general list of potential indicators is shown in Table 5.1. These indicators should be modified and made more specific given the context and situation of use.

A recent workshop in the international development sector brought together 30 KTE practitioners to develop a comprehensive list of 100 specific knowledge evaluation indicators as well as to develop practical suggestions and recommendations for improving the measurement of knowledge impact (Mansfield and Grunewald, 2013). Readers should refer to Mansfield and Grunewald (2013) for additional, more specific examples of knowledge evaluation indicators.

Table 5.1. General measures and indicators of knowledge use to inform policy and practice decision-making. Adapted from Lavis et al. (2003b) and Mansfield and Grunewald (2013).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process</strong></td>
<td>• Number of targeted publications and documents produced for transfer of knowledge to end-users (e.g. evidence summaries and evidence briefs)</td>
</tr>
<tr>
<td></td>
<td>• Number of sources and documents consulted or accessed to inform the policy- and decision-making process with knowledge (e.g. KS reviews, research publications, grey literature, expert opinion)</td>
</tr>
<tr>
<td></td>
<td>• Number of interactions, contacts, linkages, and other engagement activities between researchers, policy-makers, practitioners, and other stakeholders</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>• End-user attitudes, perceptions, awareness, and knowledge of the research, KTE products and issue</td>
</tr>
<tr>
<td>Indirect use</td>
<td>• End-user actual or self-reported use of knowledge to directly inform or support policy- and decision-making (e.g. through issue agenda-setting or the formulation, revision, implementation and evaluation of policies or programs)</td>
</tr>
<tr>
<td>Direct use</td>
<td>• Integration of knowledge within policies, programs, documents, and organizational planning, structures and systems</td>
</tr>
</tbody>
</table>
5.5. Practical exercise – Developing a knowledge evaluation strategy

Scenario:

The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) is a government-led program that conducts ongoing surveillance for antimicrobial use (AMU) and antimicrobial resistance (AMR) in selected bacterial organisms from human, animal and food sources in Canada. However, the CIPARS program does not routinely monitor AMU or AMR in the aquaculture sector, including aquatic species and seafood. Food safety and AMR is an increasing concern in the aquaculture industry due to growing public consumption and demand for seafood. In addition, over 120 outbreaks of seafood-related illnesses were reported from 2005-2010 (Tuševljak et al., 2012).

In response to these concerns, a scoping review and SR-MA of the literature was conducted to identify the prevalence and risk factors for selected bacterial pathogens, including AMU, AMR and drug residues and dyes, in targeted aquatic and seafood species and retail products (Tuševljak et al., 2012). The SR-MA found that the prevalence of some pathogens in seafood species (e.g. *Vibrio* spp. in shellfish and crustaceans) was very high, although there was significant heterogeneity (wide ranges in reported prevalence estimates) across many pathogen and seafood combinations. In addition, there was an overall lack of well-reported research for many pathogen and seafood product combinations, indicating a need for additional research and surveillance initiatives of seafood and aquatic species.

The findings from this SR-MA have been published in a peer-reviewed journal and presented at various conferences and events. However, there is a need to conduct additional KTE activities, including targeted dissemination and exchange of the results to key end-users and stakeholders (e.g. government research and surveillance groups, academia, aquaculture industry personnel, processors and producers). The following additional KTE activities have been proposed to increase dissemination of the findings to these audiences: distribution of an electronic newsletter and evidence summaries, webinars to exchange results with multiple end-users, and a stakeholder dialogue to engage all interested and impacted stakeholders on potential policy actions.

**Question:**

Your task is to develop an evaluation plan to demonstrate the potential impact of the KTE activities and SR-MA results to inform policy and practice. Using the following table, brainstorm a knowledge impact and evaluation plan, listing the corresponding KTE activities, methods for evaluation, and measures and indicators that could be used to assess its impact. An example is provided in the first two rows.
<table>
<thead>
<tr>
<th>KTE activities</th>
<th>Methods of evaluation</th>
<th>Measures of knowledge use</th>
<th>Indicators of knowledge use and potential impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify targeted dissemination and exchange activities</td>
<td>Multiple methods can be used to evaluate different measures and indicators</td>
<td>Define process and outcome measures</td>
<td>Please be specific in your selection of indicators (e.g. number of evidence briefs produced and number of stakeholders to which they are distributed)</td>
</tr>
<tr>
<td>Electronic newsletter</td>
<td>Counting of email distribution lists</td>
<td>Process</td>
<td>Number of end-users to which the newsletter is distributed</td>
</tr>
<tr>
<td>Electronic newsletter</td>
<td>Questionnaire</td>
<td>Indirect use</td>
<td>Extent that end-users read the newsletter and their attitudes towards the issue</td>
</tr>
</tbody>
</table>
5.6. Key references and suggested readings

Bennett, G., Jessani, N. (Eds.), 2011. The knowledge translation toolkit. SAGE Publications India Pvt Ltd, New Delhi, India.


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Dobbins, M., Robeson, P., Ciliska, D., Hanna, S., Cameron, R., O’Mara, L., DeCorby, K., Mercer, S., 2009. A description of a knowledge broker role implemented as part of a
randomized controlled trial evaluating three knowledge translation strategies. Implement Sci. 4, 23.


European Food Safety Authority, 2010. Application of systematic review methodology to food and feed safety assessments to support decision making. EFSA J 8, 1637.


University of Guelph, 2013. Agri-food and rural link (KTT program) http://www.uoguelph.ca/research/omafra/partnership/KTT_and_IP.shtml.


Appendix A: List of key KTE resources and organizations

The list provides a selection of key websites, organizations and online repositories that provide resources or support for knowledge transfer and exchange (KTE) and evidence-informed policy-making. It is not meant to be exhaustive, but to highlight a variety of useful and unique resources from agri-food public health and broader agri-food and health contexts.

**Agri-Food and Rural Link.** [http://www.uoguelph.ca/omafra_partnership/ktt/en/agrinfoodrurallink.asp](http://www.uoguelph.ca/omafra_partnership/ktt/en/agrinfoodrurallink.asp)
- University of Guelph, Ontario Ministry of Agriculture and Food, and Ontario Ministry of Rural Affairs Partnership that provides resources about KTE in the agri-food sector, including plain language research summaries and videos, KTE events and a community of practice, and summaries of funded KTE research and projects

**Canadian Foundation for Healthcare Improvement.** [http://www.cfhi-fcass.ca/PublicationsAndResources/ResourcesandTools.aspx](http://www.cfhi-fcass.ca/PublicationsAndResources/ResourcesandTools.aspx)
- Includes several resources to support KTE and evidence-informed policy-making, including knowledge dissemination and exchange guides and a self-assessment tool for organizations to evaluate their capacity to use research.

**Canadian Institutes of Health Research.** [http://www.cihr-irsc.gc.ca/e/29418.html](http://www.cihr-irsc.gc.ca/e/29418.html)
- Provides resources, learning modules and casebooks for KTE in health research.

**Centre for Evidence Based Medicine.** [http://www.cebm.net/](http://www.cebm.net/)
- Provides resources, training and guidance for knowledge synthesis and evidence-based medicine. Also provides tools to support different stages of the evidence-based medicine process, including question formulation, identifying evidence and critical appraisal.

**Cochrane Collaboration.** [http://www.cochrane.org/](http://www.cochrane.org/)
- Provides resources and guidelines to support knowledge synthesis, with a focus on healthcare interventions. Cochrane systematic reviews (SRs) are indexed in the Cochrane Database of Systematic Reviews.

**Health Evidence.** [http://healthevidence.org/](http://healthevidence.org/)
- Online registry of SRs, syntheses and guidelines for public health interventions. Also provide knowledge brokering consultations and training, critical appraisals and summaries for all indexed resources, and tools to support evidence-informed decision-making in public health.

- Online registry of SRs and other knowledge syntheses in the area of health services and health systems, as well as quality ratings and one-page summaries of indexed content. Content is primarily focused on health, but also contains some evidence in the broader areas of public health and food security. Also contains many complementary resources to assist end-users about how to search for, appraise and use research to inform decision-making.


- Wiki site that is supported by the Consultative Group on International Agricultural Research, Knowledge Management for Development Community (KM4DEV), the Food and Agriculture Organization, UNICEF and the United Nations Development Program. The wiki lists methods and tools that can be used to support KTE for international development in the areas of agriculture, fisheries, food and nutrition.


- Initiative of the Joint Institute for Food Safety and Applied Nutrition and Centre for Food Safety and Applied Nutrition (United States Food and Drug Administration). Primarily indexes and provides resources for risk assessments and other risk-based tools to support risk management and decision-making (e.g. risk profiles and multi-criteria decision analysis), but also includes knowledge syntheses (e.g. SRs and meta-analyses) that address agri-food public health issues.


- Contains resources and guides for policy-makers and practitioners to support evidence-informed decision-making about environmental health issues (e.g. inventory of evidence reviews, workshops, journal club).

National Collaborating Centre for Healthy Public Policy. [http://www.ncchpp.ca/](http://www.ncchpp.ca/)

- Contains resources and guides to support the synthesis of public policies, knowledge exchange and deliberative processes, economic evaluation, and other aspects of evidence-informed public policy.

National Collaborating Centre for Methods and Tools. [http://www.nccmt.ca/registry/browse/all/1/view-eng.html](http://www.nccmt.ca/registry/browse/all/1/view-eng.html)

- Contains a registry of >100 resources to support evidence-informed policy-making in public health, including methods and tools for knowledge synthesis, dissemination, exchange and evaluation. Also provides training and guidelines on the evidence-informed public health process.
**K* (KStar) Initiative.**
http://www.inweh.unu.edu/River/KnowledgeManagement/KStar.htm
- Initiative of the United Nations University – Institute for Water, Environment and Health, in Canada, focused on how to better understand and apply KTE concepts, referred to collectively as “K*”, in various sectors. A key output of this initiative is a K* Concept Paper resulting from a 2012 conference that describes the core concept of K* and the key principles of its functions and processes.

**KT Clearinghouse.** http://ktclearinghouse.ca/
- Repository that is funded by the Canadian Institutes of Health Research. Provides KTE guidelines, tools, resources and access to networks and an online community.

**McMaster Health Forum.** http://www.mcmasterhealthforum.org/index.php
- The McMaster Health Forum conducts stakeholder dialogues and produces evidence briefs for high-priority health topics. Their website explains their approach and provides links to examples of evidence briefs and dialogue summaries. The Forum is also home to Health Systems Evidence (www.healthsystemsevidence.org), which contains many tools and resources to support evidence-informed policy-making.

**National Center for the Dissemination of Disability Research.**
http://www.ncddr.org/ktinfocenter/
- Provides a directory of relevant papers and journal articles, guidelines, training, and other resources related to KTE.

**Plain Language Action and Information Network.** http://www.plainlanguage.gov/
- Provides guidelines, examples, training, resources and tips for plain language writing and clear communication.

**Overseas Development Institute.** http://www.odi.org.uk/programmes/rapid/
- The Research and Policy in Development Programme at the Overseas Development Institute provides guidelines, case studies, toolkits and resources to support evidence-informed policy-making in international development.

**SUPPORT Tools for Evidence-Informed Health Policy-Making.** http://www.health-policy-systems.com/supplements/7/s1
- A series of 18 guiding articles aimed at policy-makers and those who support them to facilitate their conduct of various evidence-informed policy-making activities, including how to find, evaluate, interpret and assess evidence.
Appendix B: Three-page evidence summary of the efficacy of vaccination to control *Salmonella* in broiler chickens

**Evidence summary: Page 1**

Can vaccines reduce *Salmonella* in broiler chickens?

*Transforming research into practice*

**Introduction**

Broiler chickens are an important source of *Salmonella* bacteria. *Salmonella* is a zoonotic pathogen, meaning that it can be transmitted between humans and animals. The bacteria can also survive well in many different environments and spread between animals. Most poultry-associated outbreaks of *Salmonella* in humans are related to cross-contamination during food preparation and improper cooking of chicken meat and eggs.

Many different serovars of *Salmonella* can cause harm to humans. *Salmonella Typhimurium* and *Enteritidis* are two common serovars of public health concern, which can be carried by chickens. Controlling the introduction of *Salmonella* in 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 protective immunity against *Salmonella* infection. Vaccines can be given through water, spray or an injection and are made with either live or killed serovars of *Salmonella*. The main differences between these two types of vaccines are summarized in Table 1.

Table 1. Comparison of live and killed serovars of the *Salmonella* bacteria.

<table>
<thead>
<tr>
<th>Live</th>
<th>KILLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Contains a living but modified serovar of <em>Salmonella</em></td>
<td>- Contains a killed <em>Salmonella</em> serovar</td>
</tr>
<tr>
<td>- Activates the bird’s whole immune response</td>
<td>- May target more than one type of <em>Salmonella</em> serovar</td>
</tr>
<tr>
<td>- Has a longer lasting effect and requires fewer doses</td>
<td>- Activates only the antibody-producing part of the immune system and requires multiple doses</td>
</tr>
</tbody>
</table>

Killed vaccines are currently not given to broilers for two main reasons:

1) Chickens reach slaughter age before immunity from killed vaccines can fully develop since the immune response from killed vaccines takes a long time to develop.

2) Killed vaccines require a long clearance time (withdrawal time) before slaughter, making it impossible to use for short-lived broilers.

What you need to know

Evidence suggests there is a role for live vaccines in *Salmonella* control; however, the research captured in this review was not fully representative of commercial conditions.

If studies are able to show vaccine effectiveness under commercial conditions, vaccines may become a more valuable preventative measure against *Salmonella*.

While vaccines may be used on a farm for many other reasons, they are also one possible option for *Salmonella* control. Effective control and prevention of infection requires the use of multiple measures throughout broiler chicken production.
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How effective are vaccines?

A recent SR-MA\(^*\) analyzed 22 studies on vaccines for broiler chickens using live and killed serovars of Salmonella.

- Of the 22 studies included in this systematic review, nine were comparable. Results of the studies are summarized in Table 2.
- All of the studies were done in research settings outside of Canada.
- Research in layer breeds of chickens was excluded from this review.
- Live vaccines were shown to reduce but not eliminate Salmonella in broiler chickens.

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

<table>
<thead>
<tr>
<th>Serovar used for vaccine</th>
<th>Type of vaccine</th>
<th># studies that looked at this vaccine</th>
<th>% carcasses contaminated with Salmonella</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. Typhimurium (live)</td>
<td>Live</td>
<td>4 studies/5 trials</td>
<td>24%</td>
</tr>
<tr>
<td>S. Enteritidis (live)</td>
<td>Live</td>
<td>1 study/1 trial</td>
<td>81%</td>
</tr>
<tr>
<td>S. Typhimurium/</td>
<td>Killed</td>
<td>1 study/3 trials</td>
<td>78% (25 – 76%)</td>
</tr>
<tr>
<td>Enteritidis/</td>
<td>Killed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typhimurium (combined)</td>
<td>Killed</td>
<td>2 study/3 trials</td>
<td></td>
</tr>
<tr>
<td>S. Enteritidis</td>
<td>Killed</td>
<td>1 study/1 trial</td>
<td>No decrease predicted</td>
</tr>
</tbody>
</table>

*Data extracted from meta-analysis.


Which Salmonella vaccines are available to the poultry industry?

Vaccines for Salmonella are regulated by the Canadian Food Inspection Agency. Nine Salmonella vaccines for poultry were approved and licensed for use in Canada in 2012 and are listed in Table 3. There may be similarities between vaccines listed in Table 3 and those included in the systematic review, however they are not necessarily the same.

**Table 3. Summary of the nine commercial Salmonella vaccines currently approved for use in Canada.**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Scientific name</th>
<th>Manufacturer</th>
<th>Age and method of administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>AviPro(^*)</td>
<td>S. Typhimurium vaccine</td>
<td>Lohmann Animal Health International, USA</td>
<td>Use at one day of age by spray and at 14 days of age through drinking water.</td>
</tr>
<tr>
<td>Selmune(^*)</td>
<td>S. Typhimurium vaccine</td>
<td>Ceva Biomune, USA</td>
<td>Use at one day of age by spray or drinking water. Repeat dose recommended if chicks are to be kept beyond 7 weeks of age.</td>
</tr>
<tr>
<td>AviPro(^*) 109 SE4 Conc.</td>
<td>S. Enteritidis bacterin</td>
<td>Lohmann Animal Health International, USA</td>
<td>Inject at 12 and 16 weeks of age. Re-inject after 4 weeks and during molt.</td>
</tr>
<tr>
<td>AviPro(^*) 329 ND-1B2 - SE4 Conc.</td>
<td>S. Enteritidis bacterin</td>
<td>Lohmann Animal Health International, USA</td>
<td>Inject at 12 and 16, or 13 and 17 weeks of age. Re-inject after 4 weeks and during molt.</td>
</tr>
<tr>
<td>Bron-Nowvac™ SE</td>
<td>S. Enteritidis bacterin</td>
<td>Merck Animal Health, Canada</td>
<td>Inject at 10 weeks of age and after 6 weeks.</td>
</tr>
<tr>
<td>Layemune™ 3 (0.25)</td>
<td>S. Enteritidis bacterin</td>
<td>Ceva Biomune, USA</td>
<td>Inject at 12 weeks of age or older and after 4 to 6 weeks. Injection just before molt is recommended.</td>
</tr>
<tr>
<td>Layemune™ 3 (0.50)</td>
<td>S. Enteritidis bacterin</td>
<td>Ceva Biomune, USA</td>
<td>Inject at 12 weeks of age or older and after 4 to 6 weeks. Injection just before molt is recommended.</td>
</tr>
<tr>
<td>Layemune™ SE (0.25)</td>
<td>S. Enteritidis bacterin</td>
<td>Ceva Biomune, USA</td>
<td>Inject at 12 weeks of age or older and after 4 to 6 weeks. Injection just before molt is recommended.</td>
</tr>
</tbody>
</table>

*SR-MA*: Systematic Review and Meta-analysis

*Systematic Review*: a transparent process used to analyze all published studies on a specific area of knowledge or intervention

*Meta-analysis*: a statistical method for combining results of many studies into a single finding
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Can vaccines reduce Salmonella in broiler chickens?

Salmonella vaccines and control options

The broiler chicken industry is complex with multiple levels of breeding and production. Salmonella control at all stages of the production chain can influence Salmonella control efforts throughout the rest of the chain.

The industry begins with pedigreed pure-line chickens that are multiplied through five generations, setting the genetic traits of ~1.5 to 2.8 million commercial birds.

Multipliers produce the eggs from which broiler chickens are hatched. In chicken breeding, it takes 4 to 5 years for the pedigree selection at the top of the pyramid to be seen in retail chicken meat.

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

- Industry experts suggest that the middle of the production pyramid, specifically the broiler breeders (also called the multipliers), is the likely target market for vaccine use.
- Vaccination at the broiler level is not considered practical at present simply because turn-over of birds in these barns is faster than the time it takes for the birds to mount an immune response following vaccination. Rather than vaccination, breeder farms focus on a combination of interventions such as biosecurity practices as well as feed and water additives for Salmonella control.
- Beyond commercially available vaccines, a new direction for Salmonella control involves autogenous vaccines. Autogenous vaccines are developed from the serovar isolated from the target flock allowing for an intervention that closely matches the specific needs of the flock. These vaccines were not examined in this systematic review.

Are there any sensitivities?

- 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 and was not investigated in this systematic review.
- If studies are able to show vaccine effectiveness under commercial conditions, vaccines may become a more valuable preventative measure against Salmonella.
- Vaccination is a farm-specific decision to be made in cooperation with professional veterinary services. The use of vaccines is just one of many available interventions for Salmonella control programs. Effective control and prevention of Salmonella requires adherence to multiple measures or interventions along the “farm-to-fork” continuum of chicken production.
Dr. Andrijana Rajić

Andrijana works at the Food Safety and Codex Unit, Agriculture and Consumer Protection Department, Food and Agriculture Organization (FAO-UN, Rome, Italy). She is the FAO’s Secretary for One Health. She is an Adjunct Professor at the University of Guelph and University of Saskatchewan (Canada) and is currently on leave from the Laboratory for Foodborne Zoonoses (LFZ), Public Health Agency of Canada, in Guelph. Andrijana earned her DVM and MSc degrees in Infectious Diseases from the University of Sarajevo, and MSc and PhD degrees in Epidemiology from the University of Guelph. She has >20 years of professional experience in the science-to-policy arena at the interface of animal health, food safety and public health, at the provincial and national/federal levels in Europe and Canada and at the international level. In the early 1990’s, she advised two Chief Veterinary Officers in Croatia, and since then has consulted many science-to-practice or policy- and decision-makers and managers in Canada and internationally. Andrijana co-ordinated the establishment (2005-2011) of the LFZ’s Knowledge Synthesis and Transfer (KST) Team, which has pioneered the use of different KST methods in agri-food public health through an integrated approach to research, practice, and training. The group has developed and published several cornerstone scientific papers and guides for building and integrating KST capacity in the agri-food public health sector. This included delivery of KST training to >1,000 professionals or graduate students worldwide. She served on the Working Group for Systematic Reviews in Feed and Food Safety of the European Food Safety Agency (EFSA). Andrijana has also co-advised two post-doctoral fellows, several graduate students (MSc and PhD) in epidemiology, and many undergraduate students from science, veterinary, engineering and arts backgrounds. Her professional interests are epidemiology, mixed-methods research, knowledge synthesis, science-to-policy, food safety, one health, and international development. Her passions are journalism, music (live concerts) and travel.
Dr. Ian Young

Ian is an Epidemiologist with LFZ, Public Health Agency of Canada. He earned his undergraduate degree in Public Health and Safety from Ryerson University in 2007 and his PhD in Epidemiology from the University of Guelph in 2010, and he is a Certified Public Health Inspector (Canada). He has extensive expertise and experience conducting knowledge syntheses, KTE, and mixed-method research at the interface of human, animal, agri-food and environmental health. He has experience working in public health practice at the local level in Ontario, Canada, as well as in agri-food public health research and KTE in academia and at the federal level (Public Health Agency of Canada). He has also been involved in international collaborations with the Pan-American Health Organization to enhance on-farm food safety in Argentina and with the FAO in Rome to develop international training material in the area of risk analysis. Ian currently participates in an Intergovernmental Science-to-Policy Working Group in Canada and contributes to a multidisciplinary KTE Community of Practice in Guelph. He has extensive experience teaching university courses and conducting training workshops in public health and KTE science to undergraduate and graduate students, researchers, policy- and decision-makers, practitioners, and other professionals in Canada and internationally, and he has co-advised numerous graduate and undergraduate students and research assistants over the past five years. His professional interests are in the areas of knowledge synthesis, KTE, epidemiology, mixed-methods research, food safety, zoonotic diseases, science-to-policy, and evidence-informed policy-making. His personal interests include running, tennis, travel, and international culture and cuisine.