Development and Application of Strategies for Health Impact Assessment of Projects and Policies

by

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy
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Health Impact Assessment (HIA) is a combination of procedures, methods and tools used to evaluate potential health outcomes associated with proposed projects, programs and policies. An HIA differs from other types of assessments in its consideration of both positive and negative health outcomes, and inclusion of social and economic determinants of health. Although HIA has evolved over the past two decades, it remains underutilized. There are several reasons for this, including the fact that HIA methodology is lacking in clarity, consistency and transparency. This doctoral thesis tackles this issue through development of novel HIA tools that address specific research gaps associated with different steps of the HIA process. The first step is screening, which determines whether or not an HIA should be conducted. A unique screening tool that considers the practicality of conducting an HIA by comparing the value of the process versus the required investment was developed and tested by HIA practitioners around the world. Scoping is the next step, which outlines the details and boundaries of the assessment. A scoping tool was developed to systematically identify and prioritize health determinants to be included in HIA. The assessment step is where the health outcomes scoped into the HIA are evaluated for potential positive and negative
effects. A new assessment framework was created to provide a transparent method of evaluation in order to characterize impacts and reach a clear, well-justified conclusion. This framework was tested on an actual oil drilling project, allowing for identification of strengths and weaknesses of the tool. The framework was then revised to addresses issues, and was re-developed so that it could be applied within the Environmental Assessment process. Each of these tools addresses a specific research need in the field of HIA, and promotes the inclusion of health in assessing impacts of projects and policies.
Acknowledgements

Completing a Ph.D. is a difficult and rewarding experience. I would absolutely not have made it through this process without the unwavering support of several important people. First and foremost, I would like to thank my supervisor Ingrid Stefanovic. Ingrid, you allowed me to work independently as a researcher, while always offering your invaluable insight and support. I am so grateful that you kept supervising me even though your own opportunities took you across the country. They are lucky to have you. Your encouragement and willingness to let me take a step back and breathe when things got stressful or busy was much needed and greatly appreciated. I know that even after this journey ends, we will keep in touch and I look forward to many more coffee and lunch dates!

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<td>Ambient Air Quality Standards</td>
</tr>
<tr>
<td>CBA</td>
<td>cost-benefit analysis</td>
</tr>
<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
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<tr>
<td>CDPH</td>
<td>California Department of Public Health</td>
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<td>CEAA</td>
<td>Canadian Environmental Assessment Act</td>
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<td>DMT</td>
<td>Decision-making triangle</td>
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<td>DQRA</td>
<td>Detailed Quantitative Risk Assessments</td>
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<td>EA</td>
<td>Environmental Assessment</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EIR</td>
<td>Environmental Impact Report</td>
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<td>EIS</td>
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<td>HHRA</td>
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<td>HIA</td>
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<td>HiAP</td>
<td>Health in All Policies</td>
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<td>IAIA</td>
<td>International Association for Impact Assessment</td>
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<tr>
<td>NAAQS</td>
<td>National Ambient Air Quality Standards</td>
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<td>NCCHPP</td>
<td>National Collaborating Center for Healthy Public Policy</td>
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<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
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<tr>
<td>NGO</td>
<td>Non-Government Organizations</td>
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<td>PAH</td>
<td>Polycyclic aromatic hydrocarbons</td>
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<td>PM</td>
<td>Particulate Matter</td>
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<td>PQRA</td>
<td>Preliminary Quantitative Risk Assessments</td>
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<td>SEA</td>
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<td>SEIA</td>
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<td>SOPHIA</td>
<td>Society of Practitioners of HIA</td>
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<td>TAC</td>
<td>Toxic Air Contaminants</td>
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<tr>
<td>TEK</td>
<td>Traditional ecological knowledge</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<td>US EPA</td>
<td>United States Environmental Protection Agency</td>
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<tr>
<td>VOC</td>
<td>Volatile Organic Compounds</td>
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Preface

I was first exposed to the field of environmental science when I was completing my undergraduate degree in Biology at the University of Western Ontario. I then chose to pursue graduate studies in Environmental Science at the University of Toronto, with a focus in environmental health and risk assessment. As part of the program, I completed an internship at Stantec Engineering Ltd., where I worked as a Risk Assessor. In this role, I conducted assessments quantifying potential risk to human health resulting from exposure to various environmental media (e.g., soil, water, air). I was also involved in other projects that involved various methods of assessing the interaction between the environment and human health. At times, I was able to apply creative and systematic thinking to solving complex problems in the environmental health field.

Five years ago, I began working at Intrinsik, a specialty environmental consulting firm. In my role as an Environmental Health Scientist, I was able to expand on my previous knowledge and experience to apply critical thinking skills to a wide variety of special projects in environmental health. Through this experience, I was able to gain a better understanding of the complex interactions between the environment and human health, including the social, economic and cultural aspects of health and wellness.

With support from Intrinsik, I chose to pursue a Ph.D. in Environmental Science at the University of Toronto. To further enhance a strong professional and academic relationship, Intrinsik sponsored me for an Industrial Postgraduate Scholarship through the Natural Science and Engineering Research Council (NSERC, 2015). These Postgraduate scholarships have been organized in order to:

“provide financial support for highly qualified science and engineering graduates. The support allows them to gain research experience in industry while undertaking advanced studies in Canada. These scholarships are aimed at encouraging scholars to consider research careers in industry where they will be able to contribute to strengthening Canadian innovation.”

Through this scholarship, I was able to contribute to research efforts that expanded the science and knowledge within the environmental field and partake in collaborative efforts with industry. This mutually beneficial partnership both improved the quality and application
of my doctoral research, while providing Intrinsik with the academic innovation necessary to strengthen their business.

This Ph.D. research started with a simple idea and evolved over time into an interdisciplinary undertaking that included aspects of physical and environmental sciences, social sciences, economics, and philosophy. Through my doctoral work, I explore the idea that environment and human health are inextricably linked, to the point that health outcomes (positive and/or negative) can arise from any project undertaking or policy initiative, even those not traditionally associated with health or healthcare. I draw upon the concepts associated with the World Health Organization (WHO) definition of health, and the Health Impact Assessment (HIA) Framework, to develop novel methods and tools for assessing human health. The HIA process focuses on identifying the range of different determinants of health (including socio-economic factors) and I have focused on three key steps: screening; scoping; and, assessment.

I developed several tools through application of an iterative process that involved extensive review and analysis of existing methods and approaches and identification of gaps or areas requiring improvement. In order to address these gaps: (i) a screening tool was developed to consider the practicality of the HIA process through consideration of value versus investment; (ii) a scoping tool was created to systematically prioritize health determinants for inclusion in the HIA; and, (iii) a transparent assessment framework was developed to identify and characterize health outcomes, tested on a “real-world” project, and subsequently revised to further improve the process. Additionally, I considered the effect that personal values, risk attitudes and biases can have on development, application and interpretation of such tools. Limitations and future research are discussed in the context of HIA.

My work in the field of HIA has published in peer-reviewed scientific journals and has been well-received by the HIA community and others. Acknowledging the impact that this work and my publications have already had beyond academia, I am pleased to have been asked already to present my research at various forums in order to educate government and public health officials on the application and strategy of HIA in Canada.
Chapter 1

Introduction
1.0 Introduction and Research Objectives

1.1 Background and Context

Despite the fact that it is part of our daily vernacular (or perhaps for this very reason), the term “health” can be defined in a multitude of ways. There are several models or approaches to defining health, each with differing views and ideals (Tamm, 1993). Three such models are described: the medical model, the wellness model and the holistic model. The medical model emphasizes treatment of specific diseases and does not typically consider mental or social problems, or generalized problems of well-being. This is in contrast to the wellness model, which considers health as a dynamic force, defined as the extent to which an individual or group is able to realize aspirations, meet specific needs and to change or cope with the environment (WHO, 1986). Finally, the holistic model is based on the World Health Organization’s (WHO) definition of health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1948). This holistic model represents a shift in the way that health is viewed, with an expanded understanding of those non-physical factors that have the potential to influence overall health and well-being.

Challenges exist not only in defining health but also around characterizing and measuring physical, social and mental aspects of health and well-being. Although such measurements have historically focused on environmental issues, with limited consideration of health outcomes, a recent movement toward Health in All Policies (HiAP) is calling for change (Leppo et al., 2013). “Health in All Policies” is an approach to defining public policy that invites systematic consideration of health implications of decisions across all sectors, focusing on identifying benefits and avoiding harmful impacts to improving population health and equity (Leppo et al., 2013). One of the tools available for assessing these health outcomes is Health Impact Assessment (HIA), which evaluates health and well-being on a broader scale, including social determinants (WHO, 1999). Despite the fact that the practice of HIA is recognized and applied in several countries around the world, it has not reached its full potential. This is largely due to a lack of regulatory requirement for HIA as well as the high level of inconsistency among HIA methods. (See Chapter 2 for literature review and
gap analysis). This inconsistency has led to HIA being an underutilized approach to addressing health impacts of projects and policies within Canada and abroad.

This doctoral thesis aims to provide a systematic and transparent framework of methods and tools to improve HIA practice. This research aims to address shortcomings of HIA and promote consideration of health in impact assessment of projects and policies. The present introductory chapter provides an overview of various types of impact assessment, including HIA. In addition, the history and context of HIA is considered by exploring the origins of the practice, international development and application of HIA, together with the current state of the science. The determinants of health as well as HIA methodologies are described, followed by a brief description of decision-making theory. Finally, research needs, objectives and an outline for the doctoral thesis is presented.

### 1.2 The Impact of Development (Projects and Policies)

Changes in the environment often have a cascading effect that may ultimately lead to changes in the way people live their lives. These changes can range from slight, almost imperceptible changes to major deviations from the norm (IFC, 2009). Although environmental changes can have obvious and direct impacts, they can also have indirect and often unintended effects. Some of the most common vehicles for change include development projects and policy changes. Environmental and health impacts can arise from a multitude of sectors including transportation, industrial development, housing, extractive industries, power generation, waste management and health services, among others (Kemm, 2013).

Understanding and characterizing the impacts that can arise is important and can promote development and progress in a way that is both responsible and sustainable. Assessing potential changes to the environment and human health is at the core of the practice of impact assessment. There are several different types of assessments, with each focusing on a unique aspect or applying a specific methodology.
1.2.1 Types of Impact Assessment

There are several different types of assessment, depending on the scope and objective of the appraisal. For many projects or undertakings, legislation dictates the specific types of assessment required prior to approval. Different jurisdictions also have their own processes for evaluating impacts, specifically on environment and health, with varying methods. Although there are several types of Impact Assessment (IA), most do not require assessment of the broader potential for health impacts. The most common assessments are discussed in the following sections to provide a context for our broader discussion of the current state of IA and include:

- Health Impact Assessment;
- Environmental Assessment;
- Risk Assessment;
- Socio-economic Impact Assessment;
- Cost-Benefit Analysis; and,
- Public Health Assessment.

1.2.1.1 Health Impact Assessment

The following provides a brief overview of the practice of HIA to provide context for the other assessment types. Further details on HIA are provided in Section 3. Although there are a number of different definitions for Health Impact Assessment, arguably the most widely used is that developed by the World Health Organization (WHO, 1999): “a combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.” However, alternate definitions are available and tend to focus on different aspects of the process. For example, according to a textbook entitled Health Impact Assessment Principles and Practice, published by Birley (2011) HIA is defined as:

“An instrument for preparing justified recommendations for the management of future health impacts of proposals. The proposals may be policies, plans, programs or projects. HIA is primarily used before the proposal is activated and examines both positive and negative
consequences. The intention of HIA is to make recommendations supported by evidence that modify the proposal in order to safeguard and enhance population health.”

A report published by the International Finance Corporation (IFC, 2009) describes how HIA is unique inasmuch as it is applicable across various sectors and project settings, including urban, rural, greenfield, and brownfield. Essentially, anything that could potentially impact human health, positively or negatively, could be a candidate for assessment under an HIA. Not only is HIA applicable to a wide range of policies, programs and projects; it can also be conducted at different stages of implementation. There are three broad categories used to describe when an HIA is conducted. These include (Birley, 2011):

- **Prospective:** In a prospective HIA, the assessment is being conducted prior to the proposal being implemented. This approach allows for the HIA to potentially have the greatest amount of influence since nothing has been finalized and health outcomes can be mitigated or enhanced for future benefits.

- **Concurrent:** In a concurrent HIA, the assessment is being conducted during implementation of the proposal (e.g., construction or early operation). The amount of influence the HIA can have is largely dependent on how much room there is for change of project design, operation, or implementation of policies. At times, this type of assessment limits the type and nature of recommendations that can be proposed.

- **Retrospective:** In a retrospective HIA, the assessment is being conducted after implementation of the proposal (e.g., construction is complete and operations are in progress). In these cases, the result of the assessment is often not able to influence the policy or project itself, but may help to inform proposals of a similar nature in the future.

In addition to timing considerations, the level of detail involved in the HIA can vary. Table 1.1 shows the three broad types of HIA typically used, including: Rapid, Intermediate, and Comprehensive (Kemm, 2013).
Table 1.1  Typology of HIA based on effort and timeline (Ross et al., 2014)

<table>
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<tr>
<th></th>
<th>Rapid</th>
<th>Intermediate</th>
<th>Comprehensive</th>
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<tr>
<td><strong>Time</strong></td>
<td>2 days to 6 weeks</td>
<td>4 weeks to several months</td>
<td>Several months to years</td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td>Requires few resources</td>
<td>Requires moderate amount of resources</td>
<td>Requires significant resources</td>
</tr>
<tr>
<td><strong>Stakeholders</strong></td>
<td>No explicit stakeholder involvement</td>
<td>Some stakeholder involvement</td>
<td>Significant stakeholder involvement</td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td>No new data collection</td>
<td>Some new data collection: often relies on existing data banks</td>
<td>Usually involves collection of primary data</td>
</tr>
</tbody>
</table>

Additional detail around the HIA process and methodologies is provided in Chapter 2.

1.2.1.2 **Environmental Assessment**

The Canadian Environmental Assessment Agency (CEAA) defines Environmental Assessment (EA) as “a process to predict environmental effects of proposed initiatives before they are carried out” (CEAA, 2016). There are slight variations on the process specifics and terminology depending on the jurisdiction, including Environmental Impact Assessment (EIA), Environmental Impact Report (EIR), Environmental Impact Statement (EIS) and others. In the US, EA is:

“Both a decision-making process and a document that provides a systematic, reproducible, and interdisciplinary evaluation of the potential physical, biological, cultural, and socioeconomic effects of a proposed action and its practical alternatives. Proposed actions may include projects, programs, policies, or plans. In the United States, an EIA is called an Environmental Impact Statement or EIS. The National Environmental Policy Act (NEPA) requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. To meet NEPA requirements, federal agencies prepare an EIS” (CDC, 2012).

While EA has typically been a process used to evaluate environmental impacts of development projects, it often does consider social, economic and health aspects. There are socio-economic assessments, cost-benefit analyses and health risk assessments conducted as part of the overall EA process. However, these methods are not typically undertaken with broad implications (i.e., the full range determinants) on health outcomes in mind. Although
health risk assessment may be included in EA, it typically focuses only on toxicological endpoints resulting from chemical exposure.

One of the major differences between EA and HIA is that EA is a legislated regulatory process while HIA is a voluntary process (CDC, 2012). There are opportunities to include HIA within EA to further evaluate impacts on human health; this concept is explored further in Chapter 6.

1.2.1.3 Human Health Risk Assessment

Human Health Risk Assessments (HHRAs) are focused on evaluating the level of risk of adverse health effects associated with exposure to chemicals in various environmental media (e.g., soil, water, air, etc.). These types of assessments typically follow specific guidance developed by government agencies, and tend to be prescriptive in their determination of exposures and calculation of potential health risks. In Canada, HHRAs are often a required component of the EA process, focusing on potential adverse health effects resulting from exposure to chemical hazards, such as pollution and accidental spills. To maintain consistency, HHRAs tend to follow a series of steps including: problem formulation, hazard assessment; toxicity assessment; and risk characterization (Figure 1.1). Guidance on how to conduct an HHRA has been published by Health Canada at the federal level, to provide instructions for completion of simple assessments known as Preliminary Quantitative Risk Assessments (PQRAs) and more complex assessments called Detailed Quantitative Risk Assessments (DQRAs) (Health Canada, 2012). At the provincial level, specific guidance for HHRA also exists. For example, under Ontario Regulation 153/04, there is specific guidance for conducting HHRAs for brownfield redevelopment projects (MOE, 2014).
Overall, HHRA is based on the concept that there are thresholds below which adverse health effects are considered negligible. These thresholds vary depending on the chemical (e.g., carcinogens versus non-carcinogens) and the jurisdiction. Typically, HHRAs do not consider potential benefits of a proposed project. However, HHRA methods can be used within HIA to evaluate potential impacts resulting from changes in air, water and soil quality. In fact, HHRA falls under the umbrella of HIA since it evaluates potential health impacts arising from projects. According to the Centers for Disease Control and Prevention (CDC), HHRAs are different from HIAs in that they focus on biophysical risks from exposure to hazardous chemicals, whereas HIAs consider a much broader range of potential health impacts, including socio-economic considerations, and are intended to inform policy and project decisions (CDC, 2012).

Standardization of HHRA has been achieved through a 30-year history of national and international update to guidance documents. The process first began with the US National Research Council’s 1983 report, Risk Assessment in the Federal Government: Managing the Process, often referred to as the Red Book (NRC, 1983). Although there are some nuanced differences regarding specific application of HHRA in different jurisdictions, the process (i.e., framework, exposure calculations, toxicology, etc.) has largely become universal. This is not the case with HIA, since the application of various frameworks, methods and tools varies greatly both within Canada and internationally. In order for HIA to become a universal...
practice, it requires more consistent and transparent methodologies to be developed, as discussed in Chapter 2.

1.2.1.4 *Socio-Economic Impact Assessment*

Socio-economic Impact Assessment (SEIA) is an appraisal of the potential effects of a proposed project or policy from a social and economic perspective (Tamborra, 2002). This type of assessment can be conducted on its own or in combination with other forms of assessment such as EA. In this way, SEIA can be described as a form of Integrated Assessment. Integrated assessment is an iterative process that is characterized by a continual feedback loop where scientific information and stakeholder input is used to inform decision-makers and lessons and experiences from decision-makers are in turn fed back into scientific and social assessment (Tamborra, 2002).

In Canada, social and economic factors are included as components of the EA process (CEAA, 2016). In SEIA, there are several components that can be considered including land access and use, heritage and cultural resources, equitable employment, services and infrastructure, income and lifestyle and sustainability. One of the major benefits of SEIA is its ability to consider both potential negative and positive impacts. Some of the possible positive impacts considered in this type of assessment include: improvements to standard of living and employment, greater community access, and increased funding for social and cultural programs (EIRB, 2007). There are some basic steps that are followed when conducting a SEIA in order to identify and evaluate potential impacts (EIRB, 2007):

i. Screening;
ii. Profiling baseline conditions;
iii. Predicting Impacts;
iv. Identifying mitigation;
v. Evaluating significance; and,
vi. Applying mitigation and monitoring.

The steps of a SEIA are similar to those used in other assessment types, such as EA and HIA; however, it requires different methods of data collection, reliance on different information sources, unique expertise and analytical tools. A common argument against including HIA in
EA is that people believe that most, if not all, aspects of HIA are covered in SEIA. However, this is not the case. Although there is overlap between the two assessments, given that they both examine social and economic impacts, HIA takes it a step further by evaluating how these changes impact health and well-being. For example, an SEIA may consider job creation by stating the number of new employment opportunities that will result from a project, but HIA will evaluate how job creation leads to improved livelihood and socio-economic status and how that is directly or indirectly linked to specific health outcomes and often broad environmental concerns.

1.2.1.5 Cost-benefit Analysis

A cost-benefit analysis (CBA) is a decision-making approach that is used to assess the potential costs and benefits of a decision or undertaking in monetary terms (Fulop, 2005). Cost-benefit analysis is not only used in economics and business; it has also been applied to EA processes to better inform environmental decision-making. However, the value of this approach has been questioned, due to the difficulty and complexity around monetizing environmental impacts and ecosystem services (Fulop, 2005).

From a public policy perspective, CBA provides several benefits including that it (Fulop, 2005):

- considers the gains and losses of a decision for all parties involved;
- provides a valuation of impacts using a single common denominator that is universally relevant (i.e., money); and,
- values impacts based on relative importance based on people’s preferences generally using established methods of measurement.

While CBA has not been formally implemented with any regularity within HIA, the fact is that HIA can benefit from incorporating findings from CBA into the assessment to provide a foundation for evaluating some impacts (e.g., housing fluctuations, employment and income, community revenues, etc.). One potential opportunity for integration of CA and HIA, is for a CBA to be conducted on the HIA recommendations, to ensure that they are not only promoting and protecting health, but that they are economically feasible (CDC, 2012).
1.2.2 Conclusion: Types of Impact Assessment

There are several types of impact assessment, each of which is used to achieve a different objective. Environmental Assessment is focused on addressing environmental impacts. Risk Assessment calculates health risks associated with chemical exposures. Socio-economic Impact Assessment considers social and economic outcomes, and Cost-Benefit Analysis considers impacts in terms of monetary tradeoffs. Each of these assessment types considers a different aspect of how impacts can affect people and the environment; however, none of them provide a holistic assessment of health outcomes. Health Impact Assessment is a useful tool that can be used to mitigate negative impacts and enhance positive outcomes associated with projects and policies. From a methodological standpoint, HIA is the most well suited type of assessment for drawing together all aspects of development that can affect health, including environmental aspects, chemical exposures, and social and economic factors. Therefore, enhancing the HIA methodology and practice is the main focus of this doctoral thesis.

1.3 The History and Current State of Health Impact Assessment

The following sections describe the origins of the practice of HIA, history and advancements of HIA around the world and the current state of the research. Traditionally, a doctoral thesis would present a literature review and gap analysis as part of the introduction; however, my research on the state of the science on HIA has been published in a peer-reviewed journal and the article is provided as Chapter 2. In Chapter 2, additional information on HIA practice and methodology is provided along with a detailed analysis of issues and gaps in the research.

1.3.1 Origins of HIA

The origins of HIA as part of the environmental health field can be traced back to the beginnings of public health and the realization that environmental factors do have major influences on human health (Harris-Roxas, 2011). One of the well-known landmarks of public health policy was the Lalonde Report (Lalonde, 1974). This report referred to four
“health fields”, which are now considered health determinant categories: environment; human biology; lifestyle; and, and health care organization (Table 1.2).

Table 1.2 Lalonde’s Health Fields (Birley, 2011)

<table>
<thead>
<tr>
<th>Environment</th>
<th>All matters related to health external to the human body and over which an individual has little or no control. This includes both the physical and social environment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human biology</td>
<td>All aspects of health, physical and mental, developed within the human body as a result of organic makeup.</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>The aggregation of personal decisions, over which the individual has control. Self-imposed risks created by unhealthy lifestyle choices can be said to contribute to, or cause, illness or death.</td>
</tr>
<tr>
<td>Health Care Organization</td>
<td>The quantity, quality, arrangement, nature and relationships of people and resources in the provision of health care.</td>
</tr>
</tbody>
</table>

In the environmental field, HIA has largely been considered an add-on to existing EA processes, rather than supported as a stand-alone practice. The history of EA, and increase in widespread environmental consciousness, has primed government agencies and set a regulatory foundation for the application of HIA. While there are benefits to conducting HIA, both alone and within the EA framework, integration of EA and HIA is rarely done. Instead, the EA process tends to include consideration of human health, principally through the use of HHRA.

Over the past several decades, there has been an increasing recognition that social, in addition to physical factors contribute to health and well-being. This shift in the way that health is viewed is demonstrated in documents such as the Declaration of Alma Ata, which stated that attaining the highest level of health is a globally important goal that can only be realized with the coordinated action of social, economic and environmental sectors in addition to the traditional health-related sectors (WHO, 1978). Similarly, the Ottawa Charter, an international agreement that was signed at the First International Conference on Health Promotion organized by the WHO and held in Ottawa, discusses an expanded understanding of health:

“To reach a state of complete physical mental and social wellbeing, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment. Health is, therefore, seen as a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources,
as well as physical capacities. Therefore, health promotion is not just the responsibility of the health sector, but goes beyond healthy lifestyles to well-being” (WHO, 1986).

Cumulatively, this movement has led to a more holistic view of health that includes assessment of the potential impacts of community, social, mental, and spiritual factors on overall health and well-being (Harris-Roxas, 2011). The social view of health also tends to draw upon a broader definition of what constitutes evidence, when trying to evaluate potential impacts. A range of acceptable sources include scientific evidence, where available, but also more qualitative sources. This approach also tends to promote intersectoral collaboration among different disciplines.

Whether rooted in the origins of HIA or not, equity is a concept that is highly embedded in the current practice and has been identified as one of the four pillars of HIA (WHO, 1999). Equity is defined as justice according to natural law or right and freedom from bias or favoritism (Merriam-Webster, 2016). In HIA, equity is often discussed in terms of the opportunity for reducing preventable and avoidable differences in health outcomes, especially those that impede people’s ability to attain health (Heller et al., 2013; 2014). However, actually addressing equity in HIA is a difficult task that, in practice, is done with varying degrees of detail and consistency. Currently, in HIA practice impacts are often evaluated as being homogeneous across a population rather than varying across different groups. This is likely due to two main factors: (1) the increased complexity associated with evaluating the distribution of effects in addition to the already demanding task of assessing health outcomes; and, (2) there may be a lack of data available to adequately evaluate differential outcomes (Harris-Roxas, 2011).

Harris-Roxas (2011) concludes that over the past 20 years, the intersection of these three elements (i.e., environmental health, a social view of health and equity) has led to HIA as we know it today. Nevertheless, differing approaches, methods and objectives for HIA practice overall have emerged. Based on this research, a selective timeline of the History of HIA was created (Figure 1.2).
Figure 1.2  Selective timeline of the development of health impact assessment (Harris-Roxas, 2011)
1.3.2 HIA around the Globe

Health Impact Assessment has been applied in various jurisdictions around the world. The WHO has compiled a collection of HIA guidance documents from several countries including: Australia; New Zealand; Ireland; Sweden; Switzerland; United Kingdom (WHO, 2016). Guidance documents have also been published in several other countries including Canada and the United States (Health Canada, 2004; Ross et al., 2014). Although HIA has both been developed and applied to varying degrees in a number of countries around the world, the main powerhouses of HIA practice as indicated by (WHO, 2016) are all in high income countries. Selected by: (i) the presence of a WHO collaborating center for HIA; (ii) development of HIA guidance; and, (iii) completion of a number of assessments, Europe, Australia and New Zealand, and North America are the main geographic locations of HIA practice. This is likely due to the prevalence of funding and resources to develop HIA guidance and promote capacity building for the practice.

1.3.2.1 Europe

Health Impact Assessment has been embraced as a method of evaluating potential health impacts of project and policy initiatives in many European Countries (Kemm, 2013). There have been major strides in developing HIA as a practice in places like the UK, along with some of the most notable and widely used guidelines (i.e., The Merseyside Guidelines; Scott-Samuel, 2001). HIA became more popularized, particularly in England, with the publication of a paper called “Health Impact Assessment: An idea whose time has come” in 1996 (Scott-Samuel, 1996) and has continued to gain support despite a lack of capacity and legislation.

In 2001, Scotland set up the Scottish Health Impact Assessment Network to promote and support the use of HIA; however, progress has been slow and it has been suggested that integration of HIA and Equality Impact Assessments encouraged by legislation may be more useful than promoting HIA on its own (Douglas and Higgins, 2013). Similarly, in 2001, Wales implemented the Wales Health Impact Assessment Support Unit, which aims to involve those people potentially affected by a proposal in the HIA process to address equity issues. Additionally, this initiative was intended to provide support for local governments and other organizations to develop their capacity to conduct HIAs. Promotion and use of
HIA in Wales, particularly in community planning and waste management has been on the rise in recent years (Elliott et al., 2013).

In Ireland, a review of HIA in the early 2000s showed that although the practice was seldom used, its development was highly supported. A follow-up to that review in 2009 found that a range of agencies across Ireland had a firm knowledge base of HIA including tools to support the process; however, HIA is not a statutory requirement in either Northern Ireland or the Republic of Ireland, which continues to hinder its widespread application (Metcalf et al., 2013).

In the Netherlands, the practice of HIA began in the early 1990s and developed along two different lines: one related to public health and one stemming from the environmental field (den Broeder and Staatsen, 2013). In the public health field, in the late 1990s, support was given to national health-relevant initiatives including tobacco discouragement and health insurance to housing policies and transportation. However, in 2003, support from the Ministry of Health ceased and HIA became focused at a local level. In the environmental field, health was rarely a consideration in the 1990s but some changes in national and international legislation (i.e., National Action Programme for Health and Environment) promoted integration of health into the Environmental Impact Assessment (EIA) practice.

“In 2009 the Commission of EIA experts recommended that assessment of health impacts should be undertaken for large infrastructural industrial projects and airports near residential areas and in those projects where people were worried about potential health risks (e.g., intensive farming or the impacts of exposure to electromagnetic fields near high-voltage power lines). Alternatives that could prevent or limit negative health impacts, such as positioning dwellings and schools so that the health effects of noise, air pollution and other risks were minimal, and access to green spaces and opportunities for cycling and walking optimal, should be considered in EIA” (den Broeder and Staatsen, 2013).

Currently, there is no comprehensive legislation for HIA in the Netherlands, largely due to the economic crisis limiting EIA to strictly legislated requirements. Additional barriers to the use of HIA include a lack of professionals and agencies trained in assessing health impacts,
as well as a “method overload” where there is an abundance of methods and tools with a lack of knowledge regarding when to apply which approach (den Broeder and Staatsen, 2013).

Several other European countries have varying levels of experience and success with HIA, including Spain, Germany, Switzerland, Italy, France and Denmark. In Spain, the first initiative supporting HIA was publication of a guidance manual in Spanish in 2005. Since then, any HIAs that have been conducted have largely been the result of proactive local and regional health administrations (Aldosoro et al., 2013). In Germany, although early advances in HIA methodology development and practice were promising, the practice is under-utilized due to a lack of systematic and efficient application (Fehr and Mekel, 2013). In Switzerland, the Public Health Act was revised in 2004 with the addition of Article (4), which required consideration of health impacts in EIA. This move was highly political and seen by some to be an administrative obstacle to economic development. Later in 2006, the Act came into force with a compromise version of Article (4) that read “if a legislative project is likely to cause negative consequences to health then the government of Geneva can decide to require an assessment of its potential impacts on health” (Simos and Cantoreggi, 2013). A similar regulatory basis for HIA has yet to be adopted at the federal level. Due to competing tools and methods for assessment used in Switzerland, HIA has yet to demonstrate its added value.

In both Italy and France, there are opportunities for continued development and promotion of HIA, but with relatively limited application of the process thus far (Simos and Prisse, 2013; Bianchi and Cori, 2013). In both countries, the need for a legislative basis and increased focus on stakeholder engagement is necessary. In France, the lagging development of HIA compared to other European countries reflects a strong need for training and knowledge building among government agencies and professionals (Simos and Prisse, 2013).

1.3.2.2 Australia and New Zealand

Australia has been a leader in supporting the development of HIA for almost 20 years, including development of some of the world’s first HIA guidance (Harris-Roxas et al., 2013). In 2001, the National Environmental Health Council created national guidelines for HIA; these are currently being updated. In all of the jurisdictions in Australia, there is a legal requirement to conduct EIAs of major developments but there is no equivalent legislation for
HIA, and no systematic framework or trigger for undertaking HIA. Reviews of HIAs conducted in Australia and New Zealand consistently show that they lead to changes in planning and implementation of proposals, improved stakeholder relationships and added valuable information to the decision-making process (Harris-Roxas et al., 2013). Similar to Australia, New Zealand continues to be a leader in HIA development and support worldwide (Hawley-Evans and Soeberg, 2016). HIA was first established in the 1990s through the assessment of environmental effects under the Resource Management Act. In 1995, guidelines were produced for public health agencies and local authorities to ensure that health considerations were included as part of the environmental effects. The use of HIA steadily increased over time with establishment of the HIA Support Unit in 2006. Although there is a long history of HIA support both in Australia and New Zealand, a consistent allocation of resources and legislative backing would further the use of HIA, either as a stand-alone process or in coordination with EIA (Harris-Roxas et al., 2013).

1.3.2.3 North America

In the United States, the use of HIA began in the late 1990s. To date, the majority of the HIAs carried out in the US have been done voluntarily without any legislative requirement (Dannenberg and Wernham, 2013). Many of these assessments have been led by public health officials, academic public health professionals and community-based organizations, and funded by private foundations (e.g., the Pew charitable trust) and the CDC. As of 2012, almost 200 HIAs were completed or in progress across 34 states. This work has largely been focused on the built environment and transportation projects, but other sectors have been considered, such as natural resource extraction, energy, labour and employment, and agriculture (Dannenberg and Wernham, 2013).

Over the past decade, several legislative bills have been introduced that would have promoted or required the use of HIA at the federal or state levels, but none have been enacted, with the exception of Massachusetts, which requires HIA to determine the effect of transportation projects on public health and vulnerable populations (Mass Acts, 2009). A major source of opposition to the use of HIA in the US, particularly as a component of EIA, is that it will delay an already lengthy process and hinder economic development. Additionally, although the capacity is growing, there is a need for education and training
around the determinants of health and HIA processes, especially in the skills required to conduct and interpret HIAs (Dannenberg and Wernham, 2013). One of the most significant sources for HIA information and training in the US is through the Society of Practitioners of HIA (SOPHIA). In 2011, SOPHIA was formed and has since expanded to become a global network of over 250 HIA practitioners who are focused on providing leadership and promoting excellence in HIA practice (SOPHIA, 2016).

In Canada, it was proposed that health be integrated into existing EA practices. In 1992, under the leadership of Health Canada, the Federal/Provincial/Territorial Committee on Environmental and Occupational Health established a task force to facilitate integration of a broad range of health determinants into the EA process (St-Pierre and Mendell, 2013). This process resulted in several guidance documents and tools including a multi-volume handbook on HIA (HC, 2004). Based on this work, Canada was given international recognition for spearheading HIA. However, the momentum was lost with very few HIAs being conducted in Canada, and in 2010, Health Canada archived their HIA guidance. Although there continues to be interest in HIA within many of the provinces and territories, and some progress regarding legislative consideration of HIA has been made in Quebec and British Columbia, resource allocation and concrete legislative requirements are lacking (St-Pierre and Mendell, 2013). A literature review and gap analysis of the state of HIA practice within Canada is provided in Chapter 2 of this PhD thesis.

1.3.3 Current State of the Practice

In order to gain a comprehensive understanding of the current state of HIA research and practice, a systematic literature review was conducted. The review included both primary and grey literature to ensure that results captured all major publications on HIA methodologies. The information obtained from this review was critically analyzed to identify gaps within HIA research that were used to develop focused research objectives for this doctoral thesis. Detailed information on the current state of HIA is provided in Chapter 2.

1.4 The Determinants of Health

There are many different factors that influence a person’s health status. Collectively, these are known as the determinants of health. These factors can be broadly grouped into the
following: (i) the physical environment; (ii) the social and economic environment; and, (iii) individual characteristics and behaviours (WHO, 2016). Some of these factors are fixed, such as genetics, age and ethnicity, while others are variable and can change over time (e.g., employment, education, nutrition, access to health care, etc.) (Whitehead and Dahlgren, 1991). In Canada, Mikkonen and Raphael (2010) published a report on the determinants that affect the health and well-being of Canadians. Table 1.3 provides a list of some of the main health determinants that can be impacted by project or policy proposals.

Table 1.3  Sample of health determinants potentially affected by project / policy proposals (Birley, 2011)

<table>
<thead>
<tr>
<th>Principle Categories</th>
<th>Subcategories</th>
<th>Examples of health determinants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual / Family</td>
<td>Physiological</td>
<td>Age, nutrition status, disability, sex, immunity, ethnicity, genetics</td>
</tr>
<tr>
<td></td>
<td>Behavioural</td>
<td>Risk-taking behavior, occupation, risk perception</td>
</tr>
<tr>
<td></td>
<td>Socio-economic circumstances</td>
<td>Poverty, unemployment, education, social status</td>
</tr>
<tr>
<td>Environmental</td>
<td>Physical</td>
<td>Air, water and land, traffic, pollution, noise, dust, changes to natural environment, flaring, light, water use, land take, housing, crops and foods, vectors</td>
</tr>
<tr>
<td></td>
<td>Social</td>
<td>Family structure, community structure, culture, crime, gender, inequality</td>
</tr>
<tr>
<td></td>
<td>Economic</td>
<td>Loss of employment, investment</td>
</tr>
<tr>
<td>Institutional</td>
<td>Organization of health care</td>
<td>Primary care, specialist services, increased pressure on healthcare, access to healthcare, availability of drugs, quality of care</td>
</tr>
<tr>
<td></td>
<td>Other Institutions</td>
<td>Police, transport, public works, municipal authorities, local government, project sector ministry, local community organizations, NGOs, emergency services, boomtowns</td>
</tr>
<tr>
<td></td>
<td>Policies</td>
<td>Regulations, jurisdictions, laws, goals, thresholds, priorities</td>
</tr>
</tbody>
</table>

Birley (2011) discusses various models of health including the biomedical model of health and the socio-environmental model of health. The biomedical model is focused on the presence or absence of disease and the provision of healthcare services in response to ailments. This model is often the first thing people think of when discussing health. The socio-environmental model is concerned with the underlying economic, social, psychological and environmental causes of health and well-being, or lack thereof. This is the model upon which HIA is based; however, provision and access to healthcare is also typically considered. The socio-environmental model allows for a wide range of potential health determinants to be assessed for their potential to change outcomes related to health and well-being. The basic
relationship between proposals (i.e., development projects, policy changes, etc.), health determinants and health outcomes is outlined in Figure 1.3.

Figure 1.3  Association between proposals (i.e., policies and projects), health determinants and health outcomes (Modified from Birley, 2011)

The types of health determinants and outcomes that can be affected are highly dependent on the specifics of the proposed policy or project. One of the ways to identify the potential for health impacts, is to review available project or policy information (e.g., project descriptions, previous reports, completed assessments, etc.) with the following questions in mind:

- Can any aspect of this proposal negatively affect health and well-being?
- Can any aspect of this proposal positively affect health and well-being?
- Will this proposal indirectly lead to changes that could affect health now or in the future?
- Are there opportunities to improve quality of life?
- Will some individuals benefit while others be negatively affected (i.e., health equity issues)?

In order to ensure that the full range of health determinants have been considered for a particular proposal, HIA practitioners will often complete a pathway diagram showing the interrelationship between specific aspects of the proposal and their effect on various health outcomes. These diagrams are especially useful for large and complex projects that could potentially influence many different health determinants. Such diagrams allow for a clear
representation of important areas for assessment. Typically, a separate pathway diagram would be created for each of the health determinants that could be impacted. An example of a pathway diagram for a proposal that involves changes in local noise levels due to project construction and traffic is provided in Figure 1.4.

![Pathway diagram for noise effects and health outcomes](HIP, 2016)

Through an in-depth assessment of potential health determinants that can be affected by a proposed project or policy, it is possible to gain an understanding of the interactions between changes in health determinants, such as noise, and changes in health and well-being. This information becomes vital in conducting a well-organized and comprehensive HIA.

1.5 Methodologies in Health Impact Assessment

1.5.1 Steps of an HIA

There are numerous methods, approaches and tools available for conducting HIA (Birley, 2011; Kemm, 2013). The one area where there is consensus among practitioners, is the series of general steps that define the HIA process. These steps are: (i) screening; (ii) scoping; (iii)
assessment; (iv) recommendations; (v) reporting; (vi) monitoring; and, (vii) evaluation. An overview of these steps is provided in Figure 1.5.

Figure 1.5  Steps of a Health Impact Assessment (Modified from Ross et al., 2014)

1.5.2 Common Approaches

There are several ways that HIAs have been conducted. Approaches and methodologies vary widely, arguably both a strength and weakness of the practice. It could be claimed that the lack of a rigid process or framework contributes to HIA being highly adaptable in a range of different scenarios (Harris-Roxas, 2011). However, it has also been reasoned that the HIA process lacks specific direction and guidance, leading to dramatically different approaches and methods with little accountability in terms of rigour or consistent quality of assessment.

In order to try to address some of this variability within the HIA practice, the North American HIA Practice Standards Working Group developed the Minimum Elements and Practice Standards for Health Impact Assessment (Bhatia et al., 2010). This document provides guidance on the minimum requirements required to constitute an HIA and some benchmarks for effective practice (Bhatia et al., 2010). The Minimum Practice Standards provide a much needed approach for identifying true HIAs and weeding out those assessments that do not achieve certain basic milestones. Although these Standards have been well received by practitioners and used in different capacities, they do not provide
specific guidance on how to conduct HIA: “this document is not intended to comprise a
guidebook on how to conduct HIA, but rather a guidance document on what elements are
essential or desirable to include” (Bhatia et al., 2010). Therefore, a number of different HIAs,
each having its own approach, level of detail and quality of assessment, could achieve the
Minimum Practice Standards, despite the lack of consistency.

In terms of the types of HIAs commonly undertaken, Harris-Roxas (2011) provided a
typology of HIA that classifies the process into four different forms, including: (i) mandated;
(ii) decision-support; (iii) advocacy; and, (iv) community-led. For each of these forms of
HIA, the purpose, origins, role of values and judgements and type of learning is described
(Table 1.4). The “types of learning” category describes the learning that takes place as a
result of conducting the HIA and falls into one of three categories (Harris-Roxas, 2011):

- Technical learning: involves searching for technical solutions to fixed objectives;
- Conceptual learning: involves redefining goals, problem definitions and strategies;
  and,
- Social learning: emphasizes dialogue and increased interaction between stakeholders.

### Table 1.4 Typology of Health Impact Assessment (Harris-Roxas, 2011)

<table>
<thead>
<tr>
<th>Forms of HIA</th>
<th>Mandated</th>
<th>Decision-support</th>
<th>Advocacy</th>
<th>Community-led</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Occurs in the context of and EIA, IIA and ESHIA and is done to meet a regulatory or statutory requirement</td>
<td>Conducted voluntarily by or with the agreement of organizations responsible for a proposal with the goal of improving decision-making and implementation</td>
<td>Conducted by organisations or groups who are neither proponents or decision-makers, with goal of influencing decision-making and implementation</td>
<td>Conducted by potentially affected communities on issues or proposals that are of concern</td>
</tr>
<tr>
<td>Purpose</td>
<td>Meeting a regulatory or statutory Minimising negative health impacts</td>
<td>Improving decision-making and implementation Minimising negative health impacts Maximising positive health impacts</td>
<td>Ensuring under-recognised health concerns are addressed in design, decision-making and implementation Minimising negative health impacts Maximising positive health impacts</td>
<td>Ensuring the communities health-related concerns are identified and addressed Enabling greater participation of communities in decisions that affect them Minimising negative health impacts Maximising positive health impacts</td>
</tr>
</tbody>
</table>
### Forms of HIA

<table>
<thead>
<tr>
<th></th>
<th>Mandated</th>
<th>Decision-support</th>
<th>Advocacy</th>
<th>Community-led</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origins</strong></td>
<td>Environmental health</td>
<td>Environmental health, social view of health, health equity</td>
<td>Social view of health, health equity</td>
<td>Social view of health, health equity</td>
</tr>
<tr>
<td><strong>Role of values and judgements</strong></td>
<td>Almost no role for values in assessments, judgements often not acknowledged</td>
<td>Implied role for values and judgements</td>
<td>More explicit role for values and judgements</td>
<td>Driven by community values and judgements</td>
</tr>
<tr>
<td><strong>Conducted by</strong></td>
<td>Consultants</td>
<td>Government agencies, consultants</td>
<td>NGOs, universities, other agencies</td>
<td>Communities often aided by HIA practitioners in NGOs, universities or other agencies</td>
</tr>
<tr>
<td><strong>Resourced by</strong></td>
<td>Proponents</td>
<td>Government agencies</td>
<td>Varied</td>
<td>Communities themselves</td>
</tr>
<tr>
<td><strong>Overseen by</strong></td>
<td>Proponents</td>
<td>Government agencies</td>
<td>Varied</td>
<td>Communities themselves</td>
</tr>
<tr>
<td><strong>Role of stakeholders</strong></td>
<td>Providing technical information</td>
<td>Informing the assessment</td>
<td>Guiding the assessment</td>
<td>Controlling and conducting the assessment</td>
</tr>
<tr>
<td><strong>Type of learning</strong></td>
<td>Technical</td>
<td>Technical/conceptual</td>
<td>Conceptual/social</td>
<td>Social</td>
</tr>
</tbody>
</table>

Note: Environmental impact assessment (EIA); integrated impact assessment (IIA); environmental social and health impact assessment (ESHIA)

In 2013, the US Environmental Protection Agency (EPA) published a report titled “A Review of Health Impact Assessments in the U.S.: Current State-of-Science, Best Practices, and Areas for Improvement” (Rhodus et al., 2013). The review looked at several aspects of HIA practice in the United States including:

- “organizations involved in conducting the HIAs;
- funding sources;
- the types of community-level decisions being made;
- data, tools, and models used;
- self-identified data needs;
- methods of stakeholder engagement;
- pathways and endpoints;
- characterization of impacts;
- decision-making outcomes and recommendations;
- monitoring and follow-up measures;
- prioritization methods employed;
defensibility and effectiveness;
- attainment of the Minimum Elements of HIA;
- areas for improvement; and,
- identification of best practices” (Rhodus et al., 2013).

Out of the 81 HIAs reviewed from various sectors, including transportation, housing/buildings/infrastructure, land use, and waste management/site revitalization, only 13 (16%) met all of the Minimum Practice Standards developed by Bhatia et al. (2010). Overall, the review found that while HIA was successful in promoting consideration of health impacts outside of traditional health fields, the effectiveness of HIA bringing about changes in decision-making related to health outcomes is highly variable. The report concluded “there are considerable disparities in the quality and rigor of HIAs being conducted” (Rhodus et al., 2013). This led to several recommendations including: (a) ensuring that the HIA adheres to the Minimum Practice Standards; (b) use of HIA to inform decision-making at all levels (not just local); (c) use of more consistent terminology within HIA practice; (d) broader utilization of tools and resources; and, (e) identifying and closing data gaps in HIA.

“Identification of data gaps is important to transparency in HIA reporting, but it can also be useful in helping to refine methods and approaches used in HIA and identify areas for future research. Closing identified data gaps and maximizing the evidence available for use in HIA will result in more robust assessments and improved efficiency in predicting health impacts” (Rhodus et al., 2013).

1.5.3 Research Needs in HIA

There are several areas that require further research and development in the field of HIA. In Chapter 2, a comprehensive literature review was conducted to understand the current state of the science around HIA and to identify key research needs. One of the main issues was related to the unavailability of systematic and transparent HIA methodologies. This lack of consistency within HIA was found to be an issue throughout all steps of the process, including screening, scoping and assessment, which are the focus of this doctoral thesis. Each of these steps required development of specific decision-making tools and frameworks in order to facilitate a more systematic approach to HIA. An overview of different types of
decision-making models that were considered when developing HIA methods is provided in Section 6. For additional detail around the state of HIA practice and analysis of key research needs, see Chapter 2.

1.6 An Overview of Decision Making Models

There are several different types of decision-making models. An overview of some of the most common types of decision-making models is provided below to provide some background on decision theory. Additionally, several common decision-making tools were identified and their strengths and weaknesses were assessed to identify the most appropriate approach to be used in developing HIA tools as part of this doctoral research.

1.6.1 The Theory of Decision Making

There are several different theoretical models of decision-making, each with unique approaches. Gaining a basic understand on decision theory is vital in identifying which approach or tool to apply to development of HIA methods. The following models are discussed below: (i) the rational model; (ii) the model of bounded rationality; (iii) political model; and, (iv) the garbage can model.

1.6.1.1 The Rational Model

The rational model is based on the assumption of a rational and informed decision-maker (Turpin & Marais, 2004). The process of rational decision-making is comprised of a series of steps, originally described by Simon (1977):

i. Intelligence: finding occasions for decision making;
ii. Design: inventing, developing and analyzing possible courses of action;
iii. Choice: selecting a particular course of action from those available; and,

In the classic version of the rational model, often cited also as a “perfect” model, decision analysis is used to assign values to each of the alternatives during the “choice” step. Then the option with the highest value or utility is chosen above the rest. In order for the rational model to function in this matter, the following assumptions are made regarding the role of the “decision-maker”, including that they (Turpin & Marais, 2004):
• Know of all possible alternatives;
• Know the consequences of implementing each alternative;
• Have a well-organized set of preferences for these consequences; and,
• Have the computational ability to compare consequences and to determine which is preferred.

This is one of the most widely known models of decision-making; however, given the unlikelihood of an “all knowing” decision-maker, it is naïve to expect that it applies to many scenarios. In HIA, the rational model may be an ideal to strive for, with a fully informed decision-maker, but the presence of uncertainty and a diversity of human attitudes, perceptions and judgments in the decision-making process make this approach largely unrealistic.

1.6.1.2 The Model of Bounded Rationality

In contrast to the above “classic or perfect” model of rationality, the model of bounded rationality acknowledges that a decision-maker will not always have all relevant information and that an optimal choice is not always easily available (Turpin & Marais, 2004). This model is largely based on the work of Simon (1979) who focused on finding an option that would suffice, rather than seeking an optimal outcome. Turpin & Marais (2004) describe the model of bounded rationality:

“Bounded rationality is characterized by the activities of searching and satisficing. Alternatives are searched for and evaluated sequentially. If an alternative satisfies certain implicitly or explicitly stated minimum criteria, it is said to “satisfice” and the search is terminated.”

Since the models of perfect and bounded rationality both imply a rational decision-maker, some researchers do not distinguish between these two models in their classification of decision-making theories. This model is more applicable to impact assessment in general, and HIA in particular, because it does not imply a perfect decision-maker and allows for a realistic, satisfactory solution over an ideal one that is not available in actual practice. When dealing with health implications of project and policies, decisions are often necessary despite unknowns, so a perfect, definitive solution is not always realistic.
1.6.1.3 Political Model

In the political model, decision-making is viewed as “a personalised bargaining process, driven by the agendas of participants rather than rational processes” (Turpin & Marais, 2004). The people involved have different goals and values as well as different relevant information. The decision-making process ends up being a long battle of different groups, each with their own agenda: “influence and power is wielded in a deliberate manner and to further self-interest” (Turpin & Marais, 2004).

In HIA practice, this model may come into play when dealing with decision-makers who have personal or political interests in the proposed project or policy. This can also be reflective of different stakeholder groups, each with their own views and agenda concerning a proposal (e.g., a proponent who wants it to go ahead, a community who may not want the project implemented at all, etc.). Implementing the use and application of transparent and systematic HIA tools can help to better inform decision makers, especially when there are conflicting interests.

1.6.1.4 The Garbage Can Model

The garbage can model describes the decision-making process in the context of an “organized anarchy” that is based on the research of Cohen, March and Olsen (1972). Similar to the political model, it is based on multiple players, each with differing goals and views. It differs from the political model in its assumption of a chaotic and fragmented approach to decision-making rather than a deliberate manipulation for personal gain. Turpin & Marais (2004) described the garbage can model as:

“In the garbage can model, a decision is an outcome or interpretation of several relatively independent streams in an organisation. The streams of problems (looking for solutions and opportunities to be aired), of solutions (looking for issues to which they might provide an answer), and of participants (whose attention is divided and who come and go) meet each other at a choice opportunity, symbolised as a garbage can. When a decision is made, the garbage can is removed.”
Since it is the individuals involved in the process who develop the problems and solutions (i.e., the garbage) the decision that is made is dependent on those participating in the process. Similarly, since there is currently a lack of consistency within HIA practice, aside from the general steps and objective, often the end product is highly dependent on those participating in the process. Moving toward a system when HIA maintains some level of rigour and consistency despite those involved would help to promote more widespread use of this approach.

1.6.2 Decision Making Tools and Techniques

Decision-making is not only about theory; it is also about application. The following are tools and techniques for the application of decision-making. These concepts fed into the tools and frameworks that were developed as part of this doctoral research.

1.6.2.1 The Decision Matrix

A decision matrix is a tool used to evaluate all potential options associated with a decision (Burge, 2009). This typically entails creation of a table where all options are included along the first column and all of the factors that affect the decision in the first row. Then the factors affecting the decision are weighted for each of the possible options, and are typically provided with a score. Once the table is complete, a tally of all influencing factors can be summed to identify the best option. One type of decision matrix is called the Pugh Matrix, which relies on a series of simple comparisons to address complex problems (Burge, 2009):

“Many decisions often concern a number of interwoven factors or criteria for which humans struggle to handle the complexity resulting in inconsistent and irrational decisions. The Pugh Matrix provides a simple approach to taking these multiple factors into account when reaching a decision. By exploiting people’s innate ability to make a pairwise comparison allows for subjective opinions about one alternative versus another to be made more objective.”

An example of a Pugh Matrix and how it functions is provided in Figure 1.6. In this example, a series of design concepts (A, B, C, D, etc.) are evaluated against 10 criteria. The Design Concept “A” is selected as a baseline, given a score of “S” (equivalent to zero), and all others
are compared against it. Therefore, a score of “+” is better than baseline, “-“ is less than baseline and “S” is the same as baseline for each of the 10 criteria. In some cases, not shown in the example below, it is possible to use “++” to indicate much better than baseline and “--” for much worse. One of the major strengths of the Pugh Matrix is its ability to consider a multitude of factors and evaluation criteria; however, it is prone to limitations such as incomplete or incorrect evaluation criteria and can fail if conducted without adequate expertise (Burge, 2009). This approach may also not be sufficiently sensitive in accommodating different judgements about weightings or complexities of and relationships between issues affecting the final decision. Although this approach has been used in HIA practice in the past, it has been criticized for arbitrarily assigning scores to health outcomes, limiting the flexibility and transparency of the process. For these reasons, this approach was not considered appropriate for application to HIA methodology in this thesis.

Figure 1.6  Example of a Pugh Matrix

<table>
<thead>
<tr>
<th>Criteria 1</th>
<th>Design Concept A</th>
<th>Design Concept B</th>
<th>Design Concept C</th>
<th>Design Concept D</th>
<th>Design Concept BC</th>
<th>Design Concept BD</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>+</td>
<td>S</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Criteria 2</td>
<td>S</td>
<td>-</td>
<td>S</td>
<td>+</td>
<td>S</td>
<td>+</td>
</tr>
<tr>
<td>Criteria 3</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>+</td>
<td>S</td>
<td>+</td>
</tr>
<tr>
<td>Criteria 4</td>
<td>S</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Criteria 5</td>
<td>S</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Criteria 6</td>
<td>S</td>
<td>-</td>
<td>S</td>
<td>-</td>
<td>S</td>
<td>-</td>
</tr>
<tr>
<td>Criteria 7</td>
<td>S</td>
<td>+</td>
<td>S</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Criteria 8</td>
<td>S</td>
<td>+</td>
<td>S</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Criteria 9</td>
<td>S</td>
<td>-</td>
<td>S</td>
<td>-</td>
<td>S</td>
<td>-</td>
</tr>
<tr>
<td>Criteria 10</td>
<td>S</td>
<td>S</td>
<td>-</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>TOTAL +</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>TOTAL -</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL SCORE</td>
<td>0</td>
<td>-2</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
1.6.2.2 Pareto Analysis

A Pareto analysis helps to identify and prioritize decisions to identify those that will have the greatest influence on specified goals and those that will have the least impact (Tague, 2005). The Pareto analysis is based on the 80/20 rule, or the observation that 80% of a project’s benefit can come from doing 20% of the work, or that 80% of a situation’s problems can be traced to 20% of the causes (UC, 2016). A Pareto analysis is used when there are a large number of potential problems or causes and there is a need to focus on the most significant. This analysis makes use of a Pareto chart, which is a bar graph that represents the frequency or cost (time or money) associated with different issues, organized with the tallest bar on the left and the shortest on the right, providing a visual representation of the most significant problem or cause. Figure 1.7 provides an example of a Pareto chart showing different types of customer complaints.

There are both strengths and weaknesses associated with application of the Pareto analysis. One of the strengths is in the provision of a visual display of the most pressing issues. This provides the user with an easy way of identifying the appropriate course of action. The main weakness of the Pareto analysis is that in order to apply it, there must be a standard unit of measure for all issues under consideration (i.e., time, cost, etc.). Without a standard measure, this type of analysis is not possible. Therefore, the Pareto analysis is not possible for application in HIA methodological frameworks since the broad range of health determinants under consideration do not have a single common unit of measure. Additionally, the basis of the Pareto analysis (i.e., the 80/20 rule) does not necessarily apply to issues around impacts to health and well-being.
Figure 1.7  Example of a Pareto chart of customer complaints to identify the most significant source

1.6.2.3  T-Chart

A T-chart is used to weight the positive and negative aspects of a decision. In its simplest form, a T-chart is a list of all of the positives on one side of the chart and all of the negatives on the other side, and a selection is based on which side is the longest. A more complex version of the T-chart follows the same basic concept but applies relative values depending on the extent or importance of the factor involved in making the decision (UC, 2016). For example, when deciding whether or not to buy a new car, there are several factors (i.e., pros and cons) that could play into that decision (Table 1.5).

<table>
<thead>
<tr>
<th>POSITIVES (+)</th>
<th>NEGATIVES (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better engine (+2)</td>
<td>Expensive (-3)</td>
</tr>
<tr>
<td>More seating (+2)</td>
<td>Need new snow tires (-1)</td>
</tr>
<tr>
<td>Bluetooth / hands free (+1)</td>
<td></td>
</tr>
<tr>
<td>Fuel efficiency (+4)</td>
<td></td>
</tr>
<tr>
<td><strong>Total (+9)</strong></td>
<td><strong>Total (-4)</strong></td>
</tr>
</tbody>
</table>

In the example provided above, the positive aspects of buying a new car outweigh the negative. This approach works best for decisions involving simple decisions without multiple complex factors to consider. The assignment of values is also highly subjective and may not be practical for decisions involving large groups. In terms of application to HIA, the concept around the t-chart (i.e., weighing positives against negatives) could be strategically applied to consideration of both positive and negative health impacts. This approach, or some variation
involving weighting of pros and cons, may be useful in situations where there are a multitude of both positive and negative health outcomes, and a conclusion needs to be made regarding the overall effect on health. Additionally, it could be applied when weighing two opposing factors (such as costs and benefits). Ultimately, this concept has been applied in the development of an HIA screening tool (Chapter 3) as well as specific assessment methods for making final conclusions in HIA when there are a multitude of determinants (Chapter 6).

1.6.2.4 The Decision Tree

A decision tree is a flowchart or graphic that is set up in such a way to show all of the decision alternatives and possible outcomes (Lunenburg, 2010). Each “branch” of the decision tree represents one of the possible options available. When a series of decisions need to be made, all combinations of outcomes can be shown. In cases where there is a cost or probability associated with each of the options, these can be included in the decision tree to calculate the overall probability or cost of each outcome (Mitchell, 2007).

There are several benefits to using decision trees including: (i) they are simple to understand and interpret; (ii) small details that may have otherwise been missed become apparent; and, (iii) it can save time, because once the options and outcomes are laid out, a decision path is easy to follow. An example of a simple decision tree can be used to decide whether or not conditions are suitable for playing tennis (Mitchell, 2007). Figure 1.8 shows the decision tree for this scenario and how each unique path leads to a distinct outcome depending on the combination of factors (i.e., weather outlook, humidity, wind).
Figure 1.8  Example of a decision tree for determining appropriate conditions for playing tennis (Mitchell, 2007).

Decision trees tend to be the most useful when they target decisions with a limited number of factors, each taking on a small discreet number of attributes (e.g., high, medium or low; yes or no, etc.) (Mitchell, 2007). Additionally, decision trees provide a systematic and transparent way of approaching decision-making, which can be easily followed and understood. For these reasons, decision trees are ideal for application in development of methods and tools for HIA. Regarding the characterization of health effects in HIA, there are typically a small and discreet number of options (e.g., high, medium low impact) for various factors that collectively lead to specific outcomes (e.g., positive or negative effect on health). This method not only provides a more consistent and systematic approach to decision-making in HIA but it is also transparent, with decision-makers able to see exactly how a conclusion was reached. Therefore, decision-trees were applied in the development of several of the HIA tools developed as part of this doctoral thesis (Chapter 4, 5 & 6).

1.6.3 Conclusions: An Overview of Decision Making Models

In identifying a lack of systematic and transparent methods and tools for conducting HIA, several decision-making models were identified and evaluated for their potential application in addressing this gap in HIA research and practice. After evaluating the strengths and
weaknesses of each approach, the application of decision trees and T-charts, to guide and develop HIA practice, were found to be the most appropriate. The focus of the doctoral thesis is on the development, testing and application of novel approaches and tools for various steps of the HIA process. Several research objectives were developed in order to guide and focus the thesis.

1.7 Research Objectives and Chapter Outlines

The following sections describe the major research objectives and outline of the doctoral thesis.

1.7.1 Research Objectives

In identifying the key gaps in HIA research and practice in Chapter 2, it became apparent that the application of inconsistent methodologies that lack transparency was ultimately hindering the widespread application of HIA. The research objectives were developed in order to address several of these gaps, and ultimately, to provide a basis for including health in the assessment of impacts arising from project and policy decisions.

The key objectives for this doctoral thesis are as follows:

Objective I:  To identify clear HIA triggers through a streamlined HIA screening process.

Objective II: To develop a transparent and systematic approach to HIA scoping.

Objective III: To develop a method of assessment that is transparent and systematic in its approach to identifying and evaluating health impacts (positive and negative).

Objective IV: To improve the HIA process to allow for better integration within existing legislated EA processes

Objective V: To acknowledge and identify uncertainties within HIA practice and methodology, including subjective aspects of decision-making and tool development.
It is believed that fulfilling these objectives through this doctoral research will serve to further the science and application of HIA, through advancements in the methodology and improvement of the practice overall.

1.7.2 Chapter Outlines

The following sections describe each chapter, focusing on how the chapter addresses a research need and meets the objectives described above. The sections also detail how the chapter fits into the thesis as a whole, and discusses the unique contribution made by the research. Where applicable, author contributions were discussed to clearly identify any external contributions to the work.

While not necessarily reflecting the chronological order of publication, the chapters are ordered in such a way as to be consistent with the steps of the HIA process and practice (i.e., screening, scoping, assessment, etc.).

Chapter 2: Literature Review and Gap Analysis

In Chapter 2, a systematic literature review was carried out to assess the current state of HIA research and practice. The review included both primary peer-reviewed scientific literature and grey literature, namely government agency publications, focused on HIA methodologies. Through this review and critical analysis of the results, several gaps in HIA research and practice were identified. Ultimately, this chapter provides context and sets the foundation for development of specific research objectives (Section 7.0) to address gaps in the HIA literature through completion of this doctoral work.

Chapter 2, entitled “Advancing the Practice of Health Impact Assessment in Canada: Obstacles and Opportunities” was published in the peer-reviewed journal Environmental Impact Assessment Review.

Authors: LM conducted the literature review and analysis, and drafted the manuscript. IS and CO reviewed the draft and provided comments. All authors read and approved the final manuscript.

Since this article was published in 2015, it has been downloaded 22 times and cited once in the article “Measuring policy and related effects of a health impact assessment related to connectivity” published in Preventative Medicine (Bias and Abildso, 2016).

Chapter 3: HIA Screening

In Chapter 3, an HIA screening tool was developed in order to address one of the main research objectives. The goal was to create a tool that could address the issue of inconsistent HIA triggers by providing a systematic method of screening (Objective I). The tool is unique in that it is based on an approach that compares the potential value obtained from conducting the HIA against the required investment.

Chapter 3, entitled “Development of a Health Impact Assessment Screening Tool: A Value Versus Investment Approach” was published in the peer-reviewed Journal of Environmental Assessment Policy and Management.


Authors: LM conducted the review and analysis, developed the screening tool, tested the tool, analyzed the results and drafted the manuscript. IS and CO reviewed the draft and provided comments. All authors read and approved the final manuscript.

In addition to addressing one of the research objectives, this chapter provides the opportunity for testing and allows for collection of semi-quantitative data through the collection and analysis of results. Due to the nature of the tool, it was important to ensure that consistent
results could be reached for a multitude of users. This allowed for the developers to test not only the functionality but also the validity and consistency of the tool.

Chapter 4: HIA Scoping

In Chapter 4, an HIA scoping tool was developed to address the need for a transparent and systematic method for prioritizing health determinants for inclusion in assessments (Objective II). Development of this tool provided the opportunity to create a novel method of scoping for HIA that can be used to supplement existing scoping frameworks. Following an iterative development process, the HIA scoping tool was programmed into excel for ease of use. Additionally, since this article was published in August 2016, it has had more than 300 views and has been downloaded over 100 times.

Chapter 4, entitled “Prioritizing Health: A systematic approach to scoping determinants in health impact assessment” was published in the peer-reviewed Journal Frontiers in Public Health.


Authors: LM conducted the review and analysis, developed the scoping tool, programmed it into excel, and drafted the manuscript. IS and CO reviewed the draft and provided comments. All authors read and approved the final manuscript.

Chapter 5: Assessment I

In Chapter 5, an initial assessment framework was developed for evaluating potential positive and negative health impacts of projects. As part of the collaborative agreement between the University of Toronto and Intrinsik Environmental Sciences Inc. (Intrinsik), under the Natural Sciences and Engineering Research Council (NSERC) scholarship that funded this doctoral research for 3 years, I was provided with a unique opportunity to test my framework on an applied project as part of this doctoral research. The opportunity involved
completion of an HIA on an oil drilling and development project in California, USA. The research component for which I was solely responsible included development of a comprehensive framework that could be used to complete the assessment step of the HIA. This framework was a necessary and integral part of the project since a previously attempted HIA had been judged to be inadequate and lacking transparency. I developed the methodology (i.e., assessment framework) independently of the Intrinsik team conducting the HIA. This work was conducted to address the research objective to develop a method of assessment that is transparent and systematic in its approach to identifying and evaluating health impacts (Objective III). My framework was then applied to each of the 18 different determinants of health that were evaluated in the assessment. I did assess several of the determinants, in order to test the framework for effectiveness and utility, including: (i) noise emissions; (ii) light emissions; (iii) property values; (iv) access to recreational resources and greenspace; (v) aesthetics and visual resources; (vi) education funding; (vii) social cohesion; and, (ix) political involvement. The HIA team that Intrinsik put together for the project, led by Dr. Ollson, applied my assessment framework to the remaining determinants. Although I was responsible for preparing the manuscript, and it was largely focused on the unique methodology (i.e., framework) that was applied, it did report on the entire HIA process that was undertaken, which is why there are several other authors on the paper; each of them contributed to the 360-page Final HIA Report that was produced for this project (Intrinsik, 2014). Although my Supervisor Dr. Stefanovic reviewed my research efforts in relation to my development of the assessment framework she was not integrally involved in the larger project and thus decided not be cited as an author. Dr. Stefanovic did review the manuscript submitted for publication and approves of its use in my doctoral work.

Chapter 5, entitled “Health impact assessment of an oil drilling project” was published in the peer-reviewed International Journal of Occupational Medicine and Environmental Health.

Authors: LM developed the methodological framework, applied it to various determinants for testing, and drafted the manuscript. BK and CM conducted the air quality assessment. KS conducted the baseline assessment and assessed various determinants. KB conducted the scoping. MM and CO oversaw the project. IS and CO reviewed the draft and provided comments. All authors read and approved the final manuscript. IS provided comment on the manuscript but was not directly involved with the Hermosa Beach Project itself and, therefore, did not think it was appropriate to have herself listed as an author.

Overall, this chapter presents theoretical research as it is applied in a real-world setting and within a timeframe that was conducive to doctoral research. It not only addresses a major research objective and key gap within HIA practice, but it provides a foundation for further research opportunities.

Chapter 6: Assessment II

In Chapter 6, the assessment framework that was developed as part of the Hermosa Beach oil drilling and production project (Chapter 5), was revised in order to learn from application of the framework in a real-world setting, and to better align the HIA process with existing legislated EA processes (Objective IV). A review of EA processes led to the development of specific objectives for revision of the framework. This included consideration of the “significance” of the health impacts, a common approach within EA. Several other objectives were also identified, and are discussed in further detail in Chapter 6, along with the revised assessment framework and application of that framework to several test cases.

Chapter 7: Values in HIA

In Chapter 7, the practice of HIA was reviewed through the lens of human perception, values and attitudes. Although methods and tools are developed with the intention of improving objectivity and providing a more scientific approach, the human factor is integral to any decision making process. The chapter addresses a research objective by critically evaluating the HIA process, including the screening (Chapter 3), scoping (Chapter 4) and assessment
tools (Chapter 5/6) developed as part of this doctoral thesis, to consider the impact of human interpretation (Objective V). This component of the thesis was important in two respects: first, it is integral to the interdisciplinary nature of the research; second, it provides a critical review of the work conducted and provides acknowledgement of the epistemological limitations of the tools. This is imperative if they are to be applied and improved over time, to facilitate more effective use and application of HIA.

**Chapter 8: Discussion and Conclusions**

In Chapter 8, the discussions and conclusions provided in each of the preceding chapters are considered in a wider context. Achievements and relevance of findings are discussed, limitations of the research are identified, as well as opportunities for further research in the field of HIA.

**1.8 References**


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Chapter 2

Literature Review and Gap Analysis

Citation


Abstract

Health Impact Assessment (HIA) is recognized as a useful tool that can identify potential health impacts resulting from projects or policy initiatives. Although HIA has become an established practice in some countries, it is not yet an established practice in Canada. In order to enable broader support for HIA, this study provides a comprehensive review and analysis of the peer-reviewed and grey literature on the state of HIA practice. The results of this review revealed that, although there is an abundance of publications relating to HIA, there remains a lack of transparent, consistent and reproducible approaches and methods throughout the process. Findings indicate a need for further research and development on a number of fronts, including: 1) the nature of HIA triggers; 2) consistent scoping and stakeholder engagement approaches; 3) use of evidence and transparency of decision-making; 4) reproducibility of assessment methods; 5) monitoring and evaluation protocols; and, 6) integration within existing regulatory frameworks. Addressing these issues will aid in advancing the more widespread use of HIA in Canada.
2.0 Advancing the practice of health impact assessment in Canada: obstacles and opportunities

2.1 Introduction

World Health Organization (WHO) defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1948). This is considered an ideal to strive for, and it forms the basic principle upon which health impact assessment (HIA) is based. Historically, health has been a secondary consideration, if it is considered at all, in many policy/project decision-making processes. When it has been included, it tends to be limited to an evaluation of health impacts associated with environmental contaminants. More recently, it has been acknowledged that a wider range of health issues can arise from implementation of policies and projects originally thought to be outside of the scope of more traditional environmental assessment methods (NCCHPP, 2013). These issues include both direct and indirect stressors that can be distributed both temporally and geographically across a population. Often referred to as the “social determinants of health” this collection of factors related to health status ranges from biological characteristics (i.e., age, gender, genetics, etc.) to socioeconomic factors (i.e., education, income, lifestyle factors, etc.) as well as distribution of health impacts and overall perceptions of well-being (Whitehead and Dahlgren, 1991; Figure 2.1).
There are a number of different ways that health can be implicated from the execution of policy, program or project decisions. Additionally, personal values and public perceptions, attitudes and behaviors can influence health via actual or perceived impacts (Frankish et al., 1996). The complexities that surround each of these determinants and their interactions, make it particularly difficult to evaluate potential changes that may result from policy or project decisions. Despite this difficulty, these are important aspects of overall health and well-being that are currently lacking in many of the traditional assessment methods.

2.1.1 The HIA Process

The WHO (1999) has identified the four core values that form the foundation of HIA. These include: democracy, equity, sustainable development and ethical use of evidence. Democracy is introduced into the HIA process by allowing people to participate in policies or projects that may impact their health. There are varying levels of public participation in the HIAs conducted to date (Wright et al., 2005a). Equity is an inherent part of HIA since it focuses not only on the presence or absence of potential impacts but also on the distribution of impacts across populations, including vulnerable groups (Heller et al., 2014). Sustainable development can be addressed in HIA by carefully considering the extent of impacts, both
short and long term to evaluate the full effects of a particular undertaking. Finally, ethical use of evidence is an important aspect of HIA since every assessment should be based on the best available qualitative and quantitative evidence and conducted using sound methods (WHO, 1999). However, there is often a high degree of variability among HIA reports with respect to the quality of evidence and rigour of the methodology.

The WHO (1999) defines HIA as “a combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.” However, they note that there is no “correct” definition of HIA since those provided by various government and health agencies place emphasis on different aspects of the process. For example, the United States National Research Council (NRC, 2011) provides a more prescriptive definition of HIA as “a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program or project on the health of a population and the distribution of those effects within a population. HIAs provide recommendations on monitoring and managing those effects.” Another description published by Lock (2000) highlights the interdisciplinary nature of HIA and points out the quantitative and qualitative aspect of the process: “A structured method for assessing and improving the health consequences of projects and policies in the non-health sector. It is a multidisciplinary process combining a range of qualitative and quantitative evidence in a decision-making framework.” It is apparent from these and other definitions, that HIA is a process that has yet to be consistently and clearly defined and although the basic idea is similar, the details and specific methods remain inconsistent and unclear (Joffe and Mindell, 2005). Adding to this lack of consistency and clarity within the practice of HIA, is the fact that there are different approaches to the process as a whole. Birley (2011) presents the HIA spectrum that ranges from the highly technical to the highly social. Similarly, Harris-Roxas and Harris (2010) identify four models of HIA that are typically applied including mandated, decision-support, advocacy, and community-led HIAs. Each of these models serves a different purpose and the end product can appear quite different, although the authors argue that these differing approaches serve different purposes and lend themselves to the flexibility of the HIA process.
The one area where there is general consensus among HIA practitioners is the required steps or key components of an HIA (Eckerman, 2013; Taylor and Quigley, 2002; Wernham, 2011). The HIA process consists of a series of steps that are intended to provide a structural framework around which the assessment will be conducted (Figure 2.2). Although guidance documents from around the world have slight variations on these steps, the process is fundamentally the same. The first step is to conduct a screening to determine, through a rapid review of available evidence, whether an HIA is warranted (Ross et al., 2014). If it is decided that an HIA is the appropriate course of action, the assessment must be scoped. The purpose of the scoping step is to plan the overall approach to the HIA including methods, content and logistics. Feedback from stakeholder engagement initiatives plays a key role in identifying important issues for consideration in the HIA. The next step is the assessment, which can vary widely depending on the project, policy or program in question. The assessment step is where all of the planning in the scoping phase is carried out to “identify whether impacts are likely to occur and then to quantify or characterize the predicted impacts” (Ross et al., 2014). Based on the findings of the assessment, specific recommendations may be made in an attempt to mitigate negative impacts and enhance positive impacts to the extent that they are politically, socially and technically feasible. The reporting step involves dissemination of the methods and results to key stakeholders. Monitoring is intended to ensure that the control measures and health predictions in the HIA are accurate and effective. However, this is one of the least well-defined steps of HIA and is seldom implemented. Although not always included, the final step is evaluation that involves reflection and critical assessment of the HIA impact and process in order to improve the process over time (Ross et al., 2014).
Figure 2.2  The Health Impact Assessment Process

The majority of information available on HIA is from government or health agencies, with limited scientific research published in the primary literature (CDPH 2010; Health Canada, 2004; IAIA 2006; NRC, 2011; Ross et al. 2014; US EPA 2013). Those studies that do appear in the literature frequently identify the lack of a consistent methodological approach to HIA and point to the need for more prescriptive guidance (Briggs, 2008; Fehr, 1999; Forastiere et al., 2011; Negev et al., 2013). Although there have been some advancements in the field of HIA, the conclusion published by Lock (2000) is still valid today: “Those looking for an established analytical framework for considering health impacts will be disappointed. Currently there is neither an accepted gold standard nor even a simple, reliable, and evaluated method for carrying out health impact assessment.” This lack of consistency continues to have major implications on the effectiveness of HIA as a decision-making tool. In addition to the issue of having a reliable methodology, there are complexities around policy development and the decision-making processes that HIA are intended to support. It
has been suggested that although the development and use of more robust tools is important, there are other factors that influence the viability of HIA, including the level of involvement of major stakeholders and decision-makers (Bourcier et al., 2014; Haigh et al. 2013a),

2.1.2 Historical Context of HIA Practice in Canada

Canada has a long history of natural resource development and consequently has developed a process for assessment of impacts associated with these and other large-scale developments and infrastructure projects. Impact assessment of projects, programs and policies has occurred in Canada since 1974, when a federal Cabinet policy was developed to review the environmental impacts of federal decisions (Banken, 2003; NCCHPP, 2010). In 1990, the Canadian Environmental Assessment Act (CEAA) was introduced and by 1995 it was brought into full force (CEAA, 2014). Since then, major development projects in Canada have been required to complete a comprehensive Environmental Assessment (EA) process for approval. Each of the Provinces and Territories also have EA legislation. Although health is generally considered in EA, there is no specific guidance or methodology to ensure comprehensive or consistent inclusion of specific health issues. The International Association for Impact Assessment (IAIA) has stated the following with respect to health considerations in traditional environmental assessments:

“The assessment of health effects is likely to be biased towards bio-physical health determinants rather than a holistic view that also includes important wider determinants. The scope of health issues covered may reflect the industrial country roots of EIA, and therefore lack the level of comprehensiveness necessary to make the assessment fully relevant to local health conditions” (IAIA, 2006).

The current CEAA (2012) is based on “the Government’s plan for responsible resource development to modernize the regulatory system and allow for natural resources to be developed in a responsible and timely way for the benefit of all Canadians.” This includes detailed requirements for conducting EAs of designated projects where there is potential for adverse environmental effects within federal jurisdiction on a variety of levels including: fish and aquatic species, migratory birds, federal lands, cross-border effects, effects to Aboriginal peoples, etc. The responsible authority for conducting and overseeing federal EAs in most
cases is the Canadian Environmental Assessment Agency (CEAA, 2015). When an assessment is required, the EA must include an evaluation of the following: environmental effects (including cumulative) that could be caused by the project, significance of effects; mitigation measures to address significant effects; and, public comments (CEAA, 2015).

More recently, human health risk assessment (or quantitative risk assessment) has been used as a tool for evaluating potential health hazards resulting from the presence of toxic chemicals in the environment. This method of assessing health arose from new environmental laws identifying the need for science-based decision making around environmental contamination issues. To make the federal risk assessment (RA) process more consistent, Health Canada released a series of RA guidance documents as part of the Federal Contaminated Sites Action Plan and an EA document (Health Canada, 2010; 2012). The Health Canada (2010) EA document does not make any mention of HIA, and only a brief section on social economic considerations. For non-brownfield sites (including EA projects), the risk assessment methodology varies by province, with RA practitioners often relying on established best-practices to evaluate possible health risks. More recently however, it has been recognized that many health risks are complex in nature and extend beyond what is typically evaluated in an RA (Briggs, 2008).

The practice of HIA in Canada has generated interest since its introduction in the 1990s (NCCHPP, 2012). In 1998, The Canadian Handbook on Health Impact Assessment was originally published and was subsequently updated in 2000 and 2004. The handbook consisted of four volumes: 1) The Basics; 2) Approaches and Decision Making; 3) The Multidisciplinary Team; and, 4) Health Impacts by Industry Sector. The handbook was one of the first of its kind and included discussion of the usefulness of HIA and the procedures necessary to include health considerations in impact assessments (Health Canada, 2004). In 2013, Health Canada placed this set of documents into its archives – it is no longer available on their website and has yet to be replaced by any more up to date federal documentation on HIA in Canada. Despite this fact, there has been a resurgence of interest in this approach to evaluating health, with governments, health agencies and members of the public identifying the need for a more holistic assessment of health impacts (NCCHPP, 2010). Ideally, HIA would complement established EA and RA processes by taking consideration of health
impacts one step further to include social and economic determinants of health. However, the full potential of HIA has yet to be realized in Canada, as it has been in some other countries (Scott-Samuel, 2005). In their paper, Bronson and Noble (2005) discuss the challenges of integrating social and cultural health determinants into the EA process. They identify several issues around integration, including the need for a consistent definition and understanding of health, that need to be considered when proposing an HIA framework intended for integration in the EA process in Canada.

2.1.3 Study Objectives

This study aims to provide a comprehensive review and analysis of the peer-reviewed and grey literature on the state of HIA practice for the purpose of identifying obstacles that are preventing HIA from being used as a key decision-making tool for those projects and policies that have the potential to impact the health and well-being of Canadians. Key opportunities for further research and development are discussed.

2.2 Methods

The objective of this systematic literature review was to identify relevant primary and grey literature on the processes and methods associated with HIA practice. The approach was modelled after the Cochrane Handbook for Systematic Reviews of Interventions, which is based on the principle that “science is cumulative” and that by taking a weight-of-evidence approach, decisions can be made based on the best science available (Cochrane Collaboration, 2009).

Due to the interdisciplinary nature of HIA, the literature search was conducted using three major databases that cover a wide range of environmental health issues: Web of Science, PubMed and Scopus. Web of Science is a multidisciplinary database that contains high-quality publications in over 250 different subject categories; PubMed is a health and medicine database that provides access to MEDLINE containing over 24 million citations, and Scopus is the largest abstract and citation database of peer-reviewed scientific journals, books and conference proceedings with 55 million records from 5,000 publishers. The same search criteria were employed for all three databases. The keyword “health impact assessment” was used since it identified a specific type of assessment and was most likely to
return relevant results. The following inclusion criteria were applied: English-language articles published from 1990-2015 to ensure that all potentially relevant literature concerning the evolution of HIA practice would be captured. This initial search returned >500 results in PubMed, and >1,000 results in both Web of Science and Scopus. To further refine the results, the search term was restricted to the article title, producing the following: 306 (PubMed); 535 (Web of Science); 527 (Scopus). There was a high-degree of duplication among the three databases; consequently, the results were compiled with duplicates removed (n=568). The compiled results were then screened (Tier I) by title and abstract to find potentially relevant articles focusing on the practice methodology of HIA. The title and abstract were found to be relevant if they indicated that the article: 1.) discussed best practices for HIA; 2.) identified key issues with currently employed HIA methodologies; 3.) proposed novel methodologies for assessment; or 4) provided a review of HIA practices. Due to the volume of literature available on the topic of impact assessment, articles were excluded if they were specific case studies, clinical trials, epidemiological studies, or any type of health assessments other than traditional HIAs. The Tier I screening further refined relevant results (n=94) which were retained for full text review. Following a full-text review (Tier II), a total of 66 articles were retained for inclusion (Figure 2.3). The concepts, data and results extracted from the full-text articles included information on completed HIAs, lessons learned from previously employed strategies, discussions of data gaps and research needs in HIA, proposed HIA frameworks, and novel quantitative or qualitative methods.

The grey literature search was conducted using the Google search engine to ensure inclusion of government and health agency reports on HIA that have not been published in peer-reviewed scientific journals. The keyword “health impact assessment” was used, producing over 400,000 results. The first 300 results (in order of relevance) were screened by title and source (n=62). Preference was given to guidance documents and reports published by credible sources and authoritative organizations such as the WHO, US EPA, Health Canada, international government and health agencies, etc. A secondary screening of the online content found in the original webpage/document further reduced the results to 30 sources. Where available abstracts were reviewed for contents relevance, otherwise an executive summary or overview was used for secondary screening purposes. The final list of sources
were almost exclusively HIA guidance documents from reputable agencies, where pertinent methodological information was retrieved, along with reviews of HIA practice.

Figure 2.3  Systematic Approach Used to Conduct the Literature Review

2.3 Results and Discussion

The results of the literature review found that although a large volume of work is available on the topic of HIA practice, there are few articles that go beyond provision of basic assessment approaches and recommendations (NCCHPP, 2008; NHS, 2000). Detailed methodologies and specific protocols for screening, scoping and assessment in particular will be found wanting for practitioners (Knol et al., 2010; Krieger et al., 2003; Tarkowski S and Ricciardi, 2012). Despite this issue, HIA is considered essential to the future of comprehensive evaluation of health impacts from projects and policies and is widely supported as a potentially useful decision-making tool (Briggs, 2008; Chadderton et al., 2012; CHETRE, 2007; Collins and Koplan, 2009; Dannenberg et al., 2006; Metcalfe et al.,
2009; Mindell et al., 2008; NCCHPP, 2013). The results of the review have been critically appraised to identify the common elements that have prevented HIA from reaching its full potential. Through evaluation of the primary and grey literature, an extensive list of the issues and obstacles identified within the practice of HIA was created. From this list, the authors grouped common themes and found that the majority of the issues identified fell within several general categories relating to the process and implementation of HIA. Consequently, six key areas were identified as requiring further research and development in order to further the practice of HIA in Canada and around the world. These areas are discussed in detail below:

- Lack of HIA triggers;
- Consistency of scoping and stakeholder engagement approaches;
- Use of evidence and transparency of decision making;
- Reproducibility of assessment methods;
- Monitoring and evaluation protocols; and,
- Integration within existing regulatory frameworks.

2.3.1 Lack of HIA triggers

There are many potential triggers that can facilitate the initiation and utilization of HIA within the decision-making process. An HIA trigger is defined here as any driving force behind the decision of whether or not to conduct an HIA in any particular scenario. The importance of HIA triggers, especially for policies and projects where health is not typically evaluated, is rooted in the fact that the majority of health outcomes are attributed to social, economic and environmental factors. In fact, “[s]tudies have shown that only about 10 percent of health outcomes may be attributed to access to health care, and 20 percent to genetic predispositions. The remaining 70 percent are due to social and environmental factors, as well as behavioral variables which are often socially and environmentally determined” (Heller et al., 2013). Currently, the decision to undertake an HIA or to consider screening for HIA is typically the result of one of three pathways: 1) the political or policy pathway where local processes or requirements necessitate the process; 2) a funding pathway where availability of funding promotes activity; or, 3) the champion pathway whereby a local practitioner sees the potential of the process and gathers organizational support (Taylor et al.,
The issue with this approach in Canada is that there is often little to no political pressure to conduct HIA, funding is often cited as the major obstacle to conducting HIAs in general, and the promotion of the HIA process by a “champion” can be rare.

In other countries, the processes triggering HIA have become more widely used. As early adopters of HIA, Australia and New Zealand first developed national guidance in 1994 and continue to push for the integration of the HIA both on its own and as part of existing environmental impact assessment processes (Harris, 2005; Scott-Samuel, 2005; Mahoney 2005; Haigh et al., 2013a; Delany et al., 2014). However, despite continued interest from public health officials and other stakeholders, it has been found that a “lack of detailed knowledge of the potential use of HIA is often opinion based and not informed by research or practice”, which has slowed the progress of HIA in Australia and New Zealand (Haigh et al., 2013b).

In the United Kingdom, there has been a major push for policy triggers for HIA, including incorporating health into environment assessment processes (Ahmad et al., 2008; Milner et al., 2003; Mwatsama et al., 2014). Similar initiatives are being considered in Italy through integration of HIA into strategic environmental assessment (SEA) and environmental impact assessment (EIA) frameworks (Linzalone et al., 2014). This approach of triggering HIA as part of existing environmental assessment processes is also beginning to be realized in Thailand and India where tools are being developed to facilitate this integration (Dua and Acharya, 2014; Hengpraprom and Sithisarankul, 2011). In 2007, HIA was integrated into existing public health legislation in Slovakia; however, guidance on specific implementation approaches is still lacking (O’Mullane, 2014). Additionally, there has been an increase in the number of HIAs conducted in the United States, although some argue that development of HIA as a stand-alone practice rather than being triggered as part of other processes may be better suited in certain regulatory environments (Cole and Fielding, 2007). A better understanding of the legal basis for HIA in the US and in other countries may provide opportunity for regulated triggers that will foster a broader integration into public policy decisions (Rajotte et al., 2011).
With the exception of certain regulatory initiatives to facilitate the use of HIA in Quebec, there are currently no triggers for HIA in Canada at the federal or provincial levels. Although large-scale projects require an Environmental Assessment to identify and minimize potential impacts to the natural environment, no such requirements are in place for assessing impacts on human health, especially the socioeconomic determinants that are an inherent part of the HIA process. Early efforts to support the development and institutionalization of HIA in Canada have stagnated (Benusic, 2014; NCCHPP, 2013; Taylor and Quigley, 2002).

Therefore, it is imperative that a clear and consistent set of triggers be developed to identify those projects and policies that could potentially benefit from the HIA process. There is also opportunity for integration of a systematic screening approach to decision-making regarding whether or not it is practicable to conduct an HIA in different scenarios.

2.3.2 Consistency of scoping and stakeholder engagement approaches

Health is a complex issue that is fully intertwined with both the natural and anthropogenic environments in which we live. As Bhatia (2010) stated in the California Department of Public Health’s Guide for HIA:

“Living in a healthy place means having adequate housing; a secure and meaningful livelihood; access to schools, parks, and public spaces; safety and freedom from violence; unpolluted air, soil, and water; and a society that promotes not only opportunity and innovation but also cooperation, trust, and equity.”

Since there is such a huge range of potential areas for inclusion, one of the major obstacles to establishing HIA is around the consistent and defensible scoping of the assessment, including the use of community engagement. This issue of consistency in scoping was further explored by Fakhri et al. (2014) that looked at the underlying principles guiding HIA including “emphasizing the critical role of scoping in the HIA process.” The scoping process is the step where all major decision are made regarding what to include or exclude from assessment. It not only defines the boundaries of the HIA but also outlines the administrative processes by which the HIA will be carried out. There are essentially an unlimited number of ways that
health can be directly or indirectly impacted by a project or policy initiative and the scoping step of an HIA needs to provide a robust rationale for the scope of work required.

One important aspect of HIA that is often poorly executed is public participation in the process (Wright, 2005a). Typically, stakeholders, including members of the public, are brought into the HIA process at the scoping step in order to help identify those potential health impacts that are most important. The way in which stakeholders are engaged in the process varies considerably among HIAs, if it is a component of the process at all. When it is included, it tends to be one or more of the following: public open houses, key informant interviews, surveys, focus groups, and public comment periods, among others (Mindell et al., 2008). Engaging stakeholders in an HIA clearly reflects the values of a democratic society (NCCHPP, 2012); however, there is currently no clear definition of what constitutes sufficient and effective stakeholder engagement in HIA. This remains a major obstacle to the practice of HIA being consistently applied to projects and policies in Canada and around the world.

Another core value promoted by HIA is equity. Unfortunately, equity is often not adequately addressed in many HIAs (Parry and Scully, 2003; Povall et al., 2013). In their report, Heller et al. (2013) discuss the issue of inequitable distribution of health outcomes in relation to HIA and how it can be used as a tool for advancing better health and equity. The authors note that equity should not simply be addressed in the analysis of health data and identification of vulnerable populations; instead it should involve public input into the process:

“The HIA process itself is also an important instrument for building power in communities; for engaging community members in decisions that stand to affect their health and well-being; for integrating community knowledge, insights, and leadership into public decision-making processes; for building consensus around decisions; and for creating lasting relationships and collaborations across disparate constituencies. Significantly, the HIA process also provides opportunities for communities, especially those that endure health inequities, to ensure that decision-making processes reflect their health concerns and aspirations” (Heller et al., 2013).
Promoting values of democracy and equity in the HIA process is especially important at the scoping stage where major decisions are made regarding what health issues and determinants will be included in the assessment. In their study, Pursell and Kearns (2012) discussed the benefits and drawbacks to community participation in HIA. They found that active community participation in the HIA process increased knowledge of health determinants, promoted broader recognition of sources of health information for use in decision-making, and promoted a greater understanding of other stakeholders’ roles and perspectives. However, they also discussed barriers to collaboration arising from conflicting opinions on the objective and purpose of HIA (advocacy versus collaborative assessment), and a lack of specificity in approaches that provide meaningful contribution to the decision-making process.

Overall, it is apparent that although there is consensus that scoping and community engagement are vital aspects of the HIA process, there is little consistency around how HIAs are conducted. Therefore, it is imperative that a clear, defensible and consistent method for scoping HIA of projects and policies be developed, along with a more prescribed approach to community engagement initiatives.

### 2.3.3 Use of evidence and transparency of decision-making

A review conducted in 2002 identified the use and appraisal of evidence as a major gap in HIA practice (Taylor and Quigley, 2002). The review discussed limitations regarding the available evidence base for HIA and issues around effectively integrating qualitative and quantitative data into the process. Although this review was conducted over a decade ago, these limitations continue to be an issue within the practice of HIA, particularly in areas or regions with limited health data or a lack of resources.

In the US, a recent review of 81 HIAs from various sectors including transportation, housing, land use and waste management found that overall “while HIAs have helped to raise awareness and bring health into decisions outside traditional health-related fields, the effectiveness of HIAs in bringing health-related changes to pending decisions in the U.S. varies greatly. The review noted that there are considerable disparities in the quality and rigor of HIAs being conducted” (US EPA, 2013). This issue was previously highlighted in
Bhatia (2010) which identified the importance of using the best available evidence and acknowledging the limitations and uncertainties associated with HIA: “practitioners should be aware of their own biases as well as those of stakeholders and decision makers.” When values are not transparent, they can affect outcomes in unexpected ways and can constitute hidden sources of conflict amongst stakeholders and decision makers (Stefanovic, 2015).

This aspect of providing transparent evidence in HIA is tremendously important, given that a major objective is to influence the decision-making process when policies and projects have the potential to impact health. If the evidence being relied upon is of poor quality or not explicit, and the decision making behind the use, analysis and interpretation of evidence in the HIA is poor delineated, including a lack of consideration for the uncertainties and limitations, the results of the HIA may lack justification and credibility for stakeholders and decision makers.

Numerous other studies have considered the use of evidence in HIA. One such study found that the main sources of evidence used by HIA practitioners in the UK were literature reviews (71.2%), stakeholder engagement initiatives (69.2%) and expert opinion (67.3%), followed by completed HIA reports and surveys (Chilaka, 2011). An article by Herriott et al. (2010) also looked at sources of health-based evidence and identified key sources of information including: epidemiological and statistical data, published reports, research studies and grey literature: and, qualitative information (e.g., stakeholder experience and expert opinion). There is consensus among researchers and practitioners that a variety of types of evidence should be applied to the HIA process, rather than relying on a single source or type of data. Another study by Mindell et al. (2010) involved development of a practical guide to reviewing publically available evidence for use in HIA. The guide provided advice on reviewing quantitative and qualitative evidence for use in HIA and the guide was pilot tested by invited volunteers. The authors note that the guide can be locally adapted to “incorporate information on country-specific legislation and regulations, links to language-specific web-based resources and “local ownership” (i.e. the professional groups involved in the local process that resulted in the document accept it and are committed to its use), all of which are important for the successful implementation of guidelines” (Mindell et al., 2010). This guidance has already been adapted for Australia HIA practitioners, and the same should
be considered for Canada to foster a consistent and defensible approach to reviewing and evaluating evidences used in HIA.

Mindell et al. (2004) considered the implications of offering insufficient or poor quality evidence in an HIA. They emphasize the need for the best available evidence in all aspects of HIA including screening, scoping and assessment steps. Similarly, they identify a strong need for methods that “facilitate comprehensive searching across a broad range of disciplines and information sources; collate appropriate quality criteria to assess a range of study designs; synthesize different kinds of evidence; and facilitate timely stakeholder involvement” (Mindell et al., 2004). One of the major issues associated with the collection, use and evaluation of evidence in HIA is that it requires knowledge of health outcomes that can be identified across a range of disciplines. Therefore, it is vital to ensure that the evidence base is sound and the use of evidence within HIA is founded on consistent and defensible assessment methods. Part of the process requires careful consideration and selection of the practitioners who will conduct the HIA. Practitioners should have extensive experience with environmental health issues across a range of disciplines, and have the scientific capacity and resources to conduct a comprehensive evidence-based assessment that is independent and as unbiased as possible.

One of the major issues around selection and use of evidence is that HIA focuses on those health determinants that are often unsupported by available data. Mikkonen and Raphael (2010) identified 14 determinants of health that are specific to Canadians. The determinants include: gender, race, education, aboriginal status, disability, housing, early life income and income distribution, employment and working conditions, social exclusion, food insecurity, social safety net, health services, and unemployment and job security. There are major challenges associated with limited availability of evidence, especially for the social and economic determinants at more localized levels. Moreover, the evidence that is available must be used in an ethical manner. There is limited research around the issue of ethical decision-making in HIA. A study conducted by Tannahill and Douglas (2012) compared HIA and the decision-making triangle (DMT) framework with respect to the use of evidence, application of ethical principles and how they aid in decision making. Some of the ethical principles that tie into HIA include fairness, sustainability, social responsibility,
participation, openness and accountability, among others. It was concluded that the principles of HIA and the DMT framework are complementary and that HIA practice can be improved through application of ethics-based processes and methods that may include a wider range of impacts for consideration (Tannahill and Douglas, 2012; Stefanovic, 2008).

Overall, the use of robust and defensible evidence to inform a transparent decision-making process is vital to the success of HIA as a practice. The lack of available evidence for specific or localized health determinants is a major obstacle in HIA, as is the infrequent ethical and systematic use of evidence to inform recommendations to aid in the decision making process.

“If HIA predictions are not grounded on robust and sound evidence, there is the risk that the conclusions and recommendations made will be based on wrong premise. Moreover, if the evidence base is unsound, HIA may not be scientifically or legally defensible, and the reputation of HIA itself would suffer” (Chilaka, 2011).

This presents an opportunity for additional research into the types of evidence available and how that evidence can be used within HIA. Although the evidence itself will differ, the process by which it is organized, analyzed for quality, evaluated with respect to potential health outcomes and used as a basis for recommendations, should follow a consistent and logical framework. Finally, the evidence should be used in a transparent manner such that the intended audience can clearly see how the evidence influenced decision-making throughout the assessment. Overall, “HIA should be a transparent and objective process, guided by evidence from a range of sources, which confers independence and credibility on the recommendations produced” (Taylor et al., 2003a). Having said that, it is important to remember that decision making consists of more than simply an intellectual inventory of apparently rational, objective factors. Informed intuitions, collective passions and core values, sometimes much taken for granted, frame and contextualize judgment calls that feed quantitative evaluations. In the words of the National Research Council (2005), “value choices are often hidden in the simplifying assumptions of analytic techniques, and the assumed values may not be universally shared.” Challenging though it may be, incorporating that reality into an HIA is essential.
2.3.4 Reproducibility of assessment methods

One of the most promising research opportunities lies in developing methods to make HIA more universally applicable and to provide guidance on the practical implementation of specific quantitative and qualitative assessment methods (Mesa-Frias et al., 2013; Mindell et al., 2008; O’Connell and Hurley, 2009; Taylor and Quigley, 2002; Vohra, 2007). The literature on HIA, especially on specific procedures and applications, is limited by the lack of a detailed, comprehensive set of methods by which to conduct consistently defensible assessments. There remains a clear need for applied, interdisciplinary research around health impact assessment of policies and projects.

Many studies have considered the issues around HIA methodology and tool development (Finer et al., 2005; Gottlie et al., 2012; Lhachimi et al., 2012; Nazelle et al., 2011; Van Caneghem et al., 2010; Winkler et al., 2012). In a review of different HIA frameworks, Mindell et al. (2008) found that although each approach was intended to be used for conducting HIAs, they varied considerably in their use and interpretation of practice terms, their focus and relative importance of different aspects, as well as specific methodological requirements. Although more recent HIA frameworks tend to be more holistic in nature and provide general recommendations for evaluation approaches, the authors noted that “the relative strengths and weaknesses of the different approaches depend on the level of HIA to be conducted (policy or project), the extent (rapid or comprehensive), the definition of health used when conducting an HIA (biomedical or holistic), the resources available (including staff, time, expertise and funding) and the values of those involved” (Mindell et al., 2008). In a study looking at quantitative methods used in HIA, it was found that chemical exposure risk assessment can play an important role by quantifying potential health risks from exposure to environmental hazards (O’Connell and Hurley, 2009). However, quantification of these risks is a complex process that is often interpreted by stakeholders as infallible, despite the many uncertainties and assumptions that comprise the basis of the assessment. It was therefore recommended that all quantification within HIA methodology be accompanied by a detailed explanation of the potential sources of uncertainty and how this can impact the assessment overall.
The Swedish National Institute of Public Health released a document discussing quantitative methods in HIA (Brodin and Hodge, 2008). This document identified eight problem areas with respect to quantitative methods used in HIA including: 1) differentiating aims, objectives and means; 2) comparing costs and effects over time; 3) assigning price to loss or saving of human life; 4) assigning price to ill health; 5) identifying the real HIA cost or benefit of a programme; 6) managing multiple benefits/effects in HIA; 7) pricing productivity losses; and, 8) lack of available data for HIA. A brief description of each of these problem areas is included in the document and provides insight into tackling complex issues within HIA; however, the document lacks prescriptive methodology to guide HIA practitioners with respect to evaluation of specific health outcomes. This issue is further highlighted by Joffe (2003) who states that “a minimum requirement is that there should be some consistency or robustness, so that the outcome of an HIA does not depend just on who happens to carry it out, that it is not easily swayed by the vested interests that typically surround any project, and that it can withstand legal challenge.”

The use of HIA methodologies extends well beyond qualitative versus quantitative approaches. There are also issues around evaluation of equity within HIA and the distribution of effects across populations. Heller et al. (2014) published a series of equity metrics for HIA practice that “attempt to connect theory to practice and provide a set of indicators to facilitate shared understanding in the field.” These metrics are intended to be embedded into the HIA process in a way that addresses whether the HIA: focused on equity; built community capacity for engagement; resulted in a power shift benefitting those experiencing inequalities; or contributed to changes that reduced environmental health inequities. However, there is little guidance on how to conduct HIAs in such a way that will ensure that these issues are integrated into the assessment process in order to achieve the goals laid out in the equity metric. Additionally, there is some literature around integration of more global health issues, such as those relating to climate change, into HIA methodological frameworks in an attempt to facilitate local action (Brown and Spickett, 2004; Brown et al. 2014; Patz et al., 2008).

Despite these obstacles with respect to HIA methodologies, there are guidance documents that have improved the practice of HIA over the past decade and provide some preliminary best practices. The Merseyside Guidelines were among the first formalized reports to assist
practitioners with the issues and processes around commissioning and conducting HIA in the UK (Scott-Samuel et al., 2001). The report acknowledges that HIA methodology was not well-established and the guidelines were intended to provide a general overview of HIA practice: “this publication constitutes “work in progress” and development and refinement of the HIA procedures and methods described here is a continuing process” (Scott-Samuel et al., 2001). Another widely used HIA guidance document was released by the International Finance Corporation World Bank Group in 2009, which provides details on many different aspects of the HIA process (IFC, 2009). The document aims to describe best guidance practices in conducting HIAs for both new projects and expansion of existing facilities. The report identifies HIA as an adaptive process that “is applicable across industrial sectors (such as agribusiness, infrastructure, extractive industries) and project settings (such as urban, rural, greenfield, brownfield)” (IFC, 2009). The guidance provides useful advice and consideration of issues specific to development projects; however, since it is geared specifically toward projects, it is not readily adaptable to other scenarios involving policies or programs.

HIA practitioners and reviewers also rely on the Minimum Elements and Practice Standards for HIA, originally published by the North American HIA Practice Standards Working Group in 2009 and updated in 2014 (Bhatia et al., 2014). This document is intended to “provide guidance on what is required for a study to be considered an HIA (Minimum Elements) and some benchmarks for effective practice (Practice Standards)”. Overall, it aims at improving the overall quality of the HIA process to ensure that all HIAs meet a minimum set of criteria. Some of the benchmarks identified in the document include (Bhatia et al., 2014):

- What steps must be included in an HIA;
- Provision of explicit goals and objectives for achieving success;
- Inclusion of meaningful stakeholder engagement initiatives; and
- Integration and use of knowledge from different disciplines.

Despite some advances in the methodology and tools available for use in HIA, there is still no nationally recognized framework that can be applied to a range of projects and policies and ensures that regardless of whom is conducting the assessment, it is high quality,
defensible, reproducible and based on the best available evidence. Due to Canada’s large-scale industrial and natural resource development, and the goal of “health in all policies” there is a clear need for an established HIA methodology across the country.

2.3.5 Monitoring and evaluation protocols

In a review conducted by Taylor and Quigley (2002), monitoring and evaluation aspects of HIA were identified as both crucial to the process and extremely underutilized. Despite advances in HIA over the past decade, this lack of monitoring and evaluation guidelines continues to be an area of contention and uncertainty among decision makers. There are three main ways to determine the effectiveness of an HIA including an evaluation of the process, the impact, and/or the long-term health outcomes as a result of HIA recommendations. Although a quantifiable evaluation of long-term health outcomes resulting from HIA measures is ideal, it is also resource intensive and therefore not feasible in most situations (Taylor et al., 2003b). Therefore, often due to a lack of funding and resources, the majority of evaluations that are done, if they are done at all, focus on evaluating the process and impact of HIA, rather than specific health endpoints. The distinction is that an impact evaluation considers whether and how well the HIA worked, whereas a process evaluation focuses on why and how the HIA achieved its goals. Since the evaluation step is considered invaluable not only to the HIA in question but also to other practitioners to improve future HIAs, it is arguably an important step that needs to be a required component of each and every HIA. Additionally, evaluating the HIA process fosters increasing confidence in the practice by highlighting strengths, acknowledging areas for improvement, and ensuring accountability of those involved, including use of resources and achievement of initial study aims (Taylor et al., 2003b).

Liu et al. (2012), explored issues around environmental health monitoring and how to develop and implement monitoring plans in HIA. They argue that the majority of monitoring frameworks are narrow in scope with too few parameters, which limits their relevance and application to complex environmental health issues. They propose a monitoring protocol that could be used in environmental health impact assessments and is based on monitoring of “a wide range of driving forces, pressures, states, exposure and health effect variables, and using this information to identify causal links, and help decision-making” (Liu et al., 2012).
Studies conducted by Quigley and Taylor (2003; 2004) considered the importance of monitoring and evaluation in HIA and present an approach for formally evaluating HIA to determine its impact on the decision-making process. The approaches are fairly generic and focus on setting up clear objectives that can be formally evaluated after completion of the HIA. The authors note that similar methods of evaluation are employed in other disciplines. Although the articles do provide a brief list of typical methodologies that can be used in HIA monitoring and evaluation, there is little detail regarding how to implement these methods in a way that is effective, feasible and consistent.

Despite advances in the practice of HIA, there are still many questions with respect to monitoring evaluation of the process. There is still uncertainty around how exactly to evaluate an HIA to determine whether it added value to make the policy or project “better” than it would have been without an HIA (NCCHPP, 2013). Without the ability to comparatively analyze similar policies, one with an HIA component and one without, it would be difficult to objectively prove that the HIA improved population health or decreased the potential for negative health impacts. Along these lines, there is also the question of how much time and resources to dedicate to evaluation of HIA. Ideally, the evaluation process needs to be rapid while also being robust in order to provide evidence in support of HIA, while improving the process in the future (NCCHPP, 2013).

Due to the conflict between availability of funding and resources and the comprehensiveness of the assessment process, there is still no clear consensus regarding how to conduct evaluation and monitoring within HIA. At a minimum, HIAs should complete an evaluation of the process and impact of the assessment outcomes and recommendations. Additionally, the evaluation step of an HIA should be made publically available to other practitioners to foster continuous improvements within future assessments. With respect to monitoring, how and to what extent it is possible to monitor the impact of specific HIA recommendations and outcomes is still unclear. Further research examining the effectiveness of monitoring, including the variation in the types of methods employed, could provide a basic framework for monitoring that could be consistently applied to HIAs in Canada and other jurisdictions.
2.3.6 Integration within existing regulatory frameworks

In 2013, the National Collaborating Centre for Healthy Public Policy (NCCHPP) released a report titled “Canadian Experiences in Institutionalizing Health Impact Assessment” that provides information on the practice of HIA in Canada, especially as it relates to government strategies for integrating health in all policies (NCCHPP, 2013). The report identified the level of HIA undertaken in each province and territory, comparing them to 2009 classifications. In 2009, there were 7 provinces (Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Newfoundland and New Brunswick) where “some elements” of HIA had been put into place. In 2013, that number dropped to only 4 provinces (Alberta, Ontario, Quebec and Nova Scotia) while HIA was only “under discussion” in the remaining jurisdictions. Despite the majority of Canadian provinces and territories making limited progress on HIA in general, there are examples of successfully completed HIAs to date, including one conducted on mining activities located near Keno City in the Yukon (YDHSS, 2012).

In 2010, Alberta Health Services identified social environments, built environments and health disparities as key performance areas in their Health Promotion Disease and Injury Prevention Action Plan (HPP, 2011). Alberta Health and Wellness also released a guidance document for human health risk assessment (HHRA) as a part of environmental impact assessment. Although this document focuses largely on risk assessment of chemical contaminants, there is a section that discusses socio-economic considerations and health determinants (AHW, 2011). It is acknowledged that there is a link between individual/population health and socio-economic health determinants and it is stated that: “the potential for these factors to impact health, whether tangibly or otherwise, should be considered in conjunction with the results of the HHRA in interpreting the potential health impacts. Other indicators that may be addressed in the HHRA include changes to quality or way of life, changes in social or cultural patterns, stress and fear. The latter are less amenable to quantification and may not be identified by the risk assessor other than through stakeholder consultation” (AHW, 2011). Despite the fact that there is no explicit mention of HIA in this guidance document, all of the aspects of HIA are identified as necessary components of the assessment process, including social and economic determinants of health, well-being and the importance of public consultation in the process.
British Columbia was once considered a world leader in the development and promotion of HIA (Benusic, 2014). Following an increased awareness of health promotion in the 1970s and 1980s, the BC Royal Commission made a recommendation that studies of potential health effects should be included in all EIAs. Further, the Ministry of Health developed a strategy for stand-alone HIAs to be carried out for all new government policies and programs. An HIA guidance document was developed and with support of the Premier, “policy analysis procedures were changed to include considerations on the ‘likely positive or negative impact… on the health of individuals, groups, and communities’ with a broad scope of social, economic, and physical factors affecting health” (Benusic, 2014). Despite this progress, political leadership changes in the mid-1990s resulted in a shift in health priorities and HIA became “lost in the mix” (Benusic, 2014). Today, holistic assessments of health and implementation of HIA are largely discretionary.

In Quebec, HIA has a legal basis under section 54 of Quebec’s Public Health Act (2001), where “all government departments and agencies must ensure that their laws and regulations do not have a significant negative impact on the health of the population” (NCCHPP, 2013). Under the act, the Minister of Health also has the power to intervene in the plans of other ministries in the case of projects or policies that could be harmful to health and well-being. Additionally, there is a process in place to ensure that any project that is deemed to have required an HIA, or where the HIA does not adequately address health concerns, is returned to the relevant department for compliance. The report identifies lessons learned from Quebec’s implementation of HIA, including the benefits of government involvement in the process:

“The law and the intragovernmental mechanism are seen as crucial to the sustainability and stability of the HIA process within the government. The permanence of the established structures and processes also reduces the stumbling blocks created by the high mobility of personnel in the public service sector” (NCCHPP, 2013).

This suggests that in order for the practice of HIA to realize its full potential throughout Canada, a regulatory approach similar to that currently employed in Quebec offers a proven foundation for success. One way to provide a strong regulatory foundation to support HIA is
to integrate it into existing processes such as federal and provincial EAs and HHRAs. Both of these processes are well-established in Canada and have a regulatory basis for implementation and a formal review process.

Additionally, the NCCHPP (2013) has identified those conditions that make the implementation of HIA favorable in Canada from a regulatory standpoint including: a rapid yet reliable process, a legal basis linked to higher authorities; an approach based on incentives that support multiple sectors; a prospective approach to maximize potential benefits and some degree of funding. The report concluded that: “it is understood that all the Canadian provinces and territories have mechanisms that allow health issues to be taken into account in policy making or other government decisions. HIA can formalize and standardize the inclusion of health concerns” (NCCHPP, 2013). These requirements are in line with those recommended as part of the WHO European Health Cities Network (e.g., political buy-in, capacity building and adequate resourcing), which has made substantial progress in bolstering HIA in Europe (Ison, 2012).

The province of Ontario has no formal HIA guidance or regulatory mechanism; however, some municipalities are embracing HIA in theory and practice. In conjunction with Toronto Public Health, the City of Toronto developed an HIA guidance document that has been used for various projects and policy initiatives, including an HIA completed on the proposed expansion of Billy Bishop Toronto City Airport (TPH, 2008). One major strength of this framework is that it was designed to be used either as a stand-alone process or to be integrated into existing Ontario EA procedures including Individual Environmental Assessments, Environmental Screenings or Class EA processes (TPH, 2008). Similarly, HIA can be integrated into Federal EA processes by expanding the scope to include adequate evaluation of physical, social, economic and cultural determinants of health, considering how impacts can affect health and well-being. As a practice, HIA shares certain concepts and methods with many other types of assessment, including environmental impact assessment, risk assessment, strategic environmental assessment, social impact assessment and economic assessments (Mindell and Joffe, 2003). This fact has raised the question of whether HIA should be integrated into existing assessment frameworks or developed as its own stand-alone process (Morgan, 2003; Wright et al., 2005b; Bhatia and Wernham, 2008). Despite the
fact that integration of HIA into existing Canadian regulatory processes is an important opportunity in advancing the use of HIA, it is not the only avenue for adoption, nor does it ensure success: “evidence from the field of environmental impact assessment, which has a legislative framework in more than 100 countries, suggests that a mandatory legal framework is an important factor in the regular use of the tool, although it does not guarantee its effectiveness or its influence on the decision-making process” (Ahmad et al., 2008).

Therefore, it is apparent that in order for HIA to be implemented on a national level, a strong regulatory foundation is needed both to elicit HIA and provide appraisal of the process. Due to the immediate need for integration of HIA into the evaluation of major development projects in Canada and the potential difficulty around creating new legislation, it is possible that integrating HIA into existing assessment processes with established regulatory frameworks may provide a timely solution. For example, HIA could be introduced as a required component of the EA process, both at federal and provincial/territorial levels. However, due to the limited application of the EA process, typically to large-scale projects, the benefits of HIA would be diminished if only applied in these specific scenarios. Therefore, HIA should also be applied to smaller-scale projects and policies at the provincial and municipal levels, particularly when considering developments or policy changes that have the potential to impact health of Canadians.

2.4 Conclusions

Despite a broadly acknowledged need for HIAs worldwide, additional research is required on many fronts, from advancing our understanding of HIA triggers to strengthening evidence-based decision making. As an early proponent of HIA, it is unfortunate that Health Canada’s 2004 guidance on conducting HIA appears to have been largely forgotten, as HIA is consistently underutilized in project and policy decisions across the country. Currently, decisions on acceptability of potential health impacts of infrastructure and natural resource projects in Canadian EAs appear to have been largely confined to those that quantitatively evaluate the potential for chemical exposures to affect health. Although a critical step in ensuring the protection of public health we suggest that a broader evaluation, such as under the auspices of HIA, be adopted.
From this review it is clear that international frameworks for conducting HIAs exist and that many advances have been made over the past decade. However, there are several areas that require research and improvement if HIA is to be used as a key decision-making tool in Canada. We identified six major areas within the practice of HIA that required additional research and development.

**HIA Triggers:** It is important to ensure that there is a clear process in place to identify what would trigger an HIA in Canada, either federally or provincially. A systematic screening approach to decision-making regarding the need and practicability of conducting an HIA would allow jurisdictions to scope such assessments into the EA process. In addition, project proponents would benefit from an understanding on how and when an HIA would be useful to provide additional project-related information on health outcomes.

**Scoping and Stakeholder Engagement:** Although scoping of HIAs and engaging stakeholders early in the process is vital to the success of an HIA, there is little consistency in how such steps should be undertaken. A regulatory framework that describes the important facets for consideration in the scoping step would allow for greater consistency in setting terms of reference for HIAs in the EA process. In addition, best practices or guidance in describing the role of stakeholders and the type of community engagement in the scoping step would lead to more robust HIAs being conducted. This would ensure that relevant and pertinent health outcomes and vulnerable populations to be studied would be captured in the ensuing HIA.

**Evidence-Based Decision Making:** There is a need to further the science of evidenced based decision making within HIAs. Although how information is gathered, the process by which it is organized and evaluated for quality should follow a consistent and logical framework. Such frameworks could be developed in principle and form part of an overarching guidance that could be modified on a project specific basis. In addition, although there have been advances in the development of methodologies and tools for use in HIA, a lack of a nationally recognized framework that can be applied to a range of project and policies, is problematic. This leads to consternation amongst project proponents. Project proponents are often weary of engaging in the HIA process as they feel that such assessments
can lead to dramatically different conclusions or outcomes depending on how the assessment is conducted. Giving greater scientific rigor to the collection of evidence and its evaluation would serve to allay some of these fears.

**Monitoring and Evaluation:** If HIA was to garner more widespread acceptance in the EA process, then it is suggested that further research is required to examine the extent to which it is possible to monitor HIA predictions and recommendations. This would be consistent in proposed post-construction monitoring recommendations that are provided as part of any EA in Canada. Follow-up on success and failures of HIA monitoring would allow for a more comprehensive set of viable recommendations to be made in the future, while not ignoring budgetary constraints.

**Integrating Regulatory Frameworks:** There have been some of successful HIAs conducted in Canada; however, these appear to have been limited to large-scale infrastructure or natural resource projects. For wide-spread adoption of HIA it is clear that a strong national regulatory foundation is required. It is believed that such a framework could be adopted by CEAA to ensure that scoping of potential health impacts in the EA process considers the broader definition of health. It is believed that such an initiative would also allow for broader implementation at the provincial level. However, the authors caution that HIA can also be an effective tool in evaluating health of policy initiatives and smaller-scale projects at the municipal level that have the potential to impact the health of Canadians.

Addressing these data gaps will help to improve the HIA practice as a whole and within Canada to foster more widespread implementation at federal and provincial levels.

### 2.5 References


Wernham, A. (2011). Health impact assessments are needed in decision making about environmental and land use policy Health Affairs, 30(5), 947-956.


Chapter 3
Screening

Citation


Abstract

The first step of any health impact assessment (HIA) is screening to determine whether an HIA is an appropriate assessment option. Although screening tools exist, there is no universally-applied, transparent method that includes consideration of costs (investment) and benefits (value) of the HIA process. An HIA screening tool was developed to help address this need through the use of a targeted scoring system to assess the value of conducting an HIA against the required investment. The tool was subject to both internal and external testing. Individuals from eight different countries agreed to participate in testing of the HIA tool. Overall, there was a high level of agreement amongst participants regarding the investment versus value scoring as well as the screening outcome. Ultimately, the iterative development process, along with internal and external testing of the HIA screening tool, proved successful and demonstrates its applicability to a variety of scenarios.
3.0 Development of a Health Impact Assessment Screening Tool: A Value vs. Investment Approach

3.1 Background

Health impact assessment (HIA) is a rapidly evolving practice that promotes consideration of potential health impacts, both positive and negative, arising from initiatives whose primary focus is typically outside of the health sector (Ross et al., 2014). The definition of health typically associated with the practice of HIA is ‘a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’ (WHO, 1948). This includes consideration of health impacts within traditional environmental assessment practices, where there is potential for HIA to be integrated into existing regulatory-based frameworks (Fischer and Obaidullah, 2014; McCallum et al., 2015; Weston, 2000; World Bank, 1993). The World Health Organization (WHO) defines HIA as ‘a combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population’ (WHO, 1999). This definition is all-encompassing with little description of what specifically constitutes an HIA. Consequently, there are a number of tools, methods and guidance documents that aim to provide clarification on what an HIA is, and what it is not (Ross et al., 2014; Birley, 2011; Bhatia et al., 2014; CHETRE, 2007; IAIA, 2006; IFC, 2009; NCCHPP, 2008; NHS, 2000; Scott-Samuel et al., 2001).

The first step of any HIA is screening, although it could be argued that screening actually occurs before the HIA process commences, in order to determine the feasibility of proceeding with an HIA at all. Screening is defined as a selection process ‘in which a proposal is quickly assessed for its potential to affect the population’s health, and a decision is made about whether or not to undertake an HIA’ (Taylor et al., 2003). There are several HIA screening tools available (GLA, 2001; Grinnell, 2013; IPH, 2009; Stapleton and Cheney, 2004; TPH, 2008; Vohra et al., 2003), which largely focus on whether there is a potential health concern. However, the decision about whether to proceed with an HIA is often dependent on the availability and allocation of funding. Therefore, since resources are limited, it is imperative to ask whether an HIA is worth the cost. Although there are a
number of HIA screening tools available, few consider the practicality of an HIA from a resources perspective, and none include an outright comparison of the potential costs and benefits associated with conducting the HIA. Therefore, one area that is lacking is the availability of a screening tool that includes the practicality of conducting an HIA from a costs versus benefits perspective.

Even the best and most robust tools and methodologies must be considered not only on their merit but also on the potential cost or investment of implementation; a great tool that cannot be practically applied due to excessive costs is of no use. However, the cost must always be considered in relation to the potential benefit or value that applying the tool can provide.

Throughout this paper, the terms “cost” and “benefit” have been replaced with “investment” and “value” to ensure that the concepts are not confused with the popular cost–benefit analysis, which has a specific definition, objective and application that differs from the intended use in this context (Field and Olewiler, 2002; OECD, 2006). More specifically, the concept of “value” includes more than economic or financial gains but extends as well to social, cultural, moral and ecological benefits, for instance. The notion of “investment” recognizes the positive returns that may not be implied when one considers straightforward “costs.” Therefore, the tool developed by the authors and presented in this paper is based on the general principles of cost versus benefit but not strictly limited to the economists’ definitions and typical applications of these terms.

The main objective of this research is to develop a comprehensive, user-friendly HIA screening tool that includes generally accepted best practices, and is based on an evaluation of potential value versus investment of conducting an HIA. This tool is also intended to improve clarity, consistency and transparency in the screening process. The methodology aims to find a balance between being rapid enough that it is not too resource intensive but comprehensive enough to identify key components of HIA screening. It also aims to be applicable to a wide range of projects, policies and programmes. In this paper, the results of an iterative screening tool development process, including extensive internal and external testing, are presented.
3.2 Methods

The methods involved in this study include a gap analysis of existing screening tools, an iterative process for development of the screening tool content, internal testing and subsequent revision and external testing to evaluate utility of the tool and consistency of results.

3.2.1 Existing tool gap analysis

The first step in the process of developing the HIA screening tool involved conducting a thorough review of existing, publicly available HIA screening tools. The review consisted of a systematic search of both primary and grey literature and was conducted in July 2015. For primary literature, several databases (Scopus, Web of Science and PubMed) were searched using “health impact assessment” and screening which produced 242 results. These results were screened using specific inclusion/exclusion criteria: (i) English language; (ii) focus on HIA rather than other types of impact assessment; (iii) identified as a tool, toolkit, checklist or worksheet, rather than general HIA guidance; and (iv) applicable across a range of scenarios (i.e. no case studies). A Tier I screening of the title and abstract reduced the results to 44. After duplicates were removed, a Tier II partial-text screening was completed, reducing the results to one primary article to be carried forward for full-text review.

Additionally, a grey literature search was conducted using the Google internet search engine. To maintain consistency, the search term “health impact assessment” and screening was also applied producing 112,000 results. The same inclusion/exclusion criteria were applied to the first 300 results (in order of relevance). A Tier I screening (title and description) resulted in 28 resources, and a Tier II partial-text screening reduced that number to 17 HIA screening tools carried forward for full-text review. Overall, a search of both primary and grey literature resulted in the identification of several (n¼18) HIA screening tools used in various jurisdictions.

In terms of exclusion criteria, although it is recognised that case studies or published HIAs often contain information on their screening procedure, they were specifically excluded from
this review. This was due to the fact that the tool being developed is intended to supplement existing guidance documents that are widely available and could be adopted for use in future HIAs.

In order to identify gaps within existing HIA screening methodologies, the results of the literature review were analysed to determine whether any of the tools evaluate the practicality of conducting HIA and whether there is any consideration of investment and value tradeoffs. Out of the 18 tools reviewed, many consist of a form or checklist to be filled out by the person(s) conducting the screening (CHETRE, 2007; PHAC, 2004; Stapleton and Cheney, 2004; CDPH, 2010; MDH, 2001; HIP, 2011). Other tools contain questions pertaining to potential impacts (positive and negative) on different health determinants, possible equity issues and vulnerable populations, as well as the alignment of priorities with local health and government agencies (GLA, 2001; NPHSW, 2004; Stapleton and Cheney, 2004; Vohra et al., 2003; Dolman and Swift, 2007; CCW, 2008; PAHO, 2013). Some of the tools provided a list of potential determinants and asked users to identify the level of influence or impact, but none provided consideration of budget or process feasibility (MDH, 2001; Ravn et al., 2008; TPH, 2008; NHS, 2010; NCCHPP, 2014). Two tools did pose questions regarding availability of resources and time to conduct HIA; however, responses could not be fed into the decision-making process in a systematic or transparent manner (PBA, 2006; IPH, 2009). Overall, the literature review and analysis revealed that most tools did not contain any consideration of funding or resource expenditures, and none of the tools included specific analysis of the investment and value of conducting the HIA. The authors considered this to be vital information to include in evaluating whether to proceed with an HIA. To be able to justify an HIA, screening should include consideration of the feasibility and practicality of the process. Therefore, based on these findings, a new HIA screening tool based on value versus investment principles was developed.

3.2.2 Tool development

The HIA screening tool underwent an extensive review and revision process, resulting in several different iterations revised over several months prior to the final product that was sent out for testing. Revisions included re-wording of questions for clarification and revising content as the tool progressed in order to minimise the volume of questions required for
input, while maximising the output quality and consistency. Originally, the tool consisted only of the value versus investment section. However, in order to make it a cohesive HIA screening tool that addressed a range of issues and could “stand alone,” additional sections were added to make the tool more robust.

Initially, the concept for the tool was based entirely on a question-based flowchart approach that would lead the user to a final “yes” or “no” answer about whether to conduct an HIA. However, after an initial draft was developed and tested by the authors, it was apparent that the answer of whether or not to conduct an HIA was too complex to be properly conveyed in a simple flowchart, thereby necessitating a new multifaceted approach. In order to accommodate a wider range of answers, the next iteration of the HIA screening tool was based on the concept that a series of questions would lead the user to an answer that was essentially a point along a broad spectrum of possible conclusions. This would achieve the goal of having a screening tool that follows a systematic approach to reaching a resolution but allows for a more complex range of final outcomes that would foster discussion and acknowledge the fact that there is some inevitable uncertainty and subjectivity in judgment, within the decision-making process.

This concept of a spectrum was applied to the idea that there are certain investments associated with conducting an HIA, but there are also potential value added dimensions. Therefore, based on a series of questions, an estimation of the investment required could be evaluated against the potential value obtained from conducting the HIA. Ultimately, the tool would produce a score for both investment and value based on responses to several questions. These scores would be plotted on a graph, along with a margin to account for any uncertainty in responses provided. Depending on the relative scores, the plotted point would either be above or below a line that indicates whether HIA is recommended based on the concept that the practicality of an HIA approach can be identified by comparing value versus investment and identifying which is greater (i.e. value>investment or investment>value) (Figure 3.1).
Figure 3.1  Plotting value versus investment scoring results. The scores for potential value (y-axis) versus investment (x-axis) are plotted along with an uncertainty score identified by the user (dotted line around the data point) to determine whether an HIA is recommended or not on the basis of practicality of the process.

The content for this section of the HIA screening tool required numerous iterations and revisions following extensive discussion and testing by the authors to ensure that the questions adequately reflected the investment and value aspects of a wide range of project/policy/programme initiatives. The implications of this iterative development approach have been further examined in the Discussion section below.
In order to make the tool stand-alone, other aspects of HIA screening best practices were incorporated to support and enhance the value versus investment component. Overall, the final iteration of the screening tool was based on a collaborative effort that relied on findings from the HIA literature, public health guidance, personal experience and expertise and multiple rounds of testing and revision. The final version of the tool that was sent for external testing consisted of several sections (sections A–E) that evaluate (i) the potential for HIA to be applied to a given project, policy or programme; (ii) the general type of HIA that is most appropriate; (iii) the investment versus value of conducting the HIA; and (iv) extenuating factors to consider. Collectively, these sections function as a comprehensive HIA screening tool that can be used to systematically and transparently evaluate potential applications of the HIA process. A summary of each of the sections is provided below. The initial draft tool (version 1.0) that was sent for testing is provided in Appendix A and the revised tool (version 2.0) is provided in Appendix B.

Section A: It evaluates the key components of the project/policy/programme to identify whether HIA is a viable assessment option based on key considerations within current HIA best practices (Bhatia et al., 2014). It is presented in the form of a flowchart that uses a series of questions to identify upfront whether HIA should be considered (Figure 3.2). If the final determination is that HIA is “viable,” then the rest of the screening tool can be completed; however, if it is “not a viable option,” then the screening does not proceed further (i.e. only section A of the tool is completed) and HIA is excluded from further consideration.

Section B: It involves identifying the type of HIA that would be undertaken. This is considered an important aspect of the tool since “HIA” has been used as a blanket term for many different types of assessment approaches, objectives and methods. Before deciding to initiate an HIA, it is important to have a clear understanding of what type of HIA is suitable and what the end-product will look like. This is vital, since there have been issues with the HIA process not being carefully defined, which can lead to stakeholders having conflicting expectations later in the process. It is important that those involved in screening have a clear and consistent idea of what they are committing to, should they decide to proceed with an HIA. This tool intends to provide a transparent foundation for ensuring that decision makers are aligned when they are discussing whether or not to conduct an HIA.
Figure 3.2  Initial identification of HIA as a potentially viable assessment option. Using preliminary information available about the project/policy/programme, a series of questions help to identify whether HIA is a viable assessment option based on some of the basic components that make up an HIA, based on current best-practices in the field.

There are four key questions that were initially identified to help to determine the type of HIA that would be conducted if it were to proceed: (I) What is the overall approach to the HIA? (II) What types of evidence will be used as the basis for the HIA? (III) What level of stakeholder engagement can be expected? (IV) What is the anticipated level of effort required to conduct the HIA? In this section, each of these questions is posed along with three optional answers. For each question, the box that most closely aligns with the type of HIA that would be carried out for the proposed project/policy/programme is selected and each combination of answers helps to loosely define a different “type” of HIA (Figure 3.3).
Figure 3.3  Identifying the anticipated type of HIA that would be conducted. A high-level exercise in identifying the general type of HIA that would be undertaken if the decision is made to proceed, ensuring all stakeholders involved in the screening process are aligned before agreeing to move forward with the process.
Section C: It is intended to provide an analysis of the investment required to conduct the HIA versus the potential value of the process, which will help to determine the practicality of conducting an HIA for the scenario under consideration. The section consists of two major parts. The first part is comprised of five questions that consider aspects of HIA that influence the investment required, including: the level of assessment; the availability of baseline data; the amount of stakeholder engagement; budget availability; and rigour of the review process. The second part is comprised of five questions that consider aspects that influence the value of the HIA process, including: alignment with existing government and agency priorities; potential to influence decision-making; potential to impact health determinants; consideration of vulnerable and at-risk populations; and the socioeconomic status of the study population. For each of the questions, there are a series of responses that correspond to different scores (i.e. 0–3 points); only one response can be selected for each question. For each section, the scores are then totalled and participants are asked to identify the level of uncertainty associated with their responses. The uncertainty score ranges from 1 (very certain) to 3 (uncertain) and allows for more objective interpretation of results, especially in cases where there is limited information available. Finally, the results (value score, investment score and uncertainty score) are plotted to provide an indication of whether or not an HIA is recommended (Figure 3.1).

Section D: It provides the opportunity for a “reality check” to ensure that all relevant aspects of the project/policy/programme are being carefully considered. Despite the fact that the HIA screening tool can be applied to many different situations to facilitate decision-making about whether to proceed with an HIA, there may be extenuating circumstances that fall outside of the process. This section consists of a follow-up set of questions that provide specific instances where HIA may or may not be necessary, regardless of the results of the previous sections. For example, if any of the following are true, an HIA should be considered regardless of the previous scoring:

i. overwhelming public concern and/or political pressure to conduct HIA;

ii. the health impacts are potentially cumulative, complex and/or not well understood;

iii. there are severe, fatal and/or irreversible health outcomes;

iv. there are major social justice or equity issues associated with the proposal;
v. the HIA could impact the provision of basic human needs/rights; and/or
vi. the HIA aligns with the proponents’ corporate social responsibility.

Section E: It is a culmination of all of the previous sections and is the final step in the screening tool. At this point, any individuals involved in the process of deciding whether or not to conduct an HIA, should review and compare their screening results. This step should help to foster discussion, clarify information, resolve issues and facilitate agreement on the final decision with respect to whether to proceed with an HIA.

The tool was developed for the purpose of integrating established HIA screening approaches with the concept of value versus investment. Since HIA is a practice that typically involves an interdisciplinary team and can range from a rapid to comprehensive undertaking, the underlying cost is a key factor in gaining acceptance of HIA as a useful tool and for integrating health in all policies (HiaP). Therefore, application of a screening tool that takes cost into account and can help to demonstrate the validity of the process is highly valuable to the field. However, due to the nature of the tool itself, the intended user is an individual or team that has a working knowledge of HIA and the underlying human–environment–health conceptual models that govern the practice. It is not intended for use by individuals or groups with no background or training in HIA.

3.2.3 Internal and external testing

Testing is a key aspect of the process when developing a new tool or product and is typically conducted in two parts: internal testing and external testing. The first is conducted internally by the product developers to ensure initial product performance, followed by external testing that is conducted by a select group of external “real-world” users. These tests help to ensure that the product functions as intended and allows the developers to identify and work out issues prior to release. Therefore, to ensure that the HIA screening tool was user-friendly, transparent and could successfully be applied to a variety of scenarios, it was subject to both internal and external testing.

The internal testing was conducted by the authors during multiple rounds of revisions of the tool development process. A series of case studies based on potential real-world applications
of HIA was created in order to test the tool under various scenarios. The case studies were reviewed and revised based on professional experience of the authors and in an effort to replicate realistic situations as closely as possible. The final series of case studies included: (i) a proposed waste-to-energy (WTE) facility in Canada; (ii) adding bike lanes in an urban US city; (iii) development of a gold mine near a remote African village; and (iv) expansion of a major highway. The case studies and initial HIA screening tool that were sent to participants for testing purposes have been provided in Appendix A.

In order to prepare the tool for external testing, the selection and recruitment process, methods of communication and data collection/analysis, as well as the content of the tool and case studies were submitted to the Office of Research Ethics, University of Toronto. Ethics approval was obtained by the Research Ethics Board (Protocol No. 32223) on 3 November 2015.

Participants were identified as individuals who have conducted, or are likely to conduct, HIA screenings as part of their professional responsibilities. They were recruited from an extensive network of HIA practitioners, consultants, government and public health officials, non-government organisations (NGOs) and academics (n = 35). In order to obtain an adequate cross-section of these potential users, participants were selected from each of the following: (i) private sector (practitioners and consultants); (ii) public sector (government and public health); (iii) NGOs (community groups and organisations); and (iv) academics (professors and researchers). This categorisation was intended to ensure that the results reflect a variety of users and provide sufficient quantity of data for analysis.

Each of the participants was asked to complete the HIA screening tool based on the information provided to them in four distinct case studies. They were also asked to provide specific feedback on the content and utility of the tool. The tool and case studies were sent via email and responses were also collected electronically. Potential participants were contacted with a follow-up email (as per ethics approval) on four occasions over a two-month period in order to remind them of the study and their invitation to participate. Those individuals who responded to the study were excluded from additional follow-up. Several potential participants responded to the invitation with an apology that they were unable to
participate, largely due to busy schedules and the time required to complete the testing (1–2 h for all four case studies). The participants were blind copied on correspondence so that they remained anonymous to all except the corresponding author. The response data from the HIA screening tool were analyzed for consistency to determine the tool’s clarity and functionality. Additionally, feedback provided by participants was invited and reviewed to identify existing strengths and potential weaknesses associated with the tool.

3.3 Results

Out of the 35 potential participants identified, 14 (40% response rate) agreed to participate and provided their testing results. Of these, one set of results was not completed according to instructions and had to be excluded from analysis (n = 13). One can legitimately assume that reasons for choosing not to participate in the study can be attributed to several factors including a lack of interest to participate in any such academic study, a lack of incentive or scheduling challenges. One way to potentially avoid some of these problems in the future is to provide participants a longer window of opportunity to participate. Collectively, the participants are from eight different countries (Canada, US, Brazil, Australia, Scotland, the Netherlands, Switzerland and South Africa) and represent three of the four identified sectors (private, public and academic). Only the non-governmental organization sector is not represented.

Section A provided an opportunity for participants to answer a series of questions that would determine whether HIA was a viable option and whether to proceed with the rest of the HIA screening tool. Participants had a high level of agreement (70% for all cases) in their section A results (Figure 3.4). For Case 2, two participants decided that HIA was not a viable option and for Case 4, three participants came to the same conclusion. Therefore, in these instances, the remaining screening sections were not completed. In situations where HIA was considered viable, but other assessment options may be appropriate, participants were still asked to proceed through the HIA screening but to consider whether other assessment options would be more appropriate before making their final determination.
Section A results: Is HIA an option? For each of the four case studies, participants answered a series of questions in the form of a flowchart to identify whether to proceed further with HIA screening.

The section B results were the least consistent of all of the sections of the tool. Participants identified the type of HIA that would be undertaken if the decision was made to proceed with the assessment. The agreement among participants regarding what type of HIA would be conducted in terms of the (i) approach; (ii) evidence used; (iii) stakeholder roles; and, (iv) overall level of effort, was between 45% and 69% for all four case studies. However, in order for participants to obtain agreement on the HIA type, they had to select the same responses for all four of the categories. When the categories were separated out and evaluated independently, there is a higher level of agreement with 72% for HIA approach, 85% for evidence used, 88% for stakeholder roles and 82% for the overall level of effort across all four case studies. These results imply that practitioners have different ideas about the type of HIA that is needed, and suggest that there is a need for clarification in this regard before deciding to proceed with an assessment as part of a rigorous HIA screening process.

Section C provided the basis for assessing the potential value and investment involved in pursuing an HIA. This aspect of the tool is intended to act as a driver for the final decision
about whether to proceed with this approach. Participants scored both the value and investment around conducting an HIA for each of the case studies to determine whether it was a practical option. Where data point(s) were on or above the centre line (value, investment), HIA was recommended and where points were below the line (value < investment), HIA was not recommended. Participants were also asked to self-identify their level of uncertainty in their responses for each of their value and investment scores. The mean of these two scores (range = 1–3) is plotted around each data point (Figure 3.5).

Figure 3.5  Section C results: Value versus investment. Participants scored the value and investment of conducting an HIA for each case study (Case 1 for WTE facility [n = 13]; Case 2 for adding bike lanes in an urban environment [n = 11]; Case 3 for proposed mining site [n = 13]; and Case 4 for highway expansion [n = 10]). Where n < 13, participants ruled out HIA as a potential assessment option in section A of the tool and,
therefore, did not complete section C. Individual scores are plotted, with identical scores resulting in a proportionately larger data point. The maximum possible score is 15 for each section. The level of uncertainty that was self-identified by participants is also plotted around each data point. In cases with identical results, the highest level of uncertainty was plotted.

After completing all sections of the HIA screening tool, participants made a final determination regarding whether to proceed with an HIA for each of the case studies (Figure 3.6). For Case 1, there was a 92.3% rate of agreement that an HIA should be conducted. For Case 2, 61.5% of participants agreed that they would not proceed with an HIA, and for Cases 3 and 4 there was 100% participant agreement to proceed with an HIA and not to proceed, respectively. For Cases 1 and 2, one participant wanted additional information before making a final determination about whether or not to proceed with an HIA, these cases were defined as “undecided.”

![Figure 3.6 Section E results: Final decision regarding HIA. After completing all sections of the HIA screening tool, each of the participants (n = 13) made a final determination regarding whether to proceed with an HIA for each of the four case studies.](image-url)
Overall, the final decision about whether to undertake an HIA was based on the collective results of all of the sections (sections A–E), including section D, which offered participants an opportunity to conduct a “reality-check” of their scoring results and determine whether there were other factors that could influence whether an HIA should or should not proceed. However, the investment versus value component of the tool (section C) was intended to act as a driver for the decision about whether or not to conduct an HIA. Therefore, the scoring results (HIA recommended versus not recommended) were compared to the final determination of whether to proceed with an HIA (section E). There was a very high level of agreement (>90% for all case studies) between the section C scoring results and the final conclusions (Figure 3.7). For cases where the section C recommendation was not in alignment with the final HIA determination, additional discussion is provided below.

Figure 3.7 Agreement between section C scores and final results. A comparison of the section C value versus investment scoring results to the final decision about whether to proceed with an HIA (section E) for all four case studies.
3.4 Discussion

A series of four case studies was selected based on real-world scenarios where health could potentially be impacted by a proposed project, policy or programme. Overall, the participants had a high level of agreement with respect to the final determination regarding whether to proceed with an HIA. In Case 1, there was one participant who scored investment>value (12 and 11; uncertainty = ±2) for a proposed WTE facility. However, they ultimately decided to proceed with an HIA based on specific factors built into the screening tool that are intended to act as a “double-check” of the scoring (section D). Specifically, the fact that potential impacts are likely complex/cumulative, could be severe/irreversible, and that the project could result in serious social justice issues. Although the final decision does not align with the section C scoring recommendation, the score was very close to the line and the uncertainty actually overlaps it, suggesting that the results could justifiably fall within the “not recommended” category.

Case 2, which was based on a proposal to add bike lanes in an urban city, was the scenario with the lowest level of agreement among participants about whether to conduct an HIA (61.5% = no, 31% = yes and 8% = undecided). This finding accurately reflects many HIA screening situations where universal acceptance about whether to proceed with an assessment is not readily available. In these cases, the tool provides a transparent foundation for dialogue, where differences in scoring can be easily identified and discussed. Conversely, Case 3 had the highest level of agreement and the most consistent section C (value versus investment) scores with all participants scoring on or above the center line, and 100% deciding to proceed with an HIA after completing all sections of the screening tool.

In Case 4, three of the participants scored above the center line (value>investment) but decided not to proceed with HIA based on the section D “reality-check” of the scoring. Collectively, these factors included: (i) no potential to impact the decision-making process; (ii) a different type of assessment may be more appropriate; (iii) potential impacts are limited, well-understood and easily mitigated; and (iv) the time and resources are too restrictive. This case demonstrated the value of section D being included in the tool,
especially since it promotes a critical questioning of the scoring results to make sure they are defensible when considering a multitude of other factors.

Development of the HIA screening tool was an iterative process involving multiple rounds of revision and refinement. The tool itself was built to include preexisting HIA concepts, while adding value by evaluating the potential value and investment required. One of the main issues with designing such a tool is that there is some inherent subjectivity in the design and development process. Not only are personal and professional judgements a necessary part of the development process, they can also affect utilization. Each person to use the tool will have their own preconceived notions, judgements and biases that will ultimately feed into their responses (Stefanovic, 2015). Additionally, users may make assumptions based on partial information or past experiences, which can impact their scoring.

In order to account for some of these issues, there was an uncertainty component added to the value versus investment section where participants were asked to self-rate the level of uncertainty around their scoring. The scores ranged from 1 (very certain) to 3 (uncertain), which allows the final score to be interpreted with some context around the possible variation within the final score. This was ultimately an invaluable part of the tool because it allowed participants to identify a perceived level of subjectivity in their own scoring and made final scores more fluid in their interpretation. For example, in cases where the score clearly fell above or below the line but the uncertainty around that data point fell on or across the line, it indicated that the scoring could have produced different results based on subjectivity inherent in the process.

One way to ensure that the tool is applied in a consistent and transparent manner is to identify ideal users. The ideal user for this HIA screening tool is an individual or team with some experience in the field of HIA and a working knowledge of environmental impacts on human health. A team is preferable because it is typically not up to a single individual to decide whether an HIA will justifiably proceed. Additionally, having a team conducting the screening allows for plural inputs and potentially diverse agendas to inform a final determination. However, it is important to note that the decision to perform an HIA is not always based upon a screening process; rather it can often be the ‘result of a political process.
or a regulatory requirement, because a community organization initiates one or because applicable funding becomes available’ (Ross et al., 2014). In cases where an HIA is mandated, there is no need to perform a screening exercise; however, where multiple options are being considered, it may provide a basis for prioritization. In some cases, the tool can also assist in defining the appropriate level of funding. For example, if the screening results suggest that investment $>$ value for a detailed HIA, the user can go back and re-screen based on a rapid HIA and compare the results to see if the recommendation changes. In some cases, there may be a stronger argument for a different level or type of HIA than was originally intended.

As part of the external testing participants were asked to answer a series of questions pertaining to the tool’s utility, clarity, performance and applicability to their current role/profession. The questions were as follows:

i. In your opinion, how user-friendly is the tool?

ii. Were there any places in the tool you would have liked additional clarification or detail?

iii. Would you use this tool to facilitate HIA screening in your profession?

The responses were carefully reviewed and compiled to determine whether and how the tool could be further improved. Collective responses to the first question indicated that the participants agreed that the tool was user-friendly and easy to follow, even for novice practitioners. There were a couple of participants who indicated that there was a learning curve associated with the first run through the tool, but subsequent uses proved to be much easier. The tool was properly completed by all but one participant, which suggests that the tool and instructions were adequate for successful completion.

The most valuable participant feedback is related to the tool’s clarity and function. All of the recommendations discussed below have been incorporated into an updated version (2.0) of the HIA screening tool that is provided as Appendix B. Although the recommendations will ultimately improve the clarity of the tool, none of the suggested revisions required any major alterations or functional changes to the tool. This updated version of the tool is the one that should be used by practitioners wanting to apply this approach to their HIA screening.
Although the tool was identified as being user-friendly overall, there were some areas where participants would have preferred additional clarification or detail. One participant recommended that section A provide additional narrative to indicate a “potential” impact to equity since there is no certainty around impacts until after an assessment has been completed. This update was included in the final version of the tool.

Another comment that was provided by multiple participants (n = 2) was that some aspects of the tool seemed to address aspects of HIA scoping, rather than screening. Although it may be true that identifying the type of HIA (section B) is typically done as part of the scoping process, the authors thought it was important to ensure that individuals are in general agreement about what the HIA entails before deciding whether to proceed. Since discussions around the HIA type usually does not commence until screening is complete, this can create problems around conflicting expectations later in the process. Therefore, the authors have identified preliminary high-level scoping to be a necessary component of a comprehensive screening process. Despite this, the selection process in section B could be further improved based on testing feedback. Specifically, participants were unclear about the distinction between the first and second rows of section B (approach and evidence); therefore, the first section (approach) was removed to reduce redundancy and improve clarity. This does not impact functionality of the tool overall.

A few participants also provided feedback on specific questions in section C that determine value versus investment. Many of these comments were valuable in terms of ensuring that the tool is applicable to an even broader set of scenarios, including situations where specific information is not available. Much of the feedback included adding more clarification for a few of the questions (such as providing examples), as well as incorporating instructions for cases where the answer is unknown. Overall, none of these revisions changed the nature of the questions or the responses in a substantive way. Instead, they improved the clarity of section C in the updated tool. Therefore, additional testing at this point was deemed unnecessary. However, given that no single tool is static or unconditionally in its applicability, future research and refinement of the tool is vital, and to be expected.
Finally, there were several comments regarding how providing an electronic version of the tool would strengthen its utility and ease of use. Specifically, there were suggestions for a computer-based platform that automatically tabulates scores based on the selected responses, plots those scores on the graphs and then summarizes the results from all sections of the tool in a summary page or table. In addition to making the tool easier to use, this process would also increase efficiency by automating several components, thus reducing time to completion. Therefore, building an electronic platform would be a logical next step in the evolution of this HIA screening tool.

3.5 Conclusions

The iterative development process, along with internal and external testing of the HIA screening tool, proved successful. The tool integrates well-established aspects of the screening process but advances it to include an analysis of potential value versus investment of the HIA process to ensure practicality. With constant challenges around budget and resource availability, assessments must be completed only when there is a strong justification to do so. Developing a tool that can consistently and transparently justify whether or not to proceed with an HIA based on the potential for health impacts, type of HIA and level of effort required and practicality of the process, is essential. Ultimately, the tool strikes a balance between objectivity and subjectivity in its approach to HIA screening, while providing a foundation for decision-making and fostering dialogue where inconsistencies and issues arise. This type of approach is a necessary condition of garnering further acceptance and appropriate application of HIA in the future.

3.6 References


http://hiaconnect.edu.au/old/hia_a_practical_guide.htm


Chapter 4

Scoping

Citation


Abstract

The determinants of health are those factors that have the potential to affect health, either positively or negatively, and include a range of personal, social, economic, and environmental factors. In the practice of Health Impact Assessment (HIA), the stage at which the determinants of health are considered for inclusion is during the scoping step. The scoping step is intended to identify how the HIA will be carried out and to set the boundaries (e.g., temporal and geographical) for the assessment. There are several factors that can help to inform the scoping process, many of which are considered in existing HIA tools and guidance; however, a systematic method of prioritizing determinants was found to be lacking. In order to analyze existing HIA scoping tools that are available, a systematic literature review was conducted including both primary and grey literature. A total of 10 HIA Scoping tools met the inclusion/exclusion criteria and were carried forward for comparative analysis. The analysis focused on minimum elements and practice standards of HIA scoping that have been established in the field. The analysis determined that existing approaches lack a clear, systematic method of prioritization of health determinants for inclusion in HIA. This
finding led to the development of a Systematic HIA Scoping tool that addressed this gap. The decision matrix tool uses factors such as impact, public concern and data availability to prioritize health determinants. Additionally, the tool allows for identification of data gaps and provides a transparent method for budget allocation and assessment planning. In order to increase efficiency and improve utility, the tool was programmed into Microsoft Excel. Future work in the area of HIA methodology development is vital to the ongoing success of the practice and utilization of HIA as a reliable decision-making tool.
4.0 Prioritizing health: a systematic approach to scoping determinants in health impact assessment

4.1 Introduction

The determinants of health are those factors that have the potential to affect health, either positively or negatively, and include the range of personal, social, economic, and environmental factors (ODPHP, 2014). Some of these factors are related to aspects of biological or genetic makeup that cannot be changed, while others are the result of personal circumstances (i.e., lifestyle choices, employment, income, etc.). Further, both individual and population level health have the potential to be affected by changes in the environment, including social, built and natural environments. These changes are often not directly linked to health or health care, but impact health via indirect pathways (WHO, 2016a).

In the practice of Health Impact Assessment (HIA) the stage at which the determinants of health are considered for inclusion in the evaluation is during the scoping step. The scoping step is intended to identify how the HIA appraisal will be carried out and to set the boundaries (e.g., temporal and geographical) for the assessment (WHO, 2016b). This is also typically the first stage where stakeholders are able to provide input into the HIA process. Since scoping is intended to set up a blueprint for the entire HIA, it is a vital part of the process that continues to guide and focus the practice going forward (McCallum et al., 2015; Ross et al., 2014).

There is an established set of “Minimum Elements and Practice Standards” that have been widely employed in the HIA field and provide guidance on conducting scoping (Bhatia et al., 2014). The guidance specifies that a range of health issues to be examined in the HIA should be identified, specifically, that scoping should include systematic consideration of potential pathways (direct, indirect and cumulative), and the final scope should focus on those impacts with the greatest potential significance when factors such as impact, stakeholder priorities and equity are taken into consideration. However, one issue with the scoping step of HIA is that there is currently no consistent and transparent way of identifying priorities when it comes to assessing determinants. Rather, it is typically a subjective determination made by those conducting the scoping exercise. This can pose a problem when complex projects have
a multitude of determinants that could impact health and should be included in the HIA. This problem becomes even more apparent when there is a limited amount of funding for the assessment.

There are several factors that can help to inform the scoping process, many of which are considered in existing HIA tools and guidance (Figure 4.1); however, a clear, transparent and systematic method of prioritizing determinants is lacking. The objective of this research was to evaluate the current inventory of HIA scoping tools to identify their strengths and deficiencies, focusing on prioritization of determinants and systematic methodologies for scoping. Based on these findings, a tool was developed to enhance the practice of HIA scoping by providing a systematic method of prioritizing health determinants for inclusion in the assessment while including consideration of data gaps and budget constraints. This tool will improve upon currently employed practices around HIA scoping that are often discretionary and can lack sufficient transparency or consistency.

Figure 4.1  Key factors involved in HIA scoping step (Bhatia et al., 2014)
4.2 Materials and Methods

In order to analyze existing HIA scoping tools that are available, a systematic literature review was conducted in the spirit of the Cochrane Handbook for Systematic Reviews, which is based on the notion that science is cumulative and by taking a weight-of-evidence approach, decisions can be made based on the best information available (The Cochrane Collaboration, 2009). The search included both the primary peer-reviewed literature and the publically available grey literature, which were both screened based on a specific set of inclusion criteria. These included: (i) articles published in English; (ii) must be related to formal HIA rather than other forms of impact assessment (i.e., risk assessment, environmental assessment, equity assessment, socio-economic assessment, etc.); (iii) clearly identified as an HIA tool, with a methodology or process to follow (i.e., toolkits, workbooks, worksheets, grids, checklists, etc.) rather than general HIA guidance documents; (iv) applicability across a range of scenarios and sectors rather than specific HIA case studies.

The primary literature search strategy included using the search terms “health impact assessment AND scoping” to seek out relevant articles in several interdisciplinary databases including: Scopus, Web of Science, and PubMed. This search resulted in a total of 96 articles with duplicates omitted. A Tier I screening included a review of titles and abstracts, which reduced the total results to 23 primary articles. This was followed by a Tier II screening which included a full-text review to determine relevancy, based on the inclusion/exclusion criteria applied, resulting in one primary article being carried forward for comparative analysis.

The grey literature search was conducted using the Google internet search engine. In order to maintain consistency, the same search terms were applied, producing 45,100 results. The first 500 (as they appear; in order of relevance), were screened. A Tier I screening was completed looking only at the source title and description, resulting in 92 potentially relevant resources with duplicates omitted. A Tier II screening was then conducted which included a preliminary full-text review. Often this consisted of reviewing an executive summary, introductory chapter, or results section, to determine whether the resource met the inclusion/exclusion criteria. This was considered necessary at this stage as some of the
documents were hundreds of pages in length. This Tier II screening resulted in 9 resources being carried forward for full-text review and comparative analysis.

In total, the literature search produced 10 distinct HIA scoping tools that met the inclusion/exclusion criteria, all of which were included in a comparative analysis to identify any gaps in current methodology and inform development of more robust HIA scoping methods and processes (Figure 4.2).

![Diagram of literature review strategy and inclusion criteria for HIA Scoping Tools]

**Figure 4.2 Literature review strategy and inclusion criteria for HIA Scoping Tools**

Based on the comparative analysis, a method development process was undertaken to address gaps identified in existing HIA scoping practice. This was an iterative process that involved development of a specific methodological approach and theory, followed by review and revision, development of a user interface, internal testing and final revision. The results of both the comparative analysis and resulting methodology are provided in detail below.

**4.3 Results**

The results of the literature search culminated in a comparative analysis of existing HIA scoping tools in order to identify the level of transparency and consistency associated with
current methodologies, particularly regarding the selection of health determinants for inclusion in HIA.

4.3.1 Analysis of Existing HIA Tools

The results of the literature search indicate that the majority of HIA tools are part of the publicly accessible grey literature, with only one tool published in the primary literature. In total 10 HIA scoping tools were identified that met the inclusion/exclusion criteria. All of these tools were then analyzed to determine whether they met certain criteria, particularly with respect to scoping of health determinants. These criteria were adapted from the Minimum Elements and Practice Standards, which have been developed and widely used in the field of HIA (Bhatia et al., 2014). Although these standards “are not rigid criteria for acceptability but represent the authors’ perspective on best practices”, they have been extensively applied as a method of quality assurance among practitioners and reviewers alike. The results of the comparative analysis are provided in Table 4.1.

Based on the analysis conducted, it is apparent that there is a wide range of approaches and tool formats for HIA scoping. Out of the tools reviewed, the majority of them took the form of a table or checklist to be filled out, containing a series of key questions or issues to consider. Although this format is highly adaptable across a broad range of scenarios, it is highly subjective and would likely result in variable, often arbitrary scoping outcomes depending on who is conducting the scoping.

The first area of consideration focused on stakeholder engagement, which is a key component of the HIA practice and is often introduced in the scoping step. The minimum elements and practice standards state that “a stakeholder engagement plan should be developed that establishes not only which stakeholders should be invited to participate in the process, but also the level of engagement to be solicited, and the methods that will be utilized to promote stakeholder participation throughout the HIA process” (Bhatia et al., 2014). While two of the tools included fairly detailed discussion and/or consideration of stakeholder engagement, including identifying key parties and engagement approaches, the rest either did not address stakeholders in the scoping step at all, or provided limited consideration of the issue. For example, asking the question “who are the key stakeholders?” was posed without
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<tbody>
<tr>
<td>Bert et al., 2015</td>
<td>Scoping grid to characterize impacts</td>
<td>No</td>
<td>Yes: provides a list of 33 potential impact areas</td>
<td>No</td>
<td>Limited: impacts characterized using a 5-point scale (highly negative [-2] to highly positive [+2])</td>
<td>Limited: impact and identification of higher risk groups characterized</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Castonguay and St-Pierre, 2014</td>
<td>Series of key questions</td>
<td>No</td>
<td>No: but suggests creating a ‘logic model’</td>
<td>Limited: identifies type of HIA (rapid, intermediate, comprehensive) and parameters</td>
<td>No</td>
<td>No</td>
<td>Limited: asks for team identification (project management role, scientific role, knowledge brokering role)</td>
<td>Limited: asks to identify parameters (temporal, geographic, financial)</td>
</tr>
<tr>
<td>CREW, 2012</td>
<td>Toolkit: key questions, tips and general information</td>
<td>Yes: suggests involvement and provides some examples of typical stakeholders and engagement tips</td>
<td>Yes: provides a table of 47 possible health determinants</td>
<td>Limited: asks key questions and considers sources of evidence</td>
<td>No</td>
<td>Limited: impacts generally characterized but no clear priority determination</td>
<td>Limited: asks question “roles and responsibilities?”</td>
<td>Limited: asks question “what financial and human resources are available?”</td>
</tr>
<tr>
<td>DDL, 2014</td>
<td>Scoping worksheet</td>
<td>Limited: “stakeholders” and “community engagement” are listed as key details to be filled out</td>
<td>Limited: provides space for a causal pathway to be developed</td>
<td>Yes: scoping tables include input for details of assessment, evidence/data, boundaries, deadlines and reporting requirements</td>
<td>Limited: table provided to identify prioritized health impacts but no systematic methods</td>
<td>Limited: identifies the need for priority health issues to be identified but no basis other than causal pathway</td>
<td>Yes: an entire table is dedicated to details on HIA activities, timelines, who is responsible and who will review</td>
<td>No</td>
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<tr>
<td>HIP, 2011</td>
<td>Scoping exercise and worksheet</td>
<td>Limited: suggests various outreach options to solicit feedback</td>
<td>Yes: provides example pathway diagrams to help identify health outcomes</td>
<td>Limited: worksheet allows for input of data sources and methods to be used</td>
<td>Limited: worksheet allows for priority input but no systematic approach</td>
<td>Limited: worksheet allows input of key information and priority but no clear link</td>
<td>Limited: identifies it as an essential task but not included in the worksheet</td>
<td>No</td>
</tr>
<tr>
<td>IPH, 2002</td>
<td>Scoping table provides key questions and general info</td>
<td>Yes: requires identification of steering committee; stakeholders, informants</td>
<td>No</td>
<td>Yes: requires details on evaluation of evidence, reporting information, recommendations, and evaluation protocols</td>
<td>No</td>
<td>No</td>
<td>Yes: provides a breakdown of key requirements and tasks and asks for assignment of responsibility for each</td>
<td>Yes: asks about costs and identifies key areas for budgetary consideration</td>
</tr>
<tr>
<td>Metro Vancouver, 2015</td>
<td>Series of scoping tools</td>
<td>Limited: provides stakeholder assessment table to fill out with key contacts and level of importance</td>
<td>Limited: suggests creation of an ‘activity impact influence diagram’ providing limited health determinant examples</td>
<td>Yes: provides a detailed section to identify the HIA terms of reference and a scoping checklist to identify the type of HIA</td>
<td>Limited: determination of priority is based on user judgement of several factors</td>
<td>Yes: uses impact and likelihood as factors to determine priority</td>
<td>Yes: requires a comprehensive terms of reference to be signed off, includes roles and responsibilities of team members</td>
<td>No</td>
</tr>
<tr>
<td>PHAC, 2005</td>
<td>Key questions and scoping checklist</td>
<td>Limited: asks about community concerns and identification of key stakeholders</td>
<td>No</td>
<td>Limited: provides a scoping checklist to determine level of HIA (“brief vs more thorough”) and asks key questions about data</td>
<td>No</td>
<td>No</td>
<td>Limited: asks who will conduct HIA and skills needed</td>
<td>Limited: asks about “budget and sources of funding”</td>
</tr>
<tr>
<td>Vohra et al., 2003</td>
<td>Scoping table with key question/ issues (Only Section 3 included in analysis)</td>
<td>Limited: asks to identify which professional and community stakeholders will be consulted</td>
<td>Limited: asks whether there are any specific health impacts the HIA should focus on</td>
<td>Limited: asks a questions about what approach/model will be used for the HIA, study population and geographic area</td>
<td>No</td>
<td>No</td>
<td>Limited: asks questions regarding who is responsible for project management and who is on the steering committee</td>
<td>No: no questions about budget in the scoping section of the toolkit</td>
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<tr>
<td>WHIASU, 2012</td>
<td>Scoping checklist with guidance notes</td>
<td>Limited: asks “who are the stakeholders?” and states that their involvement is important</td>
<td>No</td>
<td>Limited: asks questions about HIA type, boundaries, methods</td>
<td>No</td>
<td>Limited: suggests focusing on impacts most likely to occur and affect health</td>
<td>Limited: asks to identify roles and responsibilities</td>
<td>Limited: asks “what financial and human resources are available?”</td>
</tr>
</tbody>
</table>
providing any additional information, or process details. Such a limited approach would likely not result in a comprehensive stakeholder engagement process, nor does it foster transparency or reproducibility within HIA scoping.

The next aspect of scoping included in the analysis was whether there is any provision for the selection of determinants, which has been identified as a key practice standard: “the range of health issues to be examined in the HIA should be clearly defined” (Bhatia et al., 2014). Out of the 10 scoping tools analyzed, only 3 provided clear guidance on identifying potential health issues, by providing either a list of health determinants that the user can review and select from, or a series of example pathway diagrams to show impact linkages. Although other tools touched on the importance of identifying potential health determinants, they were limited to having the user respond to answer the question of “which health determinants will be included” or by leaving space for a pathway diagram to be created. This approach may work in situations where the person conducting the scoping has a strong background in HIA and environment-health interactions but would be difficult for novice or even intermediate users to complete without additional guidance or specific process requirements.

Establishing a plan to carry out the HIA was the next factor considered in the analysis. Despite the fact that the entire objective of scoping is to create a plan or blueprint for the HIA, many of the tools provided only limited process guidance on doing so. In the minimum practice standards it is stated that “a plan for conducting the HIA should be established” with a list of several factors to be considered in developing the plan including; impacts, boundaries, evidence sources, research methods, role and responsibilities and information dissemination (Bhatia et al., 2014). The majority of the tools provided a series of questions addressing key issues to be considered in conducting the HIA, including those listed in the minimum practice standards; however, many of the tools failed to address several of the important factors listed.

The next two sections included analysis of whether a systematic method of focusing on impacts of greatest significance was included in the scoping tool, and whether priority health issues were identified based on key factors. Both of these aspects of scoping are identified in the minimum practice standards, which discuss the need for systematic determination of
potential health impacts and causal pathways, as well as determining priority issues to include in the HIA:

“The final scope should focus on those impacts with the greatest potential significance, with regards to factors including but not limited to magnitude, severity, certainty, stakeholder priorities, and equity. [Additionally] in identifying and evaluating priority health issues, practitioners should consider the expertise of health professionals, the experience of the affected communities, and the information needs of decision-makers” (Bhatia et al., 2014)

Based on this analysis, these two aspects represent the areas with the largest methodological gaps in HIA scoping. Out of the 10 tools considered, 6 of them provided no systematic process for focusing on impacts of greatest significance and 4 of them noted the importance of prioritizing health determinants but provided no methodology for achieving this objective. As for prioritization of determinants using key factors, only one tool provided a process for using “impact” and “likelihood” to help inform priority; however, there was no clear decision-making process for determining the outcome based on these factors and therefore remains somewhat subjective and limiting in terms of reproducibility. Overall, the notion of using key factors for systematic prioritization of health determinants for inclusion in HIA, is the largest methodological gap in HIA scoping.

With respect to identifying roles and responsibilities of those involved in the HIA, all but one of the tools acknowledged this element as a key aspect of scoping. However, inclusion was typically limited to asking a question or series of questions pertaining to specific roles (i.e., project manager, expert, etc.) but in some cases more detail was required. For example, one of the tools included a comprehensive terms of reference that needed to be signed off and included information on roles and responsibilities of team members. Although the level of effort dedicated to completing this aspect of scoping is likely variable, it is an important and underrated part of planning an HIA. When roles and responsibilities are unclear, then expectations can become misaligned which can result in future problems.

The final aspect of the analysis pertained to budget considerations. Although the minimum practice standards do not directly address budget in HIA scoping, lack of budgetary consideration is often stated as one of the major obstacles to conducting HIA. Specifically,
budget restrictions can play a major role in scoping since the decision to include or exclude certain determinants is often not solely based on the level of impact or concern but is based on the amount of funding and resources available for the HIA, which can be highly variable. Although many of the tools did acknowledge budgetary considerations, they were almost exclusively limited to a single question asking about the “budget and resources” available. No process or method of including the impact of budgetary factors in the selection of determinants as part of the scoping process was identified in any of the tools.

4.3.2 Addressing Gaps: Development of a Systematic Scoping Method

With the volume of HIA guidance documents and tools that are available, creating another resource that duplicates efforts is not beneficial. Rather, addressing gaps in existing HIA scoping methodologies, as identified in the comparative analysis, can provide a way forward by building off of existing resources. For this reason, the methodology developed here, focuses on: the systematic characterization and prioritization of health determinants; addressing data gaps; and, budget allocation. Although it may be used as a stand-alone tool in some instances, it can also be applied as a supplement to other guidance documents and HIA toolkits.

The initial concept of a Systematic Scoping Tool was developed to mirror the tiered approach applied to systematic literature reviews. In a systematic literature review, screening of various pieces of information based on specific criteria promotes a transparent method of systematically weaning down a large volume of information to identify the most relevant and valuable aspects for inclusion (The Cochrane Collaboration, 2009). Applying this basic concept to an HIA scoping tool resulted in a tiered approach to prioritizing a large number of potential determinants and distilling them down to a justifiable priority list for inclusion in an HIA. This resulted in a tiered approach to systematically screening determinants for inclusion in HIA that ideally should be informed by a combination of scientific evidence and stakeholder input (Figure 4.3).
Figure 4.3  HIA Scoping Tool Overview: a systematic tiered approach to prioritizing health determinants for inclusion in the HIA.

In order to enhance transparency, each aspect of the Systematic HIA Scoping Tool had to be clearly defined to promote consistent application by a variety of users and under differing scenarios. Specific factors were selected as key indicators for which determinants to include in an HIA. The most important factor was impact, which describes the potential for the proposed project/policy to positively or negatively affect human health. This was considered the primary factor in determining priority based on the premise that if there is no potential for impacting health, then there is no reason to include it in an HIA. Further, the degree of impact (i.e., minor vs major) should dictate the relative importance of including that determinant in the assessment. The second factor included in determining priority was the level of public concern or interest. This factor was selected based on the fact that one of the
pillars of HIA is democracy and the involvement of the public and other stakeholders is a key component of the practice of HIA. In contrast to the first factor (impact), which is largely informed by scientific evidence and data, public concern/interest is informed by more subjective sources such as media coverage, opposition, and contact with local communities. By ensuring that those determinants of importance to the public are included in the HIA, the process is aligned with the founding principles of the practice. For example, at times the public is concerned about issues that are not those of most concern from an impact perspective. The final factor was data availability, which was a practical consideration for prioritizing and/or excluding certain health determinants. In cases where there is little to no data available for a particular determinant, this can provide a basis for exclusion or the requirement of additional studies to obtain the data. For each of these factors, separate definitions were developed to maintain as much consistency in the application of the methodology as possible; however, some level of interpretation, particularly in terms of the interdependence of different priority outcomes, is inevitable. For each health determinant, the tool requires that the following questions be answered in order to determine the priority level (Table 4.2).

Table 4.2 Definitions for characterizing health determinants in Tier I and Tier II Scoping

<table>
<thead>
<tr>
<th>IMPACT: What is the potential impact on human health?</th>
<th>PUBLIC CONCERN: What is the level of public concern/interest?</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/a</td>
<td>Not applicable: the determinant is not applicable to the policy/project under consideration</td>
</tr>
<tr>
<td>++++</td>
<td>Highly Positive Impact: there is potential for a significant and long-term/permanent effect that could directly or indirectly improve health and wellness</td>
</tr>
<tr>
<td>++</td>
<td>Moderately Positive Impact: there is potential for a modest and short-term/temporary effect that could directly or indirectly improve health and wellness</td>
</tr>
<tr>
<td>+</td>
<td>Slightly Positive Impact: there is potential for a minimal and short-term/temporary effect that could directly or indirectly improve health and wellness</td>
</tr>
<tr>
<td>=</td>
<td>Neutral Impact: although relevant, the effect is undetectable, even under worst-case scenarios, resulting in no impact to health and wellness</td>
</tr>
<tr>
<td>-</td>
<td>Slightly Negative Impact: there is potential for a minimal and short-term/temporary effect that could directly or indirectly diminish health and wellness</td>
</tr>
<tr>
<td>- -</td>
<td>Moderately Negative Impact: there is potential for a modest and short-term/temporary effect that could directly or indirectly diminish health and wellness</td>
</tr>
<tr>
<td>- - -</td>
<td>Highly Negative Impact: there is potential for a significant and long-term/permanent effect that could directly or indirectly diminish health and wellness</td>
</tr>
<tr>
<td>VH</td>
<td>Very High: Extreme concern/interest over proposal and/or impacts with lots of media coverage, strong opposition groups including protests, and excess public concern</td>
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feedback/correspondence (online or in person). Very high (top 10%) priority ranking in majority of stakeholder engagement feedback.

**H**

**High:** High level of concern/interest over proposal and/or impacts with some media coverage, moderate opposition/concern, and consistent public feedback/correspondence (online or in person). High priority (top 10-20%) ranking in majority of stakeholder engagement feedback.

**M**

**Medium:** Moderate level of concern/interest over proposal and/or impacts with sparse media coverage, mild opposition/concern, and some public feedback/correspondence (online or in person). Medium priority ranking (top 20-50%) in majority of stakeholder engagement feedback.

**L**

**Low:** Low level of concern/interest over proposal and/or impacts with little to no media coverage, minimal opposition/ a few concerned individuals, and limited public feedback/correspondence (online or in person). Low priority ranking (bottom 20%) in majority of stakeholder engagement feedback.

**VL**

**Very Low:** Very low level of concern/interest over proposal and/or impacts with no media coverage, no known opposition/concern, and no public feedback/correspondence (online or in person). Very low to no priority ranking (bottom 10% or not included) in majority of stakeholder engagement feedback.

**DATA AVAILABILITY: What is the availability of data?**

<table>
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<tr>
<th></th>
<th>Substantial: There is a high volume of relevant data readily available, all of which is at an appropriate scale (i.e., local/regional/global) with minimal data gaps.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><strong>Partial:</strong> There is a moderate to low volume of relevant data readily available, some of which is at an appropriate scale (i.e., local/regional/global), with some key data gaps. Some additional data may be required to be collected/obtained, if possible.</td>
</tr>
<tr>
<td>B</td>
<td><strong>Very Limited:</strong> There is a negligible volume of relevant data available, almost none of which is at an appropriate scale (i.e., local/regional/global), with several important data gaps. Large amounts of additional data may be required to be collected/obtained, if possible.</td>
</tr>
<tr>
<td>C</td>
<td><strong>None:</strong> There is no quantitative or qualitative data available. It is not possible to collect/obtain additional data.</td>
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<tr>
<td>D</td>
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</table>

Collectively, the characterization of these three factors provides a foundation for determining prioritization of all applicable health determinants. In some cases, there may be limited to no stakeholder input available at the time scoping is conducted. In this case, reliance on professional judgement and case studies from similar HIAs may be necessary, although not ideal. Further, where a health determinant is not applicable to the policy or project under consideration, it can be identified as “N/A” in Tier I and excluded from the assessment.

### 4.3.3 Priority Decision Matrix

In order to facilitate a transparent, reproducible and widely applicable method of prioritizing health determinants, a Priority Decision Matrix was created. The first version of this matrix was based on the concept that based on a combination of “impact” (large boxes: --- to +++), and “public concern/interest” (small boxes: V [very high] to VL [very low]), a priority
order could be identified for each unique outcome; resulting in 35 distinct outcomes, each assigned a different priority order accounting for both positive and negative impacts (Figure 4.4).

However, the problem with this approach was realized following some initial testing where the priority order could not be adequately justified because the outcomes were not unique enough from each other. In other words, having 35 distinct priority outcomes (#1 to #35) was too specific making it too difficult to account for the, often minor, differences that would distinguish one result from another. To address this issue, it was determined that fewer priority outcomes were needed. That way there would be distinct and unique aspects of each outcome that justify the prioritization without reducing the number of options for characterization. Therefore, it was concluded that the priority was better suited to groupings or “bands” (Figure 4.5). This way several potential outcomes were identified within the same priority group and could be fully justified when compared to other outcomes. Additionally, although negative outcomes tend to receive more focus in practice, it was considered important to categorize positive impacts as having the same relative level of importance as negative ones, since evaluating both impacts and benefits is a cornerstone of HIA.

4.3.4 Addressing Data Gaps

The third factor considered in determining priority is the availability of data. This aspect had to be included in a unique way since the amount or quality of data is important in that it defines the level of assessment that can be done, but the absence or presence of data alone should not govern the priority ranking of potentially harmful (or beneficial) effects. Therefore, in order to adequately address this issue, a sub-ranking was included to identify the data available for evaluation (A: substantial; B: Partial; C: Very Limited; D: None). This sub-ranking is then included in the overall priority listing without changing the initial prioritization determined by impact and public concern. The value of this additional ranking is that it assists in further scoping of the HIA by identifying any major or minor data gaps and providing guidance on conducting uncertainty analysis (Figure 4.6).
Figure 4.4  Priority Decision-Matrix (Version 1.0). The initial decision matrix that was based on having a different priority number assigned to each unique outcome.
Figure 4.5  Priority Decision-Matrix (Version 2.0). The revised decision matrix that was based on groupings or bands to determine priority rather than individual outcomes.
Figure 4.6 Data Gap Identification & Uncertainty Analysis. Based on data availability, gaps are identified and uncertainty analysis guidance is provided.
Based on the combination of priority order (1-5) and data availability (A-D), the data gap classification and requirements for uncertainty analysis are provided. This ensures that any high priority determinants that are lacking in data are considered in the HIA in a transparent manner. The following definitions guide the requirements set out in Figure 6.

Uncertainty analysis: uncertainty analysis must include a detailed discussion of the implications of having a lack of data for a specific determinant and whether it implicates the conclusions of the HIA as a whole. There are different requirements for the uncertainty analysis depending on the determinant priority level and availability of data:

I. Required: An extensive analysis of the limitations and uncertainty associated with the importance/priority and data availability, including discussion of the implications for the overall HIA findings is required.

II. Suggested: A moderate analysis of the limitations and uncertainty associated with the importance/priority and data availability, including discussion of the implications for the overall HIA findings, is suggested if budget and resources are available. If not, this must be explicitly stated in the HIA as a limitation.

III. Optional: A limited-scope analysis of the limitations and uncertainty associated with the importance/priority and data availability, including discussion of the implications for the overall HIA findings, is optional. No limitations statement is required.

IV. Not Required: No uncertainty analysis is required.

Following prioritization of determinants, including evaluation of the potential health impacts, public interest/concern, and data availability, the tool includes a step for consideration of other factors that may impact prioritization. These factors include things that would require deviation from the existing priority order such as equity issues, other stakeholder concerns, uncertainty around impacts, and others. The prioritization of determinants can be changed to reflect these other factors as long as some justification or explanation is provided to maintain transparency within the scoping process.
4.3.5 Budget and Resource Allocation

After the final priority order has been determined, budget allocation can be completed. This tool is not intended to provide an overall costing for HIA. Instead, it takes an HIA budget and requires the user to allocate funds for assessment of specific determinants. This process will ensure transparent allocation of resources to those determinants that have the highest priority. Additionally, if there are any key determinants that cannot be assessed due to budget restrictions, this tool provides a clear and consistent way of acknowledging this fact as a limitation of the HIA. Conversely, if too few determinants can be evaluated with existing funds, then it can provide a basis for requesting additional resources.

The first step in allocating budget is to determine how much is available for the assessment step. It is important to note that this amount should not include other costs associated with conducting the HIA, such as project management, administrative tasks, report writing, monitoring and evaluation, stakeholder engagement activities, etc. To determine the overall cost of an HIA, there are existing tools that can be used (LHO, 2005). Once the “assessment only” budget has been determined, the amounts required to assess each of the determinants should be applied, moving down the list in order of priority (highest to lowest). The concept behind this strategy is that applying budget to the assessment of determinants allows for a transparent method of inclusion in the HIA, while ensuring that the highest priority issues are considered. Allocating budget, or expected costs, to each of the determinants should continue until either the full list of determinants is included in the HIA or the budget runs out. In cases where there is insufficient budgetary allocation to include all priority determinants, a decision must be made about whether to request additional funding or acknowledge the potential limitation of excluding certain determinants from the assessment. When deciding which determinants to include/exclude, the process should also consider opportunity costs associated with not evaluating the potential impacts of certain determinants.

4.3.6 Automation of the Systematic HIA Scoping Tool

The HIA scoping tool analysis found that in addition to specific gaps in methodology, there was a lack of automated tools to promote efficiency of the scoping process. Therefore, the Systematic HIA Scoping Tool was automated to increase efficiency and utility. This
automation was considered vital since lack of time and budget to carry out HIA is one of the main issues within the practice (Birley, 2011; McCallum et al., 2015). Programming the tool in Microsoft Excel was considered essential due to the ease of use and familiarity of the program to a wide variety of potential users. Additionally, excel provided the necessary platform to build the tool in such a way that it simplified functionality by allowing the priority decision matrix to be built into the spreadsheet; thereby facilitating an otherwise complex and onerous process.

The foundation of the tool is a comprehensive list of over 70 determinants of health that were compiled from numerous well-known HIA resources (TPH, 2008; IFC, 2009; Scott-Samuel et al., 2001; CREW, 2012; Bert et al., 2015; WHO, 2016b), resulting in the most comprehensive list of determinants included in any of the HIA scoping tools reviewed. After the list of health determinants was finalized, the Systematic HIA Scoping Tool was built into excel in a table format where users could provide inputs from drop-down menus and the tool would automatically provide a priority order for all relevant determinants, based on the decision matrix outputs. Once all of the required fields have been filled, a “sort” button reorganizes the health determinants list in order of priority to easily summarize and group the most relevant issues. The priority order is based on a combination of the inputs for “impact on health”, “public concern/interest” and “data availability.” In special cases, users are able to deviate from the identified priority order by manually re-assigning priority but must provide a justification to do so. For example, if a specific determinant is listed as a priority #3, but the local public health agency has it ranked as a top priority for their region, it can be re-assigned priority #1 or #2 providing this explanation as a rationale for the adjustment.

Once the final priority order has been determined, the user can then input their total assessment budget and allocate costs for assessing each of the determinants. As the costs are assigned, the remaining budget will automatically be calculated and if the budget is exceeded, the value turns red to alert the user. This feature is a key aspect of the Systematic HIA Scoping Tool because it ensures that the highest priority determinants are included for assessment and provides a basis for exclusion of lower priority determinants, especially when budget and resources are limited (Figure 4.7). To request an automated version of the Systematic HIA Scoping Tool, please contact the corresponding author.
In the example provided in Figure 7, a theoretical characterization of environmental factors shows how the tool functions to provide a priority list based on impact and public concern (#1-5) as well as data gaps (A-D). In this example the determinants have been sorted in order of priority and in one case the priority order was deviated from with justification (i.e., “at the request of the local medical officer of health”). The total assessment budget was then entered and the assessment costs for each determinant were listed. In this example, the cost of assessing all of the determinants exceeds the budget (-$7,000), which is indicated in red as the “remaining budget”. In such cases when the determinant list exceeds the allocated budget, the HIA team can either secure additional funds to include all determinants, or the HIA can focus available resources on the higher priority determinants and provide a justification for exclusion of lower priority determinants. In addition, if the HIA is being conducted by public servants, it may be preferable to allocate hours rather than costing. In this case, the “assessment cost” column can be used to enter hours for assessing each determinant rather than monetary values to ensure there is enough time to complete the HIA.
4.3.7 Finalizing the HIA Scope of Work

The final step of the scoping process consists of defining boundaries for those determinants that have been included for assessment. Once all factors have been considered and the budgetary constraints have been applied in the automated tool, the final list of priority health determinants to be carried forward in the HIA should be listed in the following table along with all required information needed to conduct the assessment step (Table 4.3).

<table>
<thead>
<tr>
<th>Final Health Determinants (Priority #)</th>
<th>Key Data Sources</th>
<th>Temporal Boundaries</th>
<th>Geographical Boundaries</th>
<th>Vulnerable Population</th>
<th>Key Contact &amp; Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: Noise (1A)</td>
<td>Noise modelling project report; local noise monitoring data</td>
<td>Short-term: construction phase</td>
<td>Local study area (5 km)</td>
<td>Children</td>
<td>J. Smith (modelling and impact assessment)</td>
</tr>
<tr>
<td>Example: Employment (2B)</td>
<td>Local census data; project employment information</td>
<td>Long-term: construction and operation phases (30 y)</td>
<td>Regional study area (100 km)</td>
<td>Unemployed</td>
<td>R. Johnson (review and assessment)</td>
</tr>
<tr>
<td>Etc…</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is important to note that this Systematic HIA Scoping Tool is intended for users who have experience in HIA and have sufficient knowledge around environment and health interactions. This allows decisions to be made around potential impacts, which are largely based on early limited information and can be better informed during the assessment step, with an informed awareness of the potential for positive or negative outcomes resulting from proposed project or policy initiatives.

4.4 Discussion

The literature review and comparative analysis of existing HIA scoping tools found that there was a clear lack of systematic methods and processes for prioritization and selection of health determinants. Therefore, a novel methodology was developed based on application of a priority-decision matrix that characterizes key factors (i.e., impact, public concern/interest, data availability) to inform an assessment hierarchy. Combining this approach with consideration of data gaps, uncertainty analysis and budget allocation, provides a more transparent, systematic and reproducible approach to HIA scoping.
4.4.1 Rationale for Systematic Prioritization

The foundation of the Systematic HIA Scoping Tool is the priority decision-matrix, which uses key factors to inform a priority order for assessment of health determinants. The main factors that make up the basis of the decision matrix are: (i) impact; (ii) public concern/interest, and (iii) data availability. These factors were selected because they align with the pillars of HIA as well as the Minimum Elements and Practice Standards. The four main pillars of HIA are democracy, equity, sustainable development and ethical use of evidence (WHO, 1999). Democracy is defined as: “emphasizing the right of people to participate in a transparent process for the formulation, implementation and evaluation of policies that affect their life, both directly and through the elected political decision makers” (WHO, 1999). This concept was considered in the Systematic HIA Scoping Tool by including public input into the prioritization of health determinants. By involving these stakeholders in the scoping process in a way that makes a real impact to the outcome of the HIA, the tool remains consistent with the core values upon which HIA is based. Additional discussion around consideration of stakeholder input is provided below.

The other factor that was key to determining a priority order for health determinants was impact: “Health impacts are the overall effects, direct or indirect, of a policy, strategy, programme or project on the health of a population” (WHO, 1999). The impact of a specific determinant is dependent on the nature of the project, policy or program being evaluated. Therefore, a certain level of detailed information should be available for review prior to making the decision regarding potential impacts. Additionally, characterizing impacts of specific activities on various determinants of health can be a complex process that should ideally be carried out by individuals with expertise in the field of HIA, and have a strong understanding of human-environment interactions. Defining the occurrence and importance of impacts associated with health determinants should be largely informed by established science, as published in the primary literature, and/or direct observation, in combination with stakeholder input (Winkler et al., 2011; Figure 4.8). When deciding on a hierarchy of evidence to inform scoping, the strongest sources are from the primary literature (e.g., meta-analyses, reviews, studies) followed by evidence provided by key informants and stakeholders (Birley, 2011). Based on this assumption, the Systematic HIA Scoping Tool
relied first on impact evidence, informed by published literature and scientific fact, and then considered stakeholder/public input as secondary when determining priority.

Figure 4.8  Methodological triangulation to determine the occurrence and importance of health outcomes and determinants (Winkler et al., 2011)

In addition to impact and public input, the Systematic HIA Scoping Tool incorporates the “ethical use of evidence” pillar by taking into consideration the quality and availability of data. The WHO (1999) states that “the use of quantitative and qualitative evidence has to be rigorous, and based on different scientific disciplines and methodologies to get as comprehensive assessment as possible of the expected impacts.” By conducting a preliminary evaluation of the data gaps associated with each relevant health determinant, the tool promotes a transparent approach to the use of evidence in HIA. It also allows for upfront acknowledgement and communication of the limitations and possible uncertainties associated with the assessment.
4.4.2 Stakeholder Engagement in HIA Scoping

One of the least consistent areas of HIA practice is stakeholder engagement. Although it is often identified as a key component of HIA, the level of rigour in stakeholder identification, engagement and involvement in the process is highly variable (US EPA, 2013). Often the first opportunity for stakeholders to get involved is during the scoping step, where they can inform decisions about the plan for the HIA. The Minimum Elements and Practice Standards states that:

“Meaningful and inclusive stakeholder (e.g., affected community, public agency, decision-maker) participation in each step of the HIA supports HIA quality and effectiveness. Each HIA should have a specific engagement and participation approach that utilizes participatory or deliberative methods suitable to the needs of stakeholders and context” (Bhatia et al., 2014).

As part of the review and analysis of existing HIA scoping tools, identification of a stakeholder engagement approach was considered a key component of a robust scoping methodology. Although several of the HIA scoping tools acknowledged the need for some sort of stakeholder engagement and some provided examples of typical stakeholders and common engagement activities, they were not consistent or specific in their approach or application.

Recently, a collaboration between the Center for Community Health and Evaluation and Health Impact Partners resulted in a detailed report entitled “Community Participation in Health Impact Assessments: A National Evaluation”, examining the varying levels of community participation in HIA in the United States (CCHE and HIP, 2016). The results of the national evaluation found that one-third of respondents ranked the level of community participation on the low end of the spectrum (either inform or consult) without providing details on how their feedback would be incorporated into the HIA process (CCHE and HIP, 2016). Additionally, the evaluation looked at community participation methods and compared utility with effectiveness. Although obtaining feedback/comments on a draft HIA was the most popular method of participation, followed by public meetings and then inclusion on a steering committee, the most effective method was key informant interviews.
Despite the level of variability in community participation, of the 47 HIAs surveyed, 84% reported that it had a “positive” or “very positive” impact on the success of the HIA (CCHE and HIP, 2016).

Overall, they identified a range of “community participation levels” including: inform, consult, involve, collaborate, and empower (CCHE and HIP, 2016). These participation levels were adapted and used to provide some preliminary guidance on incorporating stakeholder feedback into the HIA scoping process (Figure 4.9). At a minimum, it is vital that HIA practitioners acknowledge the importance of community input and are upfront about the level of influence that various stakeholders have on the process.

<table>
<thead>
<tr>
<th>Community Participation Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inform</strong> No input into HIA scope/process</td>
</tr>
<tr>
<td><strong>Inform Engagement:</strong> Should include an accessible method of disseminating information on the HIA process and results. No input into the scoping process.</td>
</tr>
<tr>
<td><strong>Consult</strong> Possibility of limited input into HIA scope/process</td>
</tr>
<tr>
<td><strong>Consult Engagement:</strong> Should include at least one open house or public meeting to obtain feedback on the HIA scope and process. Limited input into the scoping process.</td>
</tr>
<tr>
<td><strong>Involve</strong> Clear provision of input into HIA scope/process</td>
</tr>
<tr>
<td><strong>Involve Engagement:</strong> Should include at least one open house or public meeting to obtain feedback on the HIA scope and process including multiple opportunities for comment including a public survey and/or key informant interviews. All feedback should be incorporated into the scoping process.</td>
</tr>
<tr>
<td><strong>Collaborate</strong> Clear provision of input into HIA scope/process &amp; input into decision-making process</td>
</tr>
<tr>
<td><strong>Collaborate Engagement:</strong> Should include multiple open houses or public meeting to obtain feedback on the HIA scope and process including multiple opportunities for comment including a public survey and/or key informant interviews and a public review period. All feedback should be incorporated into the scoping and assessment processes.</td>
</tr>
<tr>
<td><strong>Empower</strong> Clear provision of input into HIA scope/process through frequent feedback and final decision-making authority</td>
</tr>
<tr>
<td><strong>Empower Engagement:</strong> Should include a series of open houses and/or public meetings throughout the process to provide information and get feedback on HIA scope, assessment approach, and recommendations. Should include a multi-faceted outreach strategy (e.g., community survey (mail and online); hotline; website; door-to-door; key informant interviews, steering committee). Must include a public comment period for stakeholders to review draft report; all comments must be addressed in the final report.</td>
</tr>
</tbody>
</table>

Figure 4.9   Levels of Stakeholder Engagement in HIA Scoping. Community participation levels adapted from: (CCHE and HIP, 2016).
4.4.3 Limitations and Future Research

Although the Systematic HIA Scoping Tool was developed in order to address current gaps in the HIA scoping methodologies, including a lack of transparency and reproducibility, there are some limitations to this approach. Firstly, the literature review and comparative analysis focused on HIA scoping tools rather than general guidance documents, which omitted a large volume of work. There may be some information and process suggestions that would enhance HIA scoping; however, the variability in the application of general guidance is typically high. For this reason, the authors focused on tools that have been specifically developed to assist with the consistent application of a scoping process.

Second, the Systematic HIA Scoping Tool was developed by the authors and thus has inherent assumptions and personal judgements. As in any development process, certain decisions had to be made about how to proceed. This is especially true for the priority decision matrix that was developed to provide a consistent, transparent and systematic approach to selecting priority health determinants for inclusion in HIA. The specific factors that were selected and the definitions that were developed are intended to promote objectivity in the process; however, with different users applying the tool to various scenarios, complete objectivity is not possible. Despite this reality, the authors agree that this approach does take a step in the right direction in terms of creating more consistent methods in HIA to ensure that the practice is robust, clear and defensible.

In order to determine the efficacy of this type of scoping approach, the tool should be used by HIA practitioners and applied to a wide range of potential scenarios. In order to properly test the Systematic HIA Scoping Tool, it requires specific information on a project, policy or program and public/community input; therefore, it is not conducive to testing using theoretical case studies. Areas of future research that should be pursued are to test the tool on: large and small-scale projects in a variety of sectors, various policy initiatives, and a range of simple to complex program proposals in different jurisdictions. In some cases, the tool may benefit from enhancement based on feedback on various aspects including, effectiveness, ease of use, comprehensiveness of content, agreement with existing scoping processes, and other key aspects of the tool content and functionality.
Overall, the Systematic HIA Scoping Tool was developed based on identification of methodological gaps in existing scoping practices and it provides practitioners with a more transparent and consistent method of identifying priority health determinants for inclusion in HIA. Future work in the area of HIA methodology development is vital to the ongoing success of the practice and utilization of HIA as a reliable decision-making tool.

4.5 References


Chapter 5

Assessment (Part I)

Citation

Abstract
Objectives: The Health Impact Assessment (HIA) was conducted to evaluate the potential community health implications of a proposed oil drilling and production project in Hermosa Beach, California. The HIA considered 17 determinants of health that fell under 6 major categories (i.e., air quality, water and soil quality, upset conditions, noise and light emissions, traffic, and community livability). Material and Methods: This paper attempts to address some of the gaps within the HIA practice by presenting the methodological approach and results of this transparent, comprehensive HIA; specifically, the evaluation matrix and decision-making framework that have been developed for this HIA and form the basis of the evaluation and allow for a clear conclusion to be reached in respect of any given health determinant (i.e., positive, negative, neutral). Results: There is a number of aspects of the project that may positively influence health (e.g., increased education funding, ability to enhance green space), and at the same time there have been potential negative effects identified (e.g., odor, blowouts, property values). Except for upset conditions, the negative health outcomes have been largely nuisance-related (e.g., odor, aesthetics) without irreversible health impacts. The majority of the health determinants, that had been examined,
have revealed that the project would have no substantial effect on the health of the community. Conclusions: Using the newly developed methodology and based on established mitigation measures and additional recommendations provided in the HIA, the authors have concluded that the project will have no substantial effect on community health. This approach and methodology will assist practitioners, stakeholders and decision-makers in advancing the HIA as a useful, reproducible, and informative tool.
5.0 Health Impact Assessment of an Oil Drilling Project in California

5.1 Introduction

The World Health Organization (WHO) defines health as “a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity” (WHO, 1948). This definition is considered an ideal to strive for, and it forms the basic principle, upon which the Health Impact Assessment (HIA) is based. Historically, community health has been a secondary consideration (if it is formally considered at all) in many policy/project decision making processes. When it is included, it tends to be limited to evaluation of health impacts associated with environmental contaminants (e.g., human health risk assessment). The Health Impact Assessment is intended to incorporate a wider range of health determinants and their potential effects on health and well-being. Often referred to as the “social determinants of health” does this collection of factors related to health status range from biological characteristics (i.e., age, gender, genetics, etc.) to socioeconomic factors (i.e., education, income, lifestyle factors, etc.) (Whitehead & Dahlgren, 1991).

The HIA typically consists of a series of steps that are intended to provide a structural framework, around which the assessment will be conducted. Although guidance documents from around the world have slight variations on these steps, the process is fundamentally the same (Ross et al., 2014). The first step of any HIA is the screening step where a rapid review of the available evidence is conducted to determine whether this type of assessment is warranted. Once it has been decided that the HIA is warranted, the scoping step commences. The purpose of the scoping step is to plan the overall approach to the HIA including methods, contents and logistics. Feedback from stakeholder engagement activities (e.g., open houses, public comments, surveys, etc.) may be useful in identifying important issues for consideration in terms of the HIA.

The next step is the assessment which varies widely depending on the project. The assessment step is where all of the planning in the scoping the phase is carried out to “identify whether impacts are likely to occur and then to quantify or characterize the predicted impacts” (Ross et al., 2014). Currently, there is a high degree of inconsistency in
the quality of assessments, including scientific basis, transparency and reproducibility (Rhodus et al., 2013). Based on the findings of the assessment, specific recommendations may be made and should include input from key stakeholders to ensure they are politically, socially and technically feasible. The reporting step is self-explanatory to the extent that typical HIAs are written up in a report-style format to be distributed to decision-makers and other stakeholders. Although not always included, the evaluation step is considered to be an important aspect of the HIA since it involves reflection and critical assessment of the process in order to foster improvement. Finally, monitoring is intended to ensure that the control measures and health predictions in the HIA are accurate and effective. However, this is one of the least well-defined steps of the HIA and is seldom implemented.

The majority of information available on the HIA is from government or health agencies, with relatively little scientific research published in the primary literature (Ross et al., 2014; Rhodus et al., 2013; NRC, 2011; Bhatia, 2010; Quigley et al., 2006; Health Canada, 2010). Those studies that do appear in the literature identify the lack of a consistent methodological approach to the HIA and point to its usefulness as a tool being hindered by a lack of appropriate guidance (Fehr, 1999; Lock, 2000; Briggs, 2008; Forastiere et al., 2011; Negev et al., 2013). Without a clear methodological approach that carefully considers the interdisciplinary elements of the HIA, the major inconsistencies and differences will continue to be found in quality and scientific rigor of these important and influential components of the decision-making process (Rhodus et al., 2013). Considering that government officials, members of the public and health practitioners are calling for the HIA to become a mandatory part of assessing major infrastructure projects, it is imperative that a comprehensive, integrated framework be developed to guide practitioners.

One of the most promising research opportunities, as identified in the recent US Environmental Protection Agency (US EPA) report “A review of Health Impact Assessments in the U.S.: Current state-of-science, best practices, and areas for improvement,” lies in developing methods to make the HIA more universally applicable and to provide guidance on the practical implementation of specific quantitative and qualitative assessment methods (Ross et al., 2014). This paper attempts to address some of the gaps within the HIA practice
by presenting the methodological approach and results of the comprehensive HIA conducted on a proposed oil drilling and production project in Hermosa Beach, California.

5.1.1 Project Overview

The current boom in the U.S. domestic crude oil production is approaching the historical high of 9.6 million barrels per day, that was achieved in 1970. California remains one of the top producers of crude oil in the country, accounting for almost 1/10 of the total U.S. production (US EIA, 2014). Los Angeles is considered the most urban oil field in the country, with a long history of the petroleum industry operating in non-industrial areas (CLUI, 2010). Since industrial processes are generally not desired in densely populated areas due to environmental and health concerns, many oil drilling sites in Los Angeles have incorporated mitigation measures (e.g., noise muffling, visual barriers, closed-loop systems) to help reduce the potential impacts on surrounding communities.

The proposed project consists of drilling 30 oil wells on a 1.3-acre site currently used as a City maintenance yard in the City of Hermosa Beach. If approved, the proposed project will be completed in 4 phases (MRS, 2014). The Phase 1 involves construction activities associated with site preparation for drilling and testing. The Phase 2 consists of drilling and testing of wells in order to estimate the potential productivity and economic viability of the project.

If the Phase 2 determines that the project is economically feasible, the Phase 3 would be carried out to prepare the site for permanent oil and gas production facilities and to construct offsite pipelines. The permanent oil production facility will include tanks, vessels, piping, pumps, filters and corresponding metering equipment. The Phase 4 is the final phase of the project that will maximize oil and gas recovery through the construction of an 87-foot high drill rig, the drilling of the remaining wells, and through the continuous operation of the project. Facility operations and maintenance would continue for approximately 30–35 years, with periodic re-drills during the life of the project (MRS, 2014).

The situation in Hermosa Beach is unique since it permits local residents to vote on whether to lift the existing oil ban and allow the project to proceed. Therefore, in order to inform
voters about the potential economic, social, environmental, and health impacts (positive and negative) of the project, the City of Hermosa Beach commissioned the HIA, in addition to a Cost-Benefit Analysis (CBA) and Environmental Impact Report (EIR). The EIR complies with the California Environmental Quality Act, while the CBA and HIA are complementary documents that have been commissioned to provide community members with additional information on the project.

Consequently, the HIA is not intended to be a standalone document; it is rather complementary to the existing information provided in the EIR. The difference lies in the scope of the health impacts considered, with the HIA focusing on a wider range of health determinants, including social and economic aspects which may not have been addressed in the EIR, or may not have focused on human health implications of the project activities. Due to the volume of work required for the detailed assessment of all of the identified health determinants, this paper provides a summary of the HIA; however, these reports are publicly available on the City of Hermosa Beach website.

In California, the HIA is not legally required for this type of project. The rationale for the HIA lies in its unique approach to assessing a multitude of potential impacts (both positive and negative) that could affect community health. The HIA is intended to provide a wider scope, while relying on existing information provided in the EIR, to holistically evaluate health. Although the reports are complementary, in several instances the HIA provides further details on how specific aspects of the project could positively or negatively affect the health of the community, and proposes additional recommendations where necessary.

The approach and methodology developed for this HIA are unique, comprehensive, scientifically-based, and transparent. Due in part to the major inconsistencies among HIAs, which has been identified as a key data gap and issue about the practice, the methods have been designed in such a way that other practitioners working on a variety of projects could use this approach to ensure that future HIAs are more consistent, transparent and reproducible. Specifically, the evaluation matrix and decision-making framework that form the basis of the assessment, allow for a clear conclusion to be reached on any given health determinant (i.e., positive, negative, or neutral effect on health), which will assist
practitioners, stakeholders and decision-makers in advancing the HIA as a useful and informative tool.

5.2 Materials and Methods

The HIA typically consists of a series of steps that are intended to provide a structural framework, around which the assessment will be conducted. Although guidance documents from around the world have slight variations on these steps, they typically include: screening, scoping, assessment, recommendation, reporting, evaluation and monitoring (Ross et al., 2014).

5.2.1 Study area and population

Founded in 1907, Hermosa Beach is a small 3.7 square kilometer City on Los Angeles (LA) County’s South Bay coastline, bordered by Manhattan Beach to the north and Redondo Beach to the south. Known as “The Best Little Beach City,” it has a population of approximately 20,000 people, with a high proportion of residents between the age of 25 and 50 (US Census Bureau, 2013). The City is considered to be a desirable place to live for many reasons, especially the year-long mild temperatures ranging from highs of 19°C in winter to 25°C in summer and nighttime temperatures that rarely dip below 10°C.

The City is also known as being a popular place for outdoor activities such as surfing, volleyball, skateboarding, jogging and bicycling, among others. A diverse restaurant and bar scene also create a vibrant nightlife. Together with Manhattan Beach and Redondo Beach, Hermosa is a part of what is known as the “Beach Cities.” Hermosa Beach has its own elementary schools and middle school, but high school students are served by either Manhattan Beach or Redondo Beach. Hermosa also shares public transportation and health services with the two other Beach Cities. The City of Hermosa has its own police and fire departments, a community theater, and senior center.

5.2.2 Stakeholder engagement

Stakeholder engagement is a key component of the HIA and is particularly useful in the scoping step. Community participation and expert consultation help to ensure that important
issues and local knowledge are considered. The following stakeholders have been identified in the HIA:

- the decisions-makers (voting public of Hermosa Beach),
- local government (City of Hermosa Beach),
- non-residents who work, recreate, or otherwise spend time in Hermosa Beach,
- pro-oil and anti-oil activist groups,
- the project Applicant, and
- local health agency (Beach Cities Health District).

Specific opportunities for stakeholder involvement included: a Community Dialogue process involving a series of workshops; a public open house; an HIA scoping meeting; and an online survey. All public opportunities for engagement have been advertised to the community via multiple outlets including postcard mailers, announcements in the local newspaper, banners in public spaces, and e-mail blasts to the City mailing list.

The online survey has been conducted to help identify the key issues of concern among community members to ensure their inclusion in the HIA scoping process. The survey has consisted of the same 4 multiple choice questions asking where respondents live, whether there is concern about health impacts of the proposed project, what potential health impacts are of most concern, and if the level of concern depends on the various project the phases. A total of 292 community members have responded.

The majority of the survey participants live in Hermosa Beach near the site of the proposed project. Survey participants have ranked their level of concern for 18 topics as “very concerned,” “somewhat concerned,” “not concerned” or “no opinion;” participants have also been given the option to specify “other” concerns. Out of the 292 volunteer survey participants, 93% have either been very or somewhat concerned about the potential health impacts of the proposed project. The remaining 7% of participants have either not been concerned about potential health impacts or are not sure. Issues of most concern included explosions/spills, impacts to the ocean or beach, soil contamination, air quality, odor and surface water contamination (Table 5.1). The Community Dialogue process has been conducted concurrently with the HIA and intended to identify the values and long-term goals.
for Hermosa Beach through engaging local residents and business owners. The authors have relied on the stakeholder engagement process to inform the HIA scoping step, including incorporating key quality of life aspects identified by Hermosa Beach community members into the selection of health determinants and evaluation of overall community health and well-being.

Table 5.1  Ranking of environment and health areas of concern from community survey

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Very Concerned</th>
<th>Somewhat Concerned</th>
<th>Not Concerned</th>
<th>No Opinion</th>
<th>Rating Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosions/Spills/Accidents</td>
<td>254</td>
<td>23</td>
<td>6</td>
<td>1</td>
<td>1.13</td>
</tr>
<tr>
<td>Potential impacts to the ocean</td>
<td>259</td>
<td>16</td>
<td>10</td>
<td>1</td>
<td>1.14</td>
</tr>
<tr>
<td>Soil contamination</td>
<td>249</td>
<td>27</td>
<td>8</td>
<td>1</td>
<td>1.16</td>
</tr>
<tr>
<td>Air quality issues</td>
<td>247</td>
<td>26</td>
<td>9</td>
<td>1</td>
<td>1.17</td>
</tr>
<tr>
<td>Odor</td>
<td>248</td>
<td>25</td>
<td>8</td>
<td>2</td>
<td>1.17</td>
</tr>
<tr>
<td>Surface water contamination</td>
<td>244</td>
<td>22</td>
<td>11</td>
<td>3</td>
<td>1.19</td>
</tr>
<tr>
<td>Truck traffic</td>
<td>230</td>
<td>45</td>
<td>6</td>
<td>2</td>
<td>1.22</td>
</tr>
<tr>
<td>Drinking water contamination</td>
<td>234</td>
<td>30</td>
<td>15</td>
<td>4</td>
<td>1.25</td>
</tr>
<tr>
<td>Property values</td>
<td>223</td>
<td>33</td>
<td>19</td>
<td>4</td>
<td>1.3</td>
</tr>
<tr>
<td>Noise</td>
<td>220</td>
<td>39</td>
<td>21</td>
<td>3</td>
<td>1.32</td>
</tr>
<tr>
<td>Land subsidence (sinking)</td>
<td>212</td>
<td>43</td>
<td>16</td>
<td>6</td>
<td>1.34</td>
</tr>
<tr>
<td>Less access to community spaces</td>
<td>210</td>
<td>51</td>
<td>16</td>
<td>5</td>
<td>1.35</td>
</tr>
<tr>
<td>Earthquakes</td>
<td>207</td>
<td>55</td>
<td>20</td>
<td>2</td>
<td>1.36</td>
</tr>
<tr>
<td>Image of the city</td>
<td>210</td>
<td>41</td>
<td>24</td>
<td>4</td>
<td>1.36</td>
</tr>
<tr>
<td>Vibration</td>
<td>204</td>
<td>47</td>
<td>25</td>
<td>6</td>
<td>1.41</td>
</tr>
<tr>
<td>Parking problems</td>
<td>195</td>
<td>58</td>
<td>23</td>
<td>6</td>
<td>1.43</td>
</tr>
<tr>
<td>Lights</td>
<td>177</td>
<td>63</td>
<td>32</td>
<td>6</td>
<td>1.52</td>
</tr>
</tbody>
</table>

5.2.3 Baseline health status

The objectives of the baseline health assessment have been to establish the existing health status of the City of Hermosa Beach community, and to evaluate whether the current profile of the community reveals vulnerabilities to any of a number of health outcomes. Understanding baseline conditions is particularly important when conducting the HIA because pre-existing conditions may influence potential health impacts associated with the proposed project.

The methods used in the baseline health assessment have been based on the Guide for Health Impact Assessment from the California Department of Public Health (CDPH) (Bhatia, 2010). According to the CDPH, the selection of indicators for the baseline assessment should include indicators of health status, as well as known social, economic, and environmental health determinants, and should reflect priority health issues being addressed in the HIA.
Hermosa-specific health indicators have been compared to either Los Angeles County or the State of California, in that order of preference, depending on which measures have been available. By comparing Hermosa-specific data to that of a larger geographic region, it has been possible to characterize the health status in Hermosa in relation to expected health status. The baseline health assessment results have been used in a comparative analysis of potential health effects within the HIA and have helped to identify potentially vulnerable populations.

5.3 Development of the HIA evaluation matrix and decision-making framework

An evaluation matrix was developed for this HIA as a tool to characterize and summarize the predicted health impacts (positive, negative, and neutral) of the project so they could be compared and contrasted. Since there is no globally accepted methodology for health impact characterization in the HIA, the evaluation matrix has been developed in accordance with best practices published in a number of guidance documents (Ross et al., 2014; Rhodus et al., 2013; NRC, 2011; Bhatia, 2010; Quigley et al., 2006).

The evaluation matrix included consideration of the different characteristics of potential impacts including geographic extent, magnitude, likelihood, adaptability, and others (Table 5.2). Each of these characteristics has been independently evaluated based on data from the EIR, baseline health status, evidence from the scientific and public health literature, and professional judgment. The evaluation has been conducted based on a scenario where proposed EIR mitigation measures are implemented (post-mitigation), which would be required under the California Environmental Quality Act (MRS, 2014). Therefore, the assessment has been able to ensure that mitigation measures are adequately protective and, if not, to propose additional recommendations based on the HIA findings.

For each health determinant evaluated in the HIA, a scientific assessment of the potential health impact includes a detailed discussion of all aspects of the evaluation matrix. A specific definition has been used for each element to ensure a consistent and meaningful assessment across all determinants.
Table 5.2  Elements of the HIA Evaluation Matrix

<table>
<thead>
<tr>
<th>Health Determinant</th>
<th>List the determinant being assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential Health Outcome</td>
<td>List potential health outcomes associated with each determinant</td>
</tr>
<tr>
<td>Geographic Extent</td>
<td>Localized or Community</td>
</tr>
<tr>
<td>Vulnerable Populations</td>
<td>List subgroups that could be disproportionately affected by Project activities</td>
</tr>
<tr>
<td>Magnitude</td>
<td>Low, Medium, High, or Unknown</td>
</tr>
<tr>
<td>Adaptability</td>
<td>High, Medium, Low, or Unknown</td>
</tr>
<tr>
<td>Likelihood</td>
<td>Unlikely, Possible, or Probable</td>
</tr>
<tr>
<td>Post-Mitigation Health Effect</td>
<td>Negative, Positive, No substantial Effect, or Unknown</td>
</tr>
<tr>
<td>Comments or Additional Recommended Measures</td>
<td>None, or Additional Recommendations (specific and actionable)</td>
</tr>
</tbody>
</table>

The Health Determinant: A determinant is defined as “an element that identifies or determines the nature of something.” In this case, the determinant is an element of the project that has the potential to impact health in a positive or negative manner; however, the determinant itself is non-directional.

The Potential Health Outcome: List and discuss potential health outcomes associated with the determinant (e.g., the toxicology and physical health changes associated with exposure).

The Geographic Extent: How far are the impacts likely to reach?

- Localized – limited to the areas in close proximity to the project site.
- Community – potential for wider scale impacts across the community.

The Vulnerable Populations: Are there populations that could be disproportionately affected (positively or negatively) by project activities?

The Magnitude: What is the extent of the health impact post-mitigation?

- Low – the impact is minor, it is temporary or reversible, and does not pose a hazard/benefit to health.
- Medium – the impact is detectable, it is reversible, and poses a minor to moderate hazard/benefit to health.
- High – the impact is substantial, it is permanent, and poses a major hazard/benefit to health.
- Unknown – the impact is unclear and poses an unknown hazard/benefit to health.
The Adaptability: How resilient is the community to this type of change; are they able to adapt?

- High – people will be able to adapt to the change with ease and maintain pre-project level of health.
- Medium – people will be able to adapt to the change with some difficulty and will maintain pre-project level of health, although some support may be necessary.
- Low – people will not be able to adapt or maintain pre-project level of health.

The Likelihood: What is the probability of the impact occurring based on the expected frequency of the exposure?

- Unlikely – the impact is anticipated to occur rarely, if ever.
- Possible – there is potential for the impact to occur on a regular basis.
- Probable – the impact will almost certainly occur and persist over time.

The Post-Mitigation Health Effect: What is the direction of the post-mitigation effect?

- Positive – the effect is expected to positively influence health following implementation of EIR mitigation measures.
- Negative – the effect is expected to negatively influence health following implementation of EIR mitigation measures.
- No substantial effect – there is no substantial health effect expected following implementation of EIR mitigation measures.
- Unknown – the direction of the effect following implementation of EIR mitigation measures is unknown.

A decision-making framework has been developed as a part of the evaluation matrix to weigh each of the elements (i.e., magnitude, adaptability and likelihood) in order to come to a final conclusion on the “post-mitigation health effect” for each determinant (Figure 5.1). The elements are arranged in a descending order (top to bottom) of weight and potential influence on the final determination of effect. For example, magnitude is the most heavily weighted component in determining the “post-mitigation health effect.” This is apparent by the fact that classifying magnitude as “low” automatically leads to “no substantial effect” regardless of adaptability and likelihood.
Figure 5.1  Decision-making framework for the HI evaluation matrix (H = high; M = medium; L = low; U = unlikely; P = possible; R = probable)
Conversely, a “high” magnitude automatically leads to a directional outcome (i.e., either positive or negative). It is only when the magnitude is “medium” that adaptability and likelihood play a role in determination of the “post-mitigation health effect.” This is due to the specific nature of the definitions developed for each of the elements: magnitude, adaptability and likelihood. Each pathway through the framework leads to a specific overall conclusion that is either directional (i.e., positive or negative) or non-directional/neutral (i.e., no substantial effect). In some cases where professional judgment dictates, it is possible to deviate from the decision making framework; however, a detailed evidence-based rationale is required.

The most heavily weighted aspect of the evaluation matrix is magnitude which comprises the 1st level of the framework. Adaptability is the next level of the evaluation matrix as it relates to resiliency and ability to maintain health status if any impact were to occur. This element is less heavily weighted than magnitude but does influence the final determination of effect. The final level of the matrix is likelihood which is the probability of the impact based on the expected frequency of exposure. Likelihood is less heavily weighted than magnitude but it is similar to adaptability, and it influences the final conclusion, especially in situations where the impact is expected to occur rarely, if ever.

In case an element of the evaluation matrix is classified as “unknown,” a discussion of the uncertainty and potential influence of this limitation on the conclusions must be provided. In these scenarios, the determination of effect is situation-specific and largely based on professional judgment and sound rationale; therefore, it has been considered to be outside the scope of the decision-making framework.

5.3.1 Assessment details for the identified health determinants

The HIA considered 17 determinants of health that fall under 6 major categories (i.e., air quality, water and soil quality, upset conditions, noise and light emissions, traffic, and community livability). Consideration has been given to those determinants that had been identified as community priorities and had been most likely to be impacted by the project. Each of these outcomes has been carefully assessed, based on available evidence and
proposed mitigation measures identified in the EIR, using a combination of quantitative, semi-quantitative and qualitative approaches, where appropriate (Table 5.3). Ultimately, the aim of the assessment has been intended to determine whether the project (post-mitigation) could potentially have a negative, positive or no substantial effect on the health of the community.

Table 5.3  Assessment details for identified health determinants

<table>
<thead>
<tr>
<th>Health Determinant</th>
<th>Type of Assessment</th>
<th>Evidence / Data Used</th>
<th>Assessment Approach</th>
<th>Mitigation Measures (from the EIR)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Quality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen Dioxide (NO₂)</td>
<td>Quantitative</td>
<td>Air emissions inventory from EIR</td>
<td>Calculate 1-hr and annual average NO₂ to compare to existing air standards: WHO air quality health guidelines, California AAQS and US EPA NAAQS.</td>
<td>NOx reduction program, limited flaring, and air monitoring plan are specified in the EIR to reduce emissions of NO₂.</td>
</tr>
<tr>
<td>Particulate Matter (PM)</td>
<td>Quantitative</td>
<td>Air emissions inventory from EIR</td>
<td>Calculate 1-hr and annual average PM₂.₅ to compare to existing air standards: WHO air quality health guidelines, California AAQS and US EPA NAAQS.</td>
<td>Limited flaring, limited microturbine PM emissions, air monitoring plan, and diesel emission requirements are required by the EIR to mitigate PM emissions.</td>
</tr>
<tr>
<td>Toxic Air Contaminants (TAC)</td>
<td>Quantitative</td>
<td>Air emissions inventory from EIR</td>
<td>Calculated cancer risks and non-cancer hazard indices (acute and chronic) and cumulative impacts from chemical mixtures.</td>
<td>Various air quality management mitigation measures around flares, microturbines and fugitive emissions to reduce TAC emissions.</td>
</tr>
<tr>
<td>Hydrogen Sulfide (H₂S – Odor)</td>
<td>Semi-quantitative</td>
<td>Air emissions inventory from EIR</td>
<td>Evaluate odor effect-thresholds; expected frequency and duration of exposure; and proximity of residents.</td>
<td>Air quality mitigation measures to reduce offgassing of vapors from drilling muds, and for operational odor controls including an Odor Minimization Plan.</td>
</tr>
<tr>
<td><strong>Water &amp; Soil</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Surface water</td>
<td>Qualitative</td>
<td>Runoff information and mitigation measures discussed in the EIR</td>
<td>Potential for site-related runoff to reach the Pacific ocean was evaluated.</td>
<td>Storm Water Pollution Prevention Plan specified in the EIR designed to prevent runoff from reaching ocean; no recreational exposure expected.</td>
</tr>
<tr>
<td>Soil particles</td>
<td>Semi-quantitative</td>
<td>Soil data (limited) and mitigation in EIR</td>
<td>Review existing soil data and issues (lead) around site contamination.</td>
<td>A Remedial Action Plan proposed in the EIR requires additional soil sampling to fill data gaps. Removal of soils exceeding applicable guidelines and a Fugitive Dust Control Plan are required.</td>
</tr>
<tr>
<td><strong>Upset Scenarios</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude oil spill</td>
<td>Semi-quantitative</td>
<td>Probability of oil spill and mitigation in EIR, health literature</td>
<td>Evaluate probability of oil spill (0.07%) from EIR, mitigation effectiveness and related health literature.</td>
<td>An independent third party audit of equipment and additional upset scenario risk reduction measures are discussed in the EIR. Rapid containment and cleanup of any crude oil spills required to minimize exposure.</td>
</tr>
<tr>
<td>Well blowout</td>
<td>Semi-quantitative</td>
<td>Probability of well blowout</td>
<td>Evaluate probability of blowout during various</td>
<td>An independent third party audit of equipment and additional upset scenario risk reduction measures are discussed in the EIR. Rapid containment and cleanup of any well blowouts required to minimize exposure.</td>
</tr>
<tr>
<td>Health Determinant</td>
<td>Type of Assessment</td>
<td>Evidence / Data Used</td>
<td>Assessment Approach</td>
<td>Mitigation Measures (from the EIR)</td>
</tr>
<tr>
<td>-------------------</td>
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<td>----------------------------------</td>
</tr>
<tr>
<td>Noise &amp; Light</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise emissions</td>
<td>Quantitative</td>
<td>Noise data from EIR and health literature</td>
<td>Compare noise levels from different phases of the project with established health-based noise guidelines (WHO night noise) and typical suburban/urban noise levels.</td>
<td>Noise mitigation measures in the EIR include noise barriers and various engineering controls to lower noise from operations. Additionally, noise from construction will only be permitted during daytime hours.</td>
</tr>
<tr>
<td>Light emissions</td>
<td>Semi-quantitative</td>
<td>Information on light sources from EIR and health literature</td>
<td>Evaluate additional light sources and potential for impacts on sleep cycles using available health literature.</td>
<td>Light mitigation measures in the EIR include downcast lighting, a perimeter barrier and shielding of three sides of the drill rig will minimize any additional sources of light in the area. However, for safety reasons there will be lighting at the sight during nighttime hours.</td>
</tr>
<tr>
<td>Traffic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic safety</td>
<td>Semi-quantitative</td>
<td>Traffic impact analysis from EIR</td>
<td>Analyze traffic impact analysis from a health and safety perspective using relevant literature.</td>
<td>Traffic mitigation measures include: road improvements, a truck traffic safety program, a pedestrian protection plan, traffic restrictions (specified routes and restricted hours), and safety measures, including signage, flagmen, pavement markings, barricades, and lights.</td>
</tr>
<tr>
<td>Perceived traffic hazard</td>
<td>Qualitative</td>
<td>Health literature</td>
<td>Evaluate potential impacts from perceived traffic hazard using available literature.</td>
<td>Traffic mitigation measures may also reduce perceived hazards, especially those that restrict truck travel routes and provide additional signage and safety measures for protection of pedestrians and cyclists.</td>
</tr>
<tr>
<td>Community Livability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property values</td>
<td>Semi-quantitative</td>
<td>Property value analysis from the CBA</td>
<td>Review property value analysis, case studies of similar projects, and health literature on impacts.</td>
<td>None: the CBA determined that property values could be impacted from 0-10% in the vicinity of the project.</td>
</tr>
<tr>
<td>Access to Recreational Resources and Green Space</td>
<td>Qualitative</td>
<td>Stakeholder feedback and social/health literature</td>
<td>Review community feedback, City data on parks and recreation spaces and social/health literature</td>
<td>Provision of a ‘Tidelands Fund’ and ‘General Fund’ where project revenue can be allocated to improving green spaces and beach areas and other community resources.</td>
</tr>
<tr>
<td>Health Determinant</td>
<td>Type of Assessment</td>
<td>Evidence / Data Used</td>
<td>Assessment Approach</td>
<td>Mitigation Measures (from the EIR)</td>
</tr>
<tr>
<td>-------------------</td>
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<td>----------------------------------</td>
</tr>
<tr>
<td>Aesthetics and Visual Resources</td>
<td>Qualitative</td>
<td>Visual simulations of key observation points from the EIR</td>
<td>Review and compare changes in the visual landscape from project simulations, including community concerns and social/health literature</td>
<td>Mitigation for visual impacts includes: building structures must be complementary to the character, scale, and quality of the surrounding environment; material used for the drill rig must be ‘sky-coloured’ to blend in; and the site must contain vegetation and landscaping to improve aesthetics.</td>
</tr>
<tr>
<td>Education Funding</td>
<td>Quantitative</td>
<td>Information provided in the CBA</td>
<td>Review of educational funding provision along with education and health literature</td>
<td>A portion of project revenues will go to the Hermosa Beach School District to provide educational funding throughout the life of the project (30-35 yrs).</td>
</tr>
<tr>
<td>Social Cohesion</td>
<td>Qualitative</td>
<td>Stakeholder feedback and social/health literature</td>
<td>Review of community feedback from stakeholder engagement initiatives and social/health literature</td>
<td>None: individual disputes can arise from differing opinions, which can be distressing to some community members.</td>
</tr>
<tr>
<td>Political Involvement</td>
<td>Qualitative</td>
<td>Social/health literature</td>
<td>Review of community feedback from stakeholder engagement initiatives and social/health literature</td>
<td>None: the residents of Hermosa each have the unique opportunity to decide whether the project can proceed. This type of community control is linked to self-efficacy and overall well-being.</td>
</tr>
</tbody>
</table>

**5.4 Results**

The results of the HIA are summarized in the Table 5.4. The discussion outlining the key aspects of the assessment and results have been provided in the sections below. For additional information, the full report may be found on the Hermosa Beach website.

**Table 5.4 HIA summary of results**

<table>
<thead>
<tr>
<th>Health Determinant</th>
<th>Potential Health Outcome</th>
<th>Geographic Extent</th>
<th>Vulnerable Populations</th>
<th>Magnitude</th>
<th>Adaptability</th>
<th>Likelihood</th>
<th>Post-Mitigation Health Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Quality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen Dioxide (NO₂) Emissions</td>
<td>Respiratory irritation and airway constriction</td>
<td>Localized</td>
<td>Children; elderly; pre-existing conditions</td>
<td>Low</td>
<td>High</td>
<td>Unlikely</td>
<td>No substantial effect</td>
</tr>
<tr>
<td>Particulate Matter (PM) Emissions</td>
<td>Morbidity (e.g., cardio-pulmonary effects) and mortality.</td>
<td>Localized</td>
<td>Children; elderly; pre-existing conditions</td>
<td>Low</td>
<td>High</td>
<td>Unlikely</td>
<td>No substantial effect.</td>
</tr>
<tr>
<td>Toxic Air Contaminants (TAC) Emissions</td>
<td>Varies for the TACs. Includes acute effects, chronic non-carcinogenic and carcinogenic effects.</td>
<td>Localized</td>
<td>Children; elderly; pre-existing conditions</td>
<td>Low</td>
<td>High</td>
<td>Unlikely</td>
<td>No substantial effect.</td>
</tr>
<tr>
<td><strong>Odor Emissions</strong></td>
<td>Headache, eye nose and throat irritation, cough and nasal congestion.</td>
<td>Localized</td>
<td>Odor sensitive individuals</td>
<td>Medium</td>
<td>Low</td>
<td>Possible</td>
<td>Negative</td>
</tr>
<tr>
<td>Health Determinant</td>
<td>Potential Health Outcome</td>
<td>Geographic Extent</td>
<td>Vulnerable Populations</td>
<td>Magnitude</td>
<td>Adaptability</td>
<td>Likelihood</td>
<td>Post-Mitigation Health Effect</td>
</tr>
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</tr>
<tr>
<td><strong>Water and Soil</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Water</td>
<td>Acute health symptoms including eye and skin irritation</td>
<td>Localized</td>
<td>Beach users</td>
<td>Medium</td>
<td>Medium</td>
<td>Unlikely</td>
<td>No substantial effect</td>
</tr>
<tr>
<td>Soil Particles</td>
<td>Soil particles can contain chemicals posing varying degrees of human health risk depending on concentration and exposure</td>
<td>Localized</td>
<td>Children</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unlikely</td>
<td>No substantial effect</td>
</tr>
<tr>
<td><strong>Upset Scenarios</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Oil Spill</td>
<td>Acute health symptoms including headaches, eye/skin irritation, respiratory conditions, anxiety, and depression.</td>
<td>Localized</td>
<td>People in immediate vicinity</td>
<td>Medium</td>
<td>Medium</td>
<td>Unlikely</td>
<td>No substantial effect</td>
</tr>
<tr>
<td>Well Blowout</td>
<td>Injuries and/or fatalities and psychological effects including stress</td>
<td>Localized</td>
<td>People in immediate vicinity</td>
<td>High</td>
<td>Low</td>
<td>Unlikely</td>
<td>Negative</td>
</tr>
<tr>
<td><strong>Noise and Lighting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise Emissions</td>
<td>Annoyance, stress, sleep disturbance and hypertension and cognitive impairment at very high sound pressure levels</td>
<td>Phase 1-4: Localized (Project Site and truck/pipeline routes)</td>
<td>Residents and schoolchildren in proximity to pipeline route</td>
<td>Phase 1,2,3a,4: Low Phase 3b: Medium</td>
<td>Phase 1,2,3a,4: Possible Phase 3b: Probable</td>
<td>Phase 1,2,3a,4: No substantial effect Phase 3b: Negative</td>
<td></td>
</tr>
<tr>
<td>Light Emissions</td>
<td>Annoyance, stress and possible disturbance of typical sleep cycles</td>
<td>Localized</td>
<td>People with a direct line-of-site of the lit side of electric drill rig at night</td>
<td>Low</td>
<td>High</td>
<td>Unlikely</td>
<td>No substantial effect</td>
</tr>
<tr>
<td><strong>Traffic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic Safety</td>
<td>Potential increase in number of pedestrian, bicycle or other injuries</td>
<td>Localized</td>
<td>Pedestrians and cyclists (Children and the elderly)</td>
<td>High</td>
<td>Medium</td>
<td>Unlikely</td>
<td>No substantial effect</td>
</tr>
<tr>
<td>Perceived traffic hazards</td>
<td>Decrease in active transportation resulting in less physical activity</td>
<td>Localized</td>
<td>Pedestrians and cyclists (Children)</td>
<td>Medium</td>
<td>Medium</td>
<td>Unlikely</td>
<td>No substantial effect</td>
</tr>
<tr>
<td><strong>Community Livability</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property Values</td>
<td>Potential increase in stress and anxiety</td>
<td>Localized</td>
<td>Property owners</td>
<td>Medium</td>
<td>Medium</td>
<td>Possible</td>
<td>Negative</td>
</tr>
<tr>
<td>Access to Recreational Resources and Green Space</td>
<td>Change in physical activity levels, which can lead to other health issues</td>
<td>Community</td>
<td>None</td>
<td>Medium</td>
<td>High</td>
<td>Possible</td>
<td>Positive</td>
</tr>
</tbody>
</table>
### Health Determinant

<table>
<thead>
<tr>
<th>Health Determinant</th>
<th>Potential Health Outcome</th>
<th>Geographic Extent</th>
<th>Vulnerable Populations</th>
<th>Magnitude</th>
<th>Adaptability</th>
<th>Likelihood</th>
<th>Post-Mitigation Health Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetics and Visual Resources</td>
<td>Annoyance and stress from negative perceptions and anxiety over project aesthetics</td>
<td>Community</td>
<td>None</td>
<td>Medium</td>
<td>Medium</td>
<td>Possible</td>
<td>Negative</td>
</tr>
<tr>
<td>Education Funding</td>
<td>Increased resources and funding for education can indirectly lead to a more positive health status</td>
<td>Community</td>
<td>School children</td>
<td>Medium</td>
<td>High</td>
<td>Probable</td>
<td>Positive</td>
</tr>
<tr>
<td>Social Cohesion</td>
<td>Potential increase in stress</td>
<td>Community</td>
<td>None</td>
<td>Low</td>
<td>Medium</td>
<td>Possible</td>
<td>No substantial effect</td>
</tr>
<tr>
<td>Political Involvement</td>
<td>Increase in self-efficacy and positive impacts on health and well-being over communities' ability to vote</td>
<td>Community</td>
<td>Voters</td>
<td>Medium</td>
<td>High</td>
<td>Possible</td>
<td>Positive</td>
</tr>
</tbody>
</table>

### 5.5 Discussion

#### 5.5.1 Baseline health assessment

The City of Hermosa Beach, as defined by the 2010 Census, has the population of 19 506, including 52.7% male and 47.3% female residents. Age is an important factor in determining vulnerability to certain environmental exposures. According to the census data for Hermosa, approximately 25% of the population may be considered to be more vulnerable based on age (9% over the age of 65 and 16% under 18 years). This is lower than the percentage of Los Angeles County residents considered to be vulnerable to environmental exposures based on age (35%) (US Census Bureau, 2013). Education, income, and housing are all considered to be key social determinants of health. Social and economic factors constitute the single largest predictor of health outcomes as compared to clinical health care, health behavior, and the physical environment (Senterfitt et al., 2013). Nearly 70% of Hermosa residents have obtained a bachelor’s degree or higher as compared to < 30% in greater LA County. Average household income in Hermosa Beach is almost double as that of LA County (102 000 dollars vs. 56 000 dollars). Less than 4% of Hermosa residents live in poverty as compared to 16.3% of LA County residents.
Based on the LA County Cancer Registry, the recorded number of cancer cases in the City of Hermosa from 2000 to 2010 was within or below the expected numbers, based on age-, race- and sex-adjusted incidence rates for Los Angeles County, for most cancers. Exceptions include melanoma and breast cancer, which both have a higher number of cases than expected.

Hermosa Beach appears to have a favorable mortality profile, according to all-cause mortality, heart disease, and cancer, as compared to LA County (Bhatia, 2010). The unadjusted all-cause mortality rate in Hermosa (40.5 deaths per 10 000 people) is lower than the all-cause mortality rate in LA County (56.9 deaths per 10 000 people). Hermosa mortality rates are also lower for cardiovascular disease (9.2 vs. 15.8) and cancer (9 vs. 13.9).

A Gallup-Healthways Well Being survey of 1332 Hermosa, Manhattan and Redondo residents conducted in 2010 found that the overall well-being rate for local residents was higher than the California average rate and above the top tier of other cities. More than 90% of local residents said they had access to health care, health insurance and enough money for food, shelter and other basic needs. Two-thirds were found to be “thriving.” However, the survey also found that 46% of the Beach Cities residents felt stressed for most of the day – the number that ranked them 176th out of 188 communities surveyed (Blue Zones, 2012).

Overall, the baseline health assessment has found that Hermosa Beach is a relatively young community that is highly educated, has above average income levels, and a higher sense of well-being than other California residents. Overall, demographic indicators show that Hermosa Beach is not highly vulnerable to negative health outcomes traditionally associated with poverty, unemployment, and low educational attainment.

### 5.5.2 Air quality

The potential for air emissions from construction and operation of the project to affect air quality in Hermosa Beach was evaluated using the emissions inventory produced as a part of the EIR (MRS, 2014). The air pollutants carried forward for assessment in the HIA included nitrogen dioxide (NO₂), particulate matter (PM), toxic air contaminants (TAC), and hydrogen sulfide (H₂S) and other odorous compounds.
Nitrogen dioxide has the potential to produce a range of respiratory effects depending on the concentration in air (e.g., eye, nose and throat irritation, inflammation of lung tissue) (US EPA, 2012; ATSDR, 2014). For the HIA, the max 1-h and annual average NO$_2$ air concentrations were calculated (background plus project) and found to be below the WHO air quality health guidelines, indicating that adverse health effects were not expected to result from either short-term or long-term exposure (WHO, 2005). Additionally, there were no exceedances of California’s Ambient Air Quality Standards (AAQS), or the US EPA National Ambient Air Quality Standards (NAAQS) for NO$_2$ (US EPA, 2010, 2012; Cal EPA, 2007). Therefore, it was concluded that exposure to NO$_2$ from the proposed project (post-mitigation) was expected to have “no substantial effect” on community health.

Particulate matter (PM) is a widespread air pollutant composed of a mixture of solid and liquid particles, and its effects on health are well documented. Particles with a diameter of $\leq$ 10 $\mu$m are referred to as PM$_{10}$, and particles with a diameter of $\leq$ 2.5 $\mu$m are known as PM$_{2.5}$. Exposure, particularly to the smaller PM$_{2.5}$ particles, is associated with increased respiratory and cardiovascular disease and mortality (Zanobetti & Schwartz, 2009; CalEPA, 2005). The max 1-h and max annual average PM$_{2.5}$ air concentrations were added to baseline concentration in LA County and resulted in exceedances of the WHO air quality guidelines (WHO, 2005). However, when background levels from South Coastal LA County (assumed to better represent Hermosa Beach air quality) were used, the project was below the California annual AAQS and US EPA NAAQS (Cal EPA, 2010; US EPA, 2006).

The assessment concluded that any exceedances of the WHO air quality guidelines were based on existing background levels in the area and the project was not expected to have a material impact on existing PM$_{2.5}$ related health risks. For example, the annual average PM$_{2.5}$ air concentration across the community was 10.1–12.5 $\mu$g/m$^3$, with the project contributing an additional 0.6 $\mu$g/m$^3$ to the air-shed. This increase in PM$_{2.5}$ would not be measurable across the project area. While it was concluded that there was no substantial effect from post-mitigation exposure to PM$_{2.5}$ from the project, existing ambient levels of PM$_{2.5}$ in the area were already in the range, at which increased mortality had been observed in large urban centers.
Toxic air contaminants (TAC) may be used to describe a wide array of chemicals, including volatile organic compounds (VOC), polycyclic aromatic hydrocarbons (PAH), hydrogen sulfide (H$_2$S), inorganic elements (e.g., metals) and particulate emissions from diesel exhaust. Considering that there are many different types of groups of the TAC, the potential health effects associated with these compounds are accordingly diverse and may range from short-term sensory irritation to long-term one, that may turn into irreversible effects such as cancer (CalEPA, 2010). The nature and extent of the various toxic responses depend largely on the magnitude and duration of the exposures. Without any mitigation, project emissions of certain TAC would pose a potential risk to human health; however, given the implementation of the measures proposed in the EIR, the risk estimates are below thresholds of significance for both cancer and non-cancer endpoints, including chemical mixtures. Therefore, the proposed project is not expected to have a substantial effect on community health.

Odor may result from the release of compounds, such as H$_2$S during various drilling and production processes or upset scenarios. The most commonly reported symptoms arising from odor exposure are headaches, nasal congestion, eye, nose, and throat irritation, hoarseness, sore throat, cough, chest tightness, and shortness of breath, among others (ATSDR, 2015). The presence of odor has also been reported to interfere with people’s daily activities, use of property, social interactions, and quality of life as well as to cause fear and anxiety over chronic disease and property values (Heaney et al., 2011; Horton et al., 2009; Schinasi et al., 2011; Wings et al., 2008, 2013).

Adverse health outcomes associated with odor are related to the frequency, duration, concentration, and the individuals’ level of sensitivity. Hydrogen sulfide is a common odor associated with oil and gas production and it has a relatively low odor threshold. The H$_2$S odor threshold (i.e., the lowest concentration perceivable by human smell) is highly variable within the human population and may be detected at concentrations as low as a 1/2 of a part per billion (0.5 ppb) (Collins et al., 2000). Although mitigation measures proposed in the EIR would reduce the frequency of odor releases, they have still been identified as “significant and unavoidable” in the EIR because of the close proximity of residences and businesses to the project site. For these reasons, the HIA has identified the post-mitigation health effect as negative near the project site.
5.5.3 Water and soil quality

The assessment of water and soil quality has evaluated the potential health impacts of discharge of wastewater and surface water runoff during construction and operations; and deposition of windblown soil particulates to offsite surface soil.

If uncontrolled, project-related chemicals in stormwater runoff could be detrimental to the environment and human health. Swimming or recreating in the ocean near stormwater outflows is associated with increasing acute health symptoms, such as eye and skin irritation due to contact with polluted stormwater runoff (Haile et al., 1999). During rain, contaminants and debris that enter the storm drain system could flow into the nearby Santa Monica Bay which is already listed as an “impaired water body” for “contact” recreation. During the Phase 2 and 4, drilling operations, surface runoff at the project site would be contained with walls and berms and pumped into the water processing system for injection into the oil reservoir (MRS, 2014); therefore, preventing negative impact to surface water quality and potential health effects during operations.

Without mitigation, construction-related contaminants and debris flowing into storm drains connected to the Pacific Ocean could result in the impact to water quality and increasing acute health outcomes during the Phases 1 and 3 of the proposed project. However, the EIR mitigation measures will reduce the possibility of construction related impacts through the requirement of a Storm Water Pollution Prevention Plan (MRS, 2014). Overall, due to the EIR mitigation measures to control runoff during all project the phases, there is no substantial effect on health, arising from surface water.

Soil under the project site contains contaminants related to its former use as a landfill. While the property is currently paved over, preventing exposure, so future construction activities could release particulate emissions during trenching, grading, and other earth-moving activities. The primary contaminant of concern is lead; however, baseline data is limited and the property is not yet well characterized with respect to the level and extent of existing contamination (MRS, 2014). Additional surface soil data is required in order to fully assess the potential for a health hazard. The EIR addresses this data gap by requiring soil sampling during the Phase 1 grading, and removal of soil from the site if contamination is in
exceedance of regulatory thresholds. Implementation of the EIR remedial action plan to remove contaminated soil and mitigation measures to reduce fugitive dust emissions will reduce the possibility of hazardous soil particulate emissions during project-related activities. Therefore, soil particulates are not expected to pose a substantial effect to human health.

5.5.4 Upset conditions

The HIA has considered the potential health impacts of 2 upset conditions that are not covered under typical operational scenarios – an oil spill into the ocean and a well blowout. Potential human health impact that could result from exposure to an oil spill includes headaches, eye/skin irritation, respiratory conditions, anxiety, and depression (UDH, 2011; MDCH, 2013). In the unlikely event of a spill (0.07% chance of an oil spill to the ocean), the proponent would be required to contain and clean-up any crude oil in the environment; therefore, irreversible or chronic health outcomes would not occur and no substantial effect on human health is expected.

A well blowout could result in serious injuries and/or fatalities in the vicinity of the project site. A well blowout is a very low probability event, predicted to occur once in 323 years during drilling and once in 604,127 years during non-drilling periods if the wells are pressurized (MRS, 2014). The fear of a blowout accident could result in moderate impacts to human health due to elevated levels of stress and anxiety. Since a well blowout could have severe health consequences, and the possibility of an upset scenario occurring cannot be completely avoided through mitigation, the post-mitigation health effect is classified as negative.

5.5.5 Noise and light emissions

The potential for noise and light emissions to have an impact on human health as arising from various the phases of the project has been assessed in the HIA. Although both noise and light are useful components of everyday life, they are highly subjective emissions that may be perceived differently by different individuals (WHO, 2009; Pierrette et al., 2012). Noise is ubiquitous in suburban/urban and commercial areas. The most common effect of exposure to environmental noise is annoyance, although more severe effects may be observed at higher sound levels. Noise-related annoyance, typically described as a feeling of displeasure evoked
by a noise, has been extensively linked to a variety of common noise sources such as rail, road, and air traffic (Berglund & Lindvall, 1995; Laszlo et al., 2012; WHO, 2011).

Although annoyance is considered to be the least severe potential impact of community noise exposure (WHO, 2011; Babisch, 2012), it has been hypothesized that sufficiently high levels of noise related annoyance could lead to negative emotional responses (e.g., anger, disappointment, depression, or anxiety) and psychosocial symptoms (e.g., tiredness, stomach discomfort and stress) (WHO, 2011; Fields et al., 1997, 2001; Job, 1999; Öhrström, 2004, 2006). Since the project-related activities predicted to produce the highest noise levels have been only permitted during daytime hours, nighttime impact of noise is not a primary concern in the current HIA.

The impact of project-related noise emissions on the local community, particularly residents located around the project site and along the pipeline and truck routes is negative without the use of mitigation measures; however, the EIR has identified a variety of mitigation techniques to reduce the potential impact of noise on the surrounding community including a 35-foot acoustical barrier around the project site (MRS, 2014). Based on the current HIA, no substantial effect on human health is expected to result from project activities in the Phases 1, 2, 3a (site construction) and 4. There is some potential for negative health effects arising from high levels of noise associated with the pipeline construction (the Phase 3b); however, this is expected to be short-term in duration (approx. one week per location) and is limited to daytime hours.

The invention and widespread use of artificial light, especially at night, has become a necessity in many areas of the world to enhance commerce, promote social activity, and increase public safety (Blask, 2012). Despite the fact that the use of artificial light is a widespread consequence of industrial and economic development, it may have unintended negative consequences, especially when it becomes inefficient, annoying and unnecessary (Chepesiuk, 2009; Falchi et al., 2011). The major health concern related to excessive “light-at-night” is disruption of sleep and biological circadian rhythms which influence melatonin production and promote overall health (Blask, 2009, 2012; Amaral et al., 2014).
To ensure visibility, the site security and worker safety, artificial lighting would have to be installed as a part of the project (MRS, 2014). The majority of the on-site lighting would be shielded and downcast to reduce glare. Additionally, the site would have a 35-foot acoustical barrier to eliminate light spill beyond the site boundary in most cases. Therefore, light emissions are not expected to have a substantial effect on community health. The one exception to this is the presence of lighting on the electric drill rig, which extends up to 26.5 m. Therefore, residents who have a line-of-sight view of the exposed side of the electric drill rig from their bedroom window(s) may be disproportionately impacted.

5.5.6 Traffic

The traffic assessment has focused on the potential impacts that the project may have on traffic safety and the effect that the perceived decrease in pedestrian safety could have on active transportation (i.e., walking, biking). Vehicular traffic is a well-known potential safety hazard. Traffic safety hazards are associated with a number of factors, including a vehicle volume, vehicle type, road infrastructure, driving behavior, and population density. Increase in traffic volume is associated with higher risk of injury and death due to vehicle-vehicle, vehicle-pedestrian, and vehicle-bicycle collisions (Wier et al., 2009; Brugge et al., 2002; Geyer et al., 2006).

Currently, fatalities resulting from motor vehicle collisions are very rare in the pedestrian and bike-friendly City of Hermosa Beach. Based on the results of a traffic impact analysis, the EIR has indicated that project-related traffic will not have a significant impact on local traffic congestion (MRS, 2014). However, the introduction of truck traffic on roads not accustomed to large trucks could represent a safety hazard to bicyclists and pedestrians. Consequently, the EIR has recommended additional mitigation, including increased crossing guard presence near the project site, installation of warning signs and lights, limiting truck size, and reconfiguring roadways. Therefore, based on implementation of these safety measures, traffic safety is not predicted to have a substantial health impact on the community.

Findings from the literature suggest that perception of safety is an important mediator of the relationship between traffic safety and active transportation, or walking/bicycle trips (Hoehner et al., 2005; Jacobsen et al., 2009). Perceived risk of injury may discourage
walking and bicycling, which may directly impact health by decreasing physical activity levels (Jongeneel-Grimen et al., 2013). Parental perception of safety is especially important for rates of walking and biking among children (Olvera et al., 2012). Since the project site is adjacent to a “safe walk to school” route within the community, there is a possibility that perceived traffic hazards could result in decreased active transportation in that area. However, the extent of the impact is limited to a small area and community members should be able to adapt by seeking alternative routes for walking and biking. Thus, the HIA has determined that there is no substantial health effect resulting from perceived traffic hazards and active transportation.

5.5.7 Community livability

Community livability defines elements that make it desirable to live in a particular place, and may include environmental, social and economic aspects. Local residents have voiced certain concerns regarding different aspects of community livability that could be affected by project activities. The following health determinants related to community livability have been identified and assessed: property values; access to recreational resources and green space; aesthetics and visual resources; education funding; social cohesion; and political involvement.

Commercial and industrial developments have the potential to impact local property values (De Vor & Groot, 2009). The complexities around property value fluctuations make it difficult to accurately evaluate the potential impact arising from 1 project. The cost-benefit analysis has concluded that property values within Hermosa Beach could be impacted by 0–10%; and it has suggested that any decrease in property values is likely to be localized (Kosmont, 2014). Any perceived or actual decrease has the potential to moderately increase stress and anxiety among Hermosa Beach residents, which could lead to a negative effect on human health.

Access to recreational areas and green space is an important community resource and may be a key component of overall health and well-being (Astell-Burt et al., 2013; Alcock et al., 2014; Ord et al., 2013). Beach residents are considered to be very active due to their proximity to the beach, access to parks and availability of recreation and fitness facilities.
Since the project would not be removing any existing green space in the community and project revenue could be used to enhance green space and recreational resources it is anticipated that there would be a positive effect on community health.

Aesthetic value is a complex concept that is highly subjective. There is a high degree of individual variability when it comes to the visual impact and/or aesthetic value of an object or a place and how this affects health and well-being (Galindo & Rodríguez, 2000; Brady, 2006; Philipp, 2001). The presence of the electric and work-over drill rigs during the Phase 2 and 4 of the project could negatively impact well-being by diminishing the aesthetic appeal of the community landscape. This could potentially lead to increased stress and anxiety; thus, the post-mitigation health effect is classified as negative. However, aesthetic and visual changes are not anticipated to have chronic effects on health.

Educational funding may provide improvements in some of the key indicators of socioeconomic status (i.e., occupation and income) and has been described as a cost-effective method of increasing health and well-being (OECD, 2010). In the cost-benefit analysis it has been estimated that the school district would receive net revenues of approximately 1.2–3.2 million dollars, over the 35-year life of the project (Kosmont, 2014). Hermosa Beach has one of the top school districts in the U.S. and the modest increase in annual funding (4–9%) that will be provided to the schools as a result of revenue from oil production is expected to have a positive effect on health now and in the future.

Social cohesion is a complex concept that is difficult to measure and is related to the interactions among community members (Jenson, 1998; Berger-Schmitt, 2000). Some local residents have voiced concerns about the situation causing a division in the community; those in favor of oil development versus those opposed it. As an indicator of health, social cohesion is linked to the idea of “quality of life” which is associated with certain aspects of health and well-being (Berger-Schmitt, 2000; Cohen et al., 2000; Poortinga, 2006). Hermosa Beach residents experience higher levels of wellbeing than most California cities (Blue Zones, 2012). Although it is not expected that all residents will experience a reduction in social cohesion due to differences of opinion, some individuals may. For those residents, this
could result in increased stress; however, social cohesion is not considered to have a substantial effect on overall community health.

Active involvement in local politics is associated with increased self-efficacy and may have positive impact on health and well-being (Berger-Schmitt, 2000; Kawachi et al., 1997; Kim et al., 2006). Hermosa Beach residents have the unique opportunity to decide whether the proposed project can go ahead by voting on whether to allow oil drilling within the City. This opportunity extends to all adult members of the community, although only a subset of the population is actively involved in politics and is more likely to benefit from the positive impact on health.

5.6 Recommendations

The following recommendations have been made based on the findings of the HIA (Table 5.5). Where a potential negative health effect has been identified or additional measures have been deemed appropriate, these recommendations have been suggested to reduce any impact and facilitate public comfort and well-being throughout construction and operation of the project.

| Table 5.5  HIA recommendations |
|-----------------|--------------------------------|
| **Health Determinant** | **Additional Recommended Measures** |
| Odor Emissions | If frequent reports of odor occur, additional study and/or periodic monitoring of odor may be warranted. |
| Well Blowout | Incorporate well blowout scenario into the City of Hermosa emergency preparedness plan. |
| Noise Emissions | In anticipation of potential elevated noise levels from pipeline construction activities (Phase 3b) it is recommended that local residents be provided with written notification of impending work including the dates and times of activities that may produce excessive noise. |
| Light Emissions | Although the magnitude is ‘low’ for the majority of residents, it could be higher for those individuals with a bedroom window in the direct line-of-sight of the exposed side of the electric drill rig that will be lit at night. It is recommended that these individuals be provided with black-out blinds or curtains to eliminate any potential impact to typical sleep patterns. |
To reduce any potential stress or anxiety that local property owners may experience as a result of the proposed project, the proponent could consider having a property value analysis conducted prior to construction, during construction and one year into operations. This analysis would need to take into consideration local, regional and national fluctuations in property values and compare and contrast the data against potential changes in the value of properties located near the proposed Project. This would help to ensure that any observed fluctuations on property values remain within expected levels and consistent with other similar communities. Additionally, the proponent could consider stabilizing “proven” impacts to property values, perhaps through an arbitrator process.

### 5.7 Monitoring and evaluation

The following monitoring recommendations have been made based on the findings of the HIA:

- The Community Liaison Committee – consideration should be given to forming a Community Liaison Committee if the project is approved, and prior to commencement of construction activities. The committee would serve as the vehicle, through which citizens could voice active concerns about project-related activities with the intention of working collaboratively with the proponent to find ways of addressing any issues.

- The Follow-up Community Health Assessment – analysis of health statistics by means of susceptible subpopulation status could identify whether some groups are disproportionately impacted by the project operations. An update to the baseline health study could be completed five years after the project becomes operational.

- The Quality of Life Health Survey – a quality of life health survey could be used as a tool to establish current baseline conditions, and to monitor whether health status changes during the project.

Although not being a component of all the HIAs, the evaluation step may demonstrate the effectiveness of the HIA in the planning process by showing what the assessment has actually achieved. An internal evaluation of the overall approach and effectiveness of the HIA is to be conducted by the authors, including both a process evaluation and an impact evaluation (Taylor et al., 2003). The process evaluation is intended to provide lessons on
how and why the HIA has been successful and where the process could be improved, whereas the impact evaluation considers whether and how well the HIA has fulfilled its intended purpose.

5.8 Conclusions

There is no simple answer to the potential impact that the project will have on the health of Hermosa Beach residents since different aspects of the project would impact the community in different ways. The authors acknowledge that 1 limitation of the HIA is that the assessment is based on population health and not on single individuals, although vulnerable populations have been considered.

There are a number of aspects of the project that may positively influence health (e.g., increased education funding, ability to enhance green space), and at the same time there have been potential negative effects identified (e.g., odor, blowouts, property values). With the exception of upset conditions, the negative health outcomes have been largely nuisance-related (e.g., odor, aesthetics) without irreversible health impacts. The majority of the health determinants, that had been examined, have revealed that the project would have no substantial effect on the health of the community.

Overall, based on the proposed mitigation measures in the EIR and additional recommendations provided in the HIA, the authors conclude that the project will have no substantial effect on community health in Hermosa Beach. This conclusion has been reached using the developed transparent methodology and matrix and the authors acknowledge that what may constitute “no substantial effect” to some stakeholders may not be socially acceptable to others. This methodology and explanation have proven valuable at the follow-up at community meetings. While some stakeholders may not have agreed with the outcome or the label of “no substantial effect” they have been appreciative that they could clearly follow how the authors have reached this conclusion.
5.9 References


Kosmont (2014). Oil drilling and recovery cost benefit analysis. Retrieved from the City of Hermosa Beach


http://www.hermosabch.org/ftp/oil_docs/FEIR%20Hermosa%20beach%20Oil%20Project_All%20Sections.pdf


Chapter 6

Assessment (Part II)

Abstract

Evaluating the potential impacts arising from large-scale development projects is a complex undertaking. One of the most widely used approaches for assessment of environmental effects of such projects is Environmental Assessment (EA). Recently, there has been a focus on including broader health impacts as part of the EA process. One of the tools available to achieve this is Health Impact Assessment (HIA); however, HIA methodologies are not consistent and were not necessarily developed with the intention of integration with EA. In order to address the issue of a lack of consistent and transparent methods for carrying out HIA, an assessment framework was developed. This framework builds upon an existing approach that was created for an oil drilling and development HIA in Hermosa Beach, California. The framework was revised with the intention of: (1) ensuring the framework is applicable when using HIA as a stand-alone process and when integrated with EA; (2) improving language to more closely align with EA processes; and, (3) devising a system for evaluating overall impact when a multitude of determinants are considered. The revised Assessment Framework is presented along with a decision matrix to help to determine potential significance of health outcomes. In order to test functionality, several health determinants were selected from the initial Hermosa Beach HIA and run through the revised framework to compare and contrast the outcomes. The revised Assessment Framework provided additional details around characterization of effect and identified whether outcomes were significant from a health perspective. This was considered a major improvement;
however, additional testing on a range of scenarios would be beneficial. By continuing to
promote transparency within HIA by developing tools with this objective in mind, it has the
potential to become a widely used framework for addressing health impacts, both within the
EA process and beyond.
6.0 Development and Application of an HIA Framework: Improvements and Alignment with the EA Process in Canada

6.1 Introduction

Assessing the impacts that arise from major infrastructure developments is a complex undertaking that has resulted in a multitude of assessment approaches and methodologies. Arguably, the most established and well-recognized of these approaches is Environmental Assessment (EA), which attempts to characterize and evaluate potential impacts arising from large-scale development projects. Depending on the jurisdiction, EA is often referred to as Environmental Impact Assessment (EIA), Environmental Impact Statement (EIS) or Environmental Impact Report (EIR); however, in general the approaches across North American jurisdictions are similar. In Canada, this process is overseen by the Canadian Environmental Assessment Agency (CEAA) and can be conducted either at the federal or provincial level (CEAA, 2016). The EA process is based on the identification of potential environmental impacts and the assessment of those impacts with the intention of mitigating potentially significant negative effects. With some exceptions, EAs do not explicitly consider the positive aspects of project implementation, other than potential monetary benefits resulting from project revenues and employment opportunities. Overall, the decision regarding whether to proceed with a proposal is based on a combination of assessment results, proposed impacts and mitigation measures, and priorities concerning development and economy. Overall, the current EA process is based on “the Government's plan for responsible resource development to modernize the regulatory system and allow for natural resources to be developed in a responsible and timely way for the benefit of all Canadians” (CEAA, 2012).

The EA process is regulated through the Canadian Environmental Assessment Act with the following mandate: “the Government of Canada, the Minister, the Agency, federal authorities and responsible authorities, in the administration of this Act, must exercise their powers in a manner that protects the environment and human health and applies the
precautionary principle” (CEAA, 2012). Under this legislation an Environmental Assessment (EA) should (CEAA, 2016):

I. Identify potential adverse environmental effects;
II. Propose measures to mitigate adverse environmental effects;
III. Predict whether there will be significant adverse environmental effects, after mitigation measures are implemented; and,
IV. Include a follow-up program to verify the accuracy of the assessment and the effectiveness of the mitigation measures.

Increasingly, there has been a focus on including overall impact on health as part of the EA process, outside of chemical exposures evaluated in Risk Assessments. One of the tools available to achieve this is Health Impact Assessment (HIA). The HIA process consists of several steps including: screening; scoping; assessment; recommendations; reporting; monitoring; and, evaluation (Ross et al., 2014). These steps are well aligned with the EA process, suggesting that a common approach is within reach (Figure 6.1). Despite the consensus around the steps involved in HIA, there is still considerable variation in the specific methods applied. This has resulted in a process that is highly adaptable but lacks any real consistency (McCallum et al., 2015a). Considering the broad acceptance of the EA process, it is imperative that the HIA be tailored to work within this existing framework, when necessary.

**Figure 6.1**  Steps of the EA and HIA processes (CEAA, 2016; Ross et al., 2014)
Guidelines released by the CEAA described the EA process that is used in Canada, but does not discuss evaluation of health impacts outside of chemical exposures considered in Human Health Risk Assessment (CEAA, 2016). Health Canada has released a report on significant information for environmental assessments, by pointing to specific areas of expertise that Health Canada can provide when requested to review EA (Health Canada, 2010). These areas include:

- air quality effects;
- contamination of country foods;
- drinking and recreational water quality;
- radiological effects;
- Electric and Magnetic Fields effects;
- Noise effects;
- Human Health Risk Assessment (HHRA) and risk management;
- Federal Guidelines (air, water, soil);
- Toxicology (multimedia); and,
- First Nation and Inuit health.

Despite this list of potential areas for which to provide health information in EA, the document is limited to “biophysical” aspects of health and does not include consideration of the social determinants of health. However, there are EAs that consider social and economic aspects of projects (i.e., Socio-Economic Impact Assessments), but they are largely limited to estimating aspects like the number of jobs that will be created or the amount of revenue to be received, and not necessarily how these issues influence human health and well-being:

“While SEIA tends to focus on the avoidance of adverse impacts, SEIA also provides a forum for planning how to maximize the beneficial impacts of a proposed development. Beneficial impacts can include: (i) a better standard of living due to increased access to employment, business opportunities, training and education (ii) greater access to and from a community and (iii) increased funding to improve social infrastructure and cultural maintenance programs” (MVEIRB, 2007).
Oftentimes, EAs also look at cultural impacts and may develop Community Benefits Agreements (Gibson and O’Faircheallaigh, 2010), but again these cultural aspects are typically not evaluated through a health lens. In rare cases where health is considered, it is typically disjointed with no cohesive framework that ties it together in one comprehensive section. Although it is not common practice, “Health Canada suggests that all information relevant to human health be documented in one section of the environmental assessment…” (HC, 2010). Even if there were a section dedicated to health outcomes, there is currently little to no direction or methodology provided with respect to how to consistently and thoroughly evaluate health effects within the EA process. The attempt to develop an HIA framework is timely given that the Canadian government has recently appointed an expert panel to review the EA processes:

“The Government of Canada is delivering on its commitment to review federal environmental assessment processes. The goal is to develop new, fair processes that are robust, incorporate scientific evidence, protect our environment, respect the rights of Indigenous peoples, and support economic growth” (Government of Canada, 2016).

One of the issues with inclusion of health in EA is the fact that there are a multitude of physical, social, economic and cultural influences that can directly or indirectly affect health and well-being. In order to decide what to scope into a health assessment, whether under the EA process or in a stand-alone HIA, a comprehensive scoping tool should be applied. For example, the scoping tool developed by McCallum et al. 2016 (Chapter 4) provides an extensive list of determinants and a systematic process for prioritization and inclusion. Once a list of health determinants has been justifiably selected, the assessment step of the HIA commences. It is during the assessment step that there is the most inconsistency and often a lack of transparency in HIA. It is largely dependent on the practitioner and/or HIA team to decide how to proceed with evaluating determinants and how to draw conclusions based on their findings. There are several examples of HIAs where an assessment is carried out with little to no detail regarding how determination of the impact was completed (McCallum et al., 2015a). In many cases, HIAs fail to even identify whether the proposed project or policy will have a negative impact on health overall. This leaves decision-makers and other stakeholders with the responsibility of interpreting results and drawing their own
conclusions, which may not be an optimal process, especially if they have no background in environment or public health.

In order to address the issue of developing a consistent and transparent method of carrying out HIA, an assessment framework was developed that builds upon an existing framework created for an oil drilling project in California (i.e., Hermosa HIA; See Chapter 5) (McCallum et al., 2015b). This framework was revised with the intention of: (1) ensuring the framework is applicable when using HIA as a stand-alone process and when integrated with EA; (2) improving language to more closely align with EA processes; and, (3) devising a system for evaluating overall impact when a multitude of determinants are considered. In order to test functionality, several health determinants were taken from the initial Hermosa Beach HIA (McCallum et al., 2015b) and run through the revised framework to compare and contrast the outcomes.

6.2 Methods

An assessment framework was developed to provide additional transparency and consistency to the HIA process. The key objectives, development process, framework steps, and testing results are provided and discussed in the sections below.

6.2.1 Identifying Objectives

A basic assessment framework was developed for the Hermosa Beach oil drilling and production project HIA (Chapter 5; McCallum et al., 2015b). Although this framework was successfully applied to the HIA, there were some key areas that could be enhanced to improve the process going forward. The largest area for improvement was based on integrating the HIA process with the Environmental Impact Report (EIR) process that was being conducted simultaneously. The HIA was completed as a stand-alone document; however, it ended up relying heavily on information and data from the EIR. This enhanced the quality of the HIA and allowed the two documents to complement each other. For example, the HIA was conducted based on mitigation measures that were already proposed in the EIR and would therefore be binding if the project were to move forward. This improved the accuracy of the predicted health outcomes in the HIA by basing it on a realistic outcome, rather than a worst-case scenario. Additionally, the EIR included air quality and
noise modelling, as well as a cost-benefit analysis, which were used as a foundation for assessing health determinants in the HIA. Although the HIA used information from the EIR, the EIR did not address the health concerns that were identified by the community. It would have been beneficial to have the EIR include the HIA into the process to fill these gaps.

Incorporating HIA into Environmental Assessment processes, such as EIR and EA, is a logical progression that could improve both processes by addressing current limitations. In order to accomplish this successfully, the HIA framework would need to be adapted to work within the EIR approach. A review of common EA practices in Canada (CEAA, 2016; 2015; 2012; Health Canada, 2010) was conducted to identify key elements that would make HIA framework fit into EA. Several key factors were identified including:

i. Language consistency: In order for an HIA framework to be able to fit within the EA process, the language used as part of the HIA process should be consistent with, or at least complementary to that used in the EA process.

ii. Overall approach: The assessment framework needs to be robust so that it can either be stand-alone or be integrated into an EA process. This means following a similar set of steps and taking a complementary approach to that used in EA, without relying on an EA to have the framework function effectively.

iii. Determination of significance: A vital component of the EA process is in determining significance of each of the health outcomes, so in order to allow for HIA to complement this process while adding to the rigor of the HIA practice itself, a determination of significance for each potential health outcome must be achieved within the assessment step.

iv. Developing conclusions: In addition to determining significance of individual health outcomes, it is vital that the HIA come to a conclusion regarding the overall impact on health. Therefore, an approach that allows the individual outcomes to be summarized and evaluated is key to the EA process while simultaneously improving transparency of the HIA process.
v. Mitigation considerations: All EAs consider inclusion of mitigation measures. Similarly, HIAs include recommendations to minimize negative and enhance positive impacts. These complementary concepts can be integrated so that the processes can be more easily combined, when necessary.

In identifying these key elements, specific objectives were established to guide the framework development. These included: (1) aligning the HIA framework with an EA approach; (2) using consistent language; and, (3) devising a method for coming to an overall conclusion regarding potential impacts on human health. Using these objectives, the initial framework used in the Hermosa Beach HIA was revised and improved to allow for HIA to stand-alone or be integrated into the EA process.

6.2.2 Framework Development

In order to fulfill the objectives identified for the Assessment Framework, several key revisions were made to the initial framework developed for the Hermosa Beach HIA (McCallum et al., 2015b). The first was to change the overall assessment approach to align with existing EA practices. The expectation was that this could be achieved in such a way as to be applied to HIAs being completed alone or alongside an EA. According to CEAA (2015), the recommended approach to determining whether a project is expected to cause significant effects consists of the following three stages: (I) Determining whether environmental effects are ADVERSE; (II) Determining whether environmental effects are SIGNIFICANT; and, (III) Determining whether environmental effects are LIKELY.

Additionally, the guidance around conducting EA uses specific language for making these determinations. For example, determining significance in an EA requires characterizing magnitude, reversibility, frequency and duration of effect. Thus, the Assessment Framework was revised to align with the established EA practice in Canada, and should be generally transferable/applicable to EA processes in other jurisdictions (adapted as needed), resulting in the following steps:

- Step 1: Determining if the effect is adverse or beneficial;
- Step 2: Characterizing effects (based on the magnitude, reversibility, frequency, and duration of impacts) for each health determinant;
- Step 3: Determination of significance for each health determinant;
- Step 4: Identifying uncertainties; and,
- Step 5: Summary and overall conclusions of effect on health.

These five steps constitute elements of the revised Assessment Framework. The first three steps directly align with the EA process for identifying whether effects are adverse, significant and likely. The fourth step considers the level of uncertainty associated with the assessment of each of the health determinants. Uncertainty is a key concept that is consistently used within EA practice and is especially important in cases where data gaps exist. This is something that has largely been overlooked in HIA practice, but would greatly improve the quality, rigour and transparency of the process overall. The fifth step includes a method for consolidating the assessment results by plotting significance against uncertainty for each health determinant. The purpose of this step is to summarize the process and come to a determination of the overall effect on human health. The Assessment Framework, along with a detailed description of each step, is provided below.

6.2.3 The Assessment Framework

The following steps outline the Assessment Framework and instructions on how it should be interpreted and applied.

**STEP 1: IDENTIFYING ADVERSE AND BENEFICIAL EFFECTS**

In the first step of the Assessment Framework, the objective is to identify any effects that are adverse or beneficial. Health outcomes that are either “not applicable” or “neutral” without mitigation or intervention are to be excluded from consideration. This process is similar to the exercise conducted in the HIA scoping step (see Chapter 4: McCallum et al., 2016). One key difference between EA and HIA is that HIAs consider beneficial aspects of the proposal rather than just negative or adverse effects. Therefore, determinants that could potentially have a beneficial effect (directly or indirectly) on health should also be included in the assessment. Identifying whether potential effects might be adverse or beneficial should be made based on available project information and, where information is lacking, practitioners
should take a conservative approach and include those determinants whose effects are not fully known.

Step 1 (answer for each determinant scoped into the HIA): Is the effect potentially adverse or beneficial to human health?

- If yes, proceed to step 2.
- If no, then the effect must be neutral (or not applicable) with no positive or negative influence on human health. The effect must be considered neutral (i.e., no health impact) without the implementation of any mitigation measures.

STEP 2: CHARACTERIZING EFFECTS

In Step 2, the potential effects (adverse or beneficial) are characterized by the following factors: Magnitude; Frequency; Duration; and, Reversibility. The definitions of each of these factors were developed to promote transparency and consistency in the HIA process (Table 6.1).

<table>
<thead>
<tr>
<th>Table 6.1</th>
<th>Definitions for Characterizing Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnitude: what is the severity of the effect on human health?</strong></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>The effect is minor and does not pose a hazard/benefit to health; health status will not change from baseline.</td>
</tr>
<tr>
<td>Medium</td>
<td>The effect is detectable and poses a minor to moderate hazard/benefit to health; health status could change from baseline.</td>
</tr>
<tr>
<td>High</td>
<td>The effect is severe and poses a major hazard/benefit to health; health status will change from baseline.</td>
</tr>
<tr>
<td><strong>Reversibility (and/or Adaptability): is the effect reversible; how resilient is the community to this type of change; are they able to adapt?</strong></td>
<td></td>
</tr>
<tr>
<td>Reversible</td>
<td>The effect is reversible (effect stops once exposure removed) and people will be able to recover or adapt to the change with relative ease, may require support. For positive effects, the improvement is temporary.</td>
</tr>
<tr>
<td>Irreversible</td>
<td>The effect is not reversible (effect continues once exposure is removed) people are not likely to recover or adapt to the changes, even with additional support. For positive effects, the improvement is permanent.</td>
</tr>
<tr>
<td><strong>Frequency: how often is the effect expected to occur?</strong></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>The effect occurs rarely, if ever.</td>
</tr>
<tr>
<td>Medium</td>
<td>The effect may occur occasionally.</td>
</tr>
<tr>
<td>High</td>
<td>The effect occurs on a continuous basis.</td>
</tr>
<tr>
<td><strong>Duration: what would be the duration of the effect, if it were to occur?</strong></td>
<td></td>
</tr>
<tr>
<td>Short-Term</td>
<td>A short-term (acute) effect, lasting from days to weeks.</td>
</tr>
<tr>
<td>Long-Term</td>
<td>A long-term (chronic) effect, lasting from months to years.</td>
</tr>
</tbody>
</table>
Geographic Extent: what area will be affected and/or what is the geographic boundary of assessment?

| Varies | The geographic extent is a site-specific determination of the amount of area that is anticipated to be impacted. It can include a specific study area (e.g., 5 km radius around the proposed project), a political boundary (e.g., city limits), or be based on topological or ecological features (e.g., watershed). |

Timing: what temporal aspect(s) can influence potential health outcomes?

| Varies | Timing involves temporal fluctuations that can potentially impact health and well-being outcomes (e.g., seasonal changes affecting land/resource use). |

If the HIA is stand-alone, then the characterization should be completed assuming that no mitigation measures are in place, unless there are specific measures that are guaranteed by the developer/proponent. Conversely, if the HIA is being completed as part of or alongside an EA, then the assessment should include consideration of required mitigation measures as outlined in the EA document, where applicable. Ideally, the mitigation measures will have been finalized in the EA prior to conducting the HIA. Alternately, mitigation measures can be identified and revised as a direct result of the HIA process, resulting in an iterative process to ensure protection of health and the environment through mitigation of negatives and enhancement of positives.

Each health determinant should be characterized using the best available information and data. Once characterized, follow the decision matrix (Figure 6.2) to determine the level of significance and proceed to Step 3.

- Part A: Determine baseline health conditions.
- Part B: Assess potential changes (positive/negative) as a result of project activities.

The magnitude, reversibility, frequency and duration are used to characterize each determinant, which is the first step in determining significance. These factors are all included in the Assessment framework as components contributing to whether a potential impact is significant or not significant.

Geographic extent can describe various areas of study including project sites, and locations of different scale (i.e., local, regional, national, and global scale) (CEAA, 2015). In cases where impacts need to be assessed on a number of different scales, the full Assessment Framework should be applied to each area. For example, air quality impacts may vary depending on the scale. Local impacts may be significant, whereas regional or global impacts...
may be insignificant. Assessing impacts based on differing geographic extents can also help to inform HIA recommendations.
Figure 6.2  Decision Matrix I: Characterizing Effects
Additionally, timing is considered when assessing impacts in EA and can be applied in certain situations for HIA. In EA, timing typically refers to considerations that could alter an environmental or ecological outcome depending on temporal aspects such as breeding season, migration times, etc. This can be applied to HIA in situations where timing can potentially influence health and well-being outcomes. For example, “seasonal aspects of land and resource use and whether timing is related to Aboriginal spiritual and cultural considerations” may be relevant issues (CEAA, 2015). Other aspects of timing that can be considered in HIA include timing of agricultural practices, seasonality of recreational activities, school attendance for children, and others.

In some cases, the HIA practitioner may disagree with the effect characterization resulting from application of the decision matrix. It is acknowledged that although the matrix has been designed to apply to a wider range of scenarios, it may not adequately fit all potential outcomes. Therefore, in some cases it may be appropriate to come to an alternate conclusion on effect. In these cases, it is possible to deviate from the decision matrix; however, a clear and comprehensive justification must be provided.

**STEP 3: DETERMINING SIGNIFICANCE**

Although the effect characterization is made based on the above factors (i.e., magnitude, reversibility, frequency, duration), the determination of significance must also include the likelihood of occurrence. For example, a potentially significant impact that is certain to occur would be significant; however, a potentially significant impact that is extremely rare may not be deemed to be significant in terms of overall anticipated health effects.

For each determinant, one should characterize the likelihood of the impact based on the definitions provided below and the available project information regarding probability of occurrence (Table 6.2). Then one can proceed to the final step of the decision-matrix to determine significance (Figure 6.3). Depending on the results of both the effect characterization (step 2) and likelihood (step 3), the final determination of significance for each health determinant will fall along a spectrum. This was the chosen approach to account
for scenarios where an effect might fall in between two options, leaving room for HIA practitioners to select and justify the most appropriate outcome.

**Table 6.2  Definitions for Characterizing Likelihood**

<table>
<thead>
<tr>
<th>Likelihood: What is the probability of the impact occurring?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unlikely</td>
<td>The impact is anticipated to occur rarely, if ever. This classification is appropriate for those situations where impacts are not zero but they are limited to very rare occurrences, catastrophic events, or highly unlikely system failures.</td>
</tr>
<tr>
<td>Possible</td>
<td>The impact may occur, but the probability is less than 50%.</td>
</tr>
<tr>
<td>Probable</td>
<td>The impact will likely occur, the probability is greater than 50%.</td>
</tr>
</tbody>
</table>

In making a final determination of significance, it was considered important to acknowledge that the significance of an impact is not always black and white, which is why a spectrum of significance was developed. Instead this framework, while attempting to make a determination of significance in coordination with EA practices, identifies the level of significance using subheadings that indicate positive (+) or negative (-) effects. This was done in order to better inform the decision-makers and to be more transparent in making a determination of significance. It is important to note that the term “significance” as it is applied here is different than mathematical significance for which there can be no sub-classification and where something is definitively calculated to be significant or not, without further interpretation.

To illustrate this concept of varying “levels of significance” that have been applied in this Assessment Framework, consider the example of an injury resulting from a car accident. Would one conclude that is significant in terms of a health impact or not? Before answering this question, one might want to know more about the extent of the injury. For example, if the person’s injuries consist of a few bruises, that may not be considered significant from a health perspective. Conversely, if the accident resulted in broken bones, bleeding, organ damage, paralysis and/or death, it would definitely be considered significant in terms of the negative effects on health. If one considered all of the potential effects in a range between those two extremes, one would be inclined to classify them as significant or not, depending on the extent of the effect. Presumably, one would classify any negative health outcome as significant, even though there is a threshold beyond which one might argue that a negative health effect is present but minor enough to be considered insignificant. These sorts of
Figure 6.3  Decision Matrix II: Determining Significance
considerations inform the basic principle behind how the Assessment Framework deals with significance, because when it comes to health, there are many potential outcomes with highly varied levels of severity.

This same approach to determining the level of significance can be applied for positive health outcomes as well. For example, if one considers the positive impact of exercise on health and well-being, it is likely that one would agree that any level of physical activity is beneficial, but at what point does the health benefit become significant? As with many of the factors that can influence health, there are varying degrees of positive impact. For example, if a person exercises for one hour per week it may be better than no exercise at all, but it is certainly not as beneficial as one hour a day. Additionally, the type and intensity of the physical activity may contribute to the scale of the outcome (minor to major health benefits).

Again, these concepts are embedded into the way the HIA Assessment Framework was developed to account for a wide array of potential positive and negative impacts and outcomes, with respect to health and well-being.

Consequently, aligning HIA with EA should allow for a determination of significance, while acknowledging that not all positive and/or negative impacts are created equal. The way this determination of significance should be interpreted is to first look at whether the effect is significant or not, and then look at the subcategory. The subcategories range from minor (- / +) to moderate (- - / + +) to major (- - - / + + +). This additional information around the so-called “level of significance” will help decision makers interpret the assessment more accurately and provide additional transparency that would be lacking without this differentiation. The significance level can also help to inform the HIA recommendations, mitigation measures, and any follow-up monitoring that may be required.

STEP 4: IDENTIFYING UNCERTAINTIES

One vital aspect of the EA process that has been included in the revised HIA Assessment Framework is the notion of identifying uncertainties. This concept is widely used in EA practice when evaluating potential environmental impacts of proposed projects:
“The determinations must take into account uncertainties. All project EAs involve some level of uncertainty, and observed results will often deviate, to some degree, from predictions made in the EA. Uncertainty could be related to a number of factors such as: project design and components, baseline environmental conditions, VC response, effectiveness of mitigation, overall scope of effects, and natural and human causes of accidental events” (CEAA, 2015).

In identifying the extent of uncertainty associated with the assessment of effect and subsequent determination of significance, the practice becomes more transparent, acknowledging the limitations of the process. Applying this concept to HIA allows for the same level of transparency, which is vital to a process that is highly dependent on the professional judgement of its practitioners.

In this step of the Assessment Framework, the level of uncertainty (or the level of confidence) associated with the appraisal of health impacts (positive and negative) and significance is determined. Using the definitions provided (Table 6.3), a level of uncertainty is assigned to each of the health determinants. This should be based on the quantity and quality of data and information (i.e., quality of sources, completeness of information, model validity, etc.) that has been used to make these determinations.

Table 6.3 Definitions for Characterizing Uncertainty

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>A very high level of uncertainty (i.e., very low level of confidence) is associated with the determination of significance as a result of major data or information gaps and/or a very low level of confidence associated with the assessment methods and approach.</td>
</tr>
<tr>
<td>High</td>
<td>A high level of uncertainty (i.e., low level of confidence) is associated with the determination of significance as a result of moderate data or information gaps and/or a low level of confidence associated with the assessment methods and approach.</td>
</tr>
<tr>
<td>Medium</td>
<td>A medium level of uncertainty (i.e., moderate level of confidence) is associated with the determination of significance as a result of minor data or information gaps and/or a moderate confidence associated with the assessment methods and approach.</td>
</tr>
<tr>
<td>Low</td>
<td>A low level of uncertainty (i.e., high level of confidence) is associated with the determination of significance as a result of negligible data or information gaps and/or a high level of confidence associated with the assessment methods and approach.</td>
</tr>
<tr>
<td>Very Low</td>
<td>A very low level of uncertainty (i.e., very high level of confidence) is associated with the determination of significance as a result of no data or information gaps and/or a very high level of confidence associated with the assessment methods and approach.</td>
</tr>
</tbody>
</table>
Wherever possible, multiple practitioners involved in the HIA team should conduct the uncertainty analysis for each determinant; where discrepancies are found; a discussion leading either to (I) consensus or (II) an “average” of the two classifications should be completed to reduce subjectivity.

STEP 5: OVERALL DETERMINATION OF EFFECT

Once all of the health determinants included in the HIA have been evaluated, and the significance and level of uncertainty have been established, the results should be plotted to assist in making an overall determination of effect (Figure 6.4). By plotting the significance (x-axis) against the level of uncertainty (y-axis) for each determinant, a summary of health effects can be created. This summary can then be used to weigh the positive and negative outcomes, including consideration of uncertainties, to make a final conclusion surrounding overall health impacts. Although there is some subjectivity in the weighting of results, this method of summarizing and analyzing collective results provides a more transparent method of developing conclusions, especially when a multitude of determinants are involved.

Figure 6.4 Revised HIA Framework (Step 5): Overall Determination
In some cases, multiple determinants of health will have the same “score” in terms of significance and level of uncertainty. When this occurs, the plotted points can be scaled to reflect the number of determinants with that score. For example, all single points will be the same size, but when two (or three) determinants have the same score, the plot will be twice (or three times) the size. This will provide a more accurate visual representation of the actual results, and assist with weighing the outcomes to make a final conclusion regarding health effects.

6.2.4 Testing the Framework

This Assessment Framework is the result of an iterative process of revision based on methods applied in the Hermosa Beach HIA; an evaluation of 18 determinants of health under six major categories including: air quality; water and soil quality, upset conditions, noise and light emissions, traffic, and community livability (Chapter 5; McCallum et al., 2015b).

In order to test the Assessment Framework in a way that demonstrates the improvements made and to understand how it will perform in a real-world scenario, a selection of the determinants evaluated in the Hermosa Beach HIA were chosen to test the application of the revised Assessment Framework. The original framework developed for the Hermosa Beach framework is provided in Figure 6.5 for comparison. The changes include not only alterations in the decision-making framework itself but also in the definitions used to characterize effects. This not only provided an opportunity to compare and contrast the methods, but also to see whether the objectives of the current framework have been met.
Out of the 18 determinants of health, four were selected to test the revised assessment framework: (i) odour emissions; (ii) well blowout; (iii) educational funding; and, (iv) access to recreational resources and greenspace. These four determinants were selected because they represent chemical determinants, perceptual determinants, and social economic determinants. For each of these determinants, the data and information relied upon in the Hermosa HIA remained unchanged, but was instead applied to the revised assessment framework to develop conclusions on health effects. The results obtained from the revised framework were compared to the original results and any strengths and weaknesses involved in the application of the revised framework have been discussed.

All of the evidence relied upon in the Hermosa Beach HIA for assessing odour emissions, well blowouts, educational funding, and access to recreational resources and greenspace was also used for characterizing effects within the revised Assessment Framework. Due to the volume of information used in the Hermosa HIA for assessing these determinants, it will not be repeated here; however, summaries are provided in each of the sections below. For a detailed account of the evidence, please see the full Hermosa Beach HIA report at: http://www.hermosabch.org/modules/showdocument.aspx?documentid=4634
6.3 Results

6.3.1 Odour Emissions

Odour emissions and their potential to impact human health were assessed in the Hermosa Beach HIA. The following discussion on the health implications of odour emissions, as related to the proposed oil drilling and development project in Hermosa Beach, has been taken from the final HIA document (Intrinsik, 2014):

“Sensitivity to environmental odors varies greatly from person to person. Young children, the elderly, and pregnant women may be more sensitive to odors. In general, the most commonly reported symptoms from odor exposure are headaches, nasal congestion, eye, nose, and throat irritation, hoarseness, sore throat, cough, chest tightness, shortness of breath, wheezing, heart tremors (palpitations), nausea, drowsiness, and depression (ATSDR, 2014). According to the WHO, odor annoyance can also affect overall quality of life. Adverse health outcomes associated with odor are related to the frequency, duration, concentration, and the individuals’ level of sensitivity (ATSDR, 2014). Hydrogen sulfide is the primary odor associated with oil and gas production and is the one with the lowest odor threshold. The hydrogen sulfide (H$_2$S) odor threshold (i.e., the lowest concentration perceivable by human smell) is highly variable within the human population.”

“According to the EIR, emissions during oil production operations (including testing, drilling and production phases) have the potential to create odors in the neighborhood adjacent to the Project Site. Odor emission sources associated with operational activities include onsite microturbines used to generate onsite electricity, routine and emergency flaring events, and volatile fugitive emissions from valves, compressors, pumps and connections. Drilling muds that contain hydrocarbons can surface and release hydrocarbon vapors (referred to as “mud offgassing”). Drilling muds may contain H$_2$S, benzene and other volatile contaminants, which are odiferous compounds. Upset conditions and leaking equipment components could also release odors. Additionally, the compounds used to odorize natural gas (often mercaptans) also contain sulfur compounds and, similar to H2S, have very low odor thresholds.”
The odour emissions originally evaluated as part of the Hermosa Beach HIA have been characterized, based on original project and EIR information, to test the revised Assessment Framework. The magnitude, reversibility, frequency, duration and likelihood of odour emissions have all been characterized to determine the significance with respect to health outcomes (Table 6.4). A worked example of the decision matrix used to determine significance from the perspective of health impacts of odour emissions is shown in Figure 6.6.

### Table 6.4 Odour Emissions: Characterization Summary

<table>
<thead>
<tr>
<th>Magnitude: what is the severity of the effect on human health?</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>The effect is detectable and poses a minor to moderate hazard/benefit to health; health status could change from baseline.</td>
<td></td>
</tr>
<tr>
<td>Rationale: People may experience nuisance and stress effects from odour exposure; possibly including headaches.</td>
<td></td>
</tr>
</tbody>
</table>

| Reversibility (and/or Adaptability): is the effect reversible; how resilient is the community to this type of change; are they able to adapt? |
|---------------------------------------------------------------|--------|
| Reversible |
| The effect is reversible (effect stops once exposure removed) and people will be able to recover or adapt to the change with relative ease, may require support. For positive effects, the improvement is temporary. |
| Rationale: The potential temporary effects from odour would subside quickly once the exposure is removed. |

<table>
<thead>
<tr>
<th>Frequency: how often is the effect expected to occur?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>The effect may occur occasionally.</td>
</tr>
<tr>
<td>Rationale: The EIR proposed several mitigation measures that would limit the occurrence of odour exposures; however, it is still possible during normal operations or upset conditions.</td>
</tr>
</tbody>
</table>

| Duration: what would be the duration of the effect, if it were to occur? |
|---------------------------------------------------------------|--------|
| Long-Term |
| A long-term (chronic) effect, lasting from months to years. |
| Rationale: Since odour emissions may occur occasionally during normal operations, periodic exposures over the life of the project (years) are possible long-term. |

| Likelihood: What is the probability of the impact occurring? |
|---------------------------------------------------------------|--------|
| Probable |
| The impact will likely occur, the probability is greater than 50%. |
| Rationale: The probability of at least one odour exposure event occurring, especially for residents in close proximity to the project site, is greater than 50%. |

In the Hermosa Beach HIA (Intrinsik, 2014) odour emissions were evaluated and found to be negative (as opposed to positive or neutral); however, this determination was largely based on nuisance rather than specific health outcomes. Additionally, the EIR found odour to be “significant and unavoidable” based on the following: “the potential to create a release that produces nuisance odors generating more than six odor complaints would be considered a significant impact” (MRS, 2014). Under the revised Assessment Framework, odour emissions were found to have a “minor” negative impact based on magnitude, reversibility,
Step 2:

**Figure 6.6** Assessment Framework Worked Example (Step 2 and 3): Odour Emissions
frequency and duration. Ultimately, it was determined that odour emissions were considered minor and “not significant (-)” for overall effect on health. The level of uncertainty associated with this assessment was “low” based on the high level of confidence in the information.

A comparison of the results for odour emissions from both the original and revised assessment frameworks is provided in Table 6.5. It is apparent that the revised framework has additional factors that are taken into consideration including frequency and duration. Additionally, the revised framework not only characterizes potential health effects in a more detailed way than the initial framework, with minor, moderate and major negative/positive outcomes, but also determines whether the effect is significant. For odour emissions, the revised framework adds consideration of frequency and duration of odour emissions but also changes the likelihood from possible to probable. This is due to a change in the effect characterization definition for likelihood, where it was revised to focus on probability. Since the probability of odour emissions was greater than 50% over the life of the project, it was more acceptable to classify likelihood as probable. With respect to health outcomes, both frameworks identified a negative effect on health, largely due to nuisance, but the revised framework takes it one step further to identify whether the negative effect is minor, moderate or major.

The most obvious change between the two frameworks is the determination of significance. In the initial framework, the assessment stopped at the effect characterization (positive, negative or neutral), whereas the revised framework classifies odour emissions effects as not significant ( - ) with a minor negative effect.

Table 6.5  Comparison of Initial Framework used for the Hermosa Beach HIA and the Revised Assessment Framework for Odour Emissions

<table>
<thead>
<tr>
<th></th>
<th>Initial Framework (Hermosa)</th>
<th>Revised Assessment Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnitude</strong></td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Reversibility/Adaptability</strong></td>
<td>Low</td>
<td>Reversible</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>Not Determined</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Not Determined</td>
<td>Long-Term</td>
</tr>
<tr>
<td><strong>Likelihood</strong></td>
<td>Possible</td>
<td>Probable</td>
</tr>
<tr>
<td><strong>Health Effect</strong></td>
<td>Negative</td>
<td>Minor ( - )</td>
</tr>
<tr>
<td><strong>Significance</strong></td>
<td>Not Determined</td>
<td>Not Significant ( - )</td>
</tr>
</tbody>
</table>
The determination of significance for the HIA was based on potential for adverse health outcomes from odour exposure, rather than a specified number of odour complaints (i.e., six odour complaints were considered significant), as was done in the EIR. In this way, the determination of significance does not mirror the conclusions drawn for odour impacts in the EIR, which is acceptable since the criteria for determining significance were different for each assessment. This suggests that an HIA framework that works within environmental assessment, but considers health endpoints specifically, is needed.

**6.3.2 Well Blowout**

The potential for a well blowout occurring as part of drilling and/or operations was considered in the Hermosa Beach HIA. The following discussion provides insight into the assessment process that was undertaken in the HIA, using data from the EIR, to establish the potential outcomes associated with this a well blowout upset scenario (MRS, 2014).

“As described in the EIR, well blowouts occur when drilling encounters an area of pressure that exceeds the capacity of the drilling muds, and oil and gas flow back up the well to the surface (MRS, 2014). The release of flammable material could, if it encounters an ignition source, either explode or burn. People located nearby during such an event could suffer serious health consequences. For example, direct health impacts can include fatalities and injuries that would require hospitalization, as well as neurological conditions linked to acute exposure. Injury from a well blowout could range in severity and type, including burns from contact with fire or physical injury due to getting struck by equipment parts that come loose and hit someone because of high pressures. In most documented instances of well blowouts, such as the Deepwater Horizon blowout explosion, workers face the greatest risk of death or injury as they are the closest in proximity to the situation.”

“A frequency analysis conducted for the EIR estimated the rate of upset events during the proposed Project. Assuming the reservoir is pressurized and blowouts could occur, the failure rate for a wellhead rupture during drilling is one failure per 323 years. The failure rate for a wellhead rupture during production is only one failure per 604,127 years (Table 4.8-12; MRS, 2014). In the unlikely event of a blowout, the EIR consequence analysis estimated that offsite fatalities and injuries could occur as far away as 300 and 750 feet, respectively, from
the Project Site (Figure 4.8-5; MRS, 2014). Because the proposed Project Site is located within 100 feet of businesses and 160 feet of residences, a well-blow out incident could result in fatalities and/or injuries among the public. Considering together the frequency and consequence analyses, the resulting risks exceed the EIR threshold for significance. Because the blowout scenario cannot be mitigated to a level of insignificance, the EIR concludes that blowout risks during drilling remain “significant and unavoidable” (MRS, 2014).”

The well blowout upset scenario originally evaluated as part of the Hermosa Beach HIA has been characterized, based on original project and EIR information, to test the revisions made to the Assessment Framework. The magnitude, reversibility, frequency, duration and likelihood of a well blowout have all been characterized to determine the significance with respect to health outcomes (Table 6.6). A worked example of the decision matrix used to determine significance from the perspective of health impacts of a well blowout is shown in Figure 6.7.

**Table 6.6  Well Blowout: Characterization Summary**

<table>
<thead>
<tr>
<th>Magnitude: what is the severity of the effect on human health?</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reversibility (and/or Adaptability): is the effect reversible; how resilient is the community to this type of change; are they able to adapt?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irreversible</td>
</tr>
<tr>
<td>Rationale: The effects of serious injury or death would be irreversible.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency: how often is the effect expected to occur?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Rationale: A well blowout is an extremely rare event, likely never occurring during a project, or as a singular accidental event.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration: what would be the duration of the effect, if it were to occur?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Term</td>
</tr>
<tr>
<td>Rationale: The effects of serious injury or death would be permanent.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Likelihood: What is the probability of the impact occurring?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unlikely</td>
</tr>
<tr>
<td>Rationale: The probability of a well blowout occurring is &quot;once in 323 years during drilling and once in 604,127 years during non-drilling periods if the wells are pressurized&quot; as predicted in the EIR.</td>
</tr>
</tbody>
</table>
Step 2:

**Health Determinant**

---

**MAGNITUDE**
- Low
- Medium
- High

**REVERSIBILITY / ADAPTABILITY**
- Reversible
- Irreversible

**FREQUENCY**
- Low
- Medium
- High

**DURATION**
- St
- Lt

**CHARACTERIZING EFFECTS**
- Not Significant (=)
- MINOR (-)
- MODERATE (- -)
- MAJOR (- - -)

Step 3:

**LIKELIHOOD**
- Unlikely
- Possible
- Probable

**SIGNIFICANCE**
- Not Significant (=)
- Not Significant (-)
- Significant (- -)

---

**Figure 6.7** Assessment Framework Worked Example (Step 2 and 3): Well Blowout
In the Hermosa Beach HIA (Intrinsik, 2014), the health effect of a well blowout was identified as “negative” (as opposed to “neutral” or “positive”). The EIR also evaluated the potential for a well blowout scenario and found that it was not significant during operations but was considered “significant and unavoidable” during drilling (MRS, 2014):

“The Applicant has proposed features to reduce these risks, including the use of offshore equivalent-style blow out preventer equipment (BOPE), venting to flare and non-cascading shutdown systems. However, blowout scenarios can still occur due to the potential for a pressurized reservoir and the potential for BOPE failures, and these are difficult to mitigate and would be significant during drilling.”

Under the revised Assessment Framework, a well blowout upset scenario was found to have a “major” negative impact based on magnitude, reversibility, frequency and duration. Ultimately, it was determined that, when likelihood was considered, a well blowout was “significant (- - -)” for overall effect on health. The level of uncertainty associated with this assessment was “medium” based on the data used in the EIR and the overall approach (i.e., predictive risk analysis).

A comparison of the results a well blowout scenario from both the original and revised assessment frameworks is provided in Table 6.7. The revised framework adds consideration of frequency and duration of a well-blowout; however, these were not necessary to characterize the health effect because a high magnitude impact that is irreversible automatically leads to a major (- - -) health outcome (Figure 6.7). The reversibility/adaptability definitions have also been updated to reflect two options (reversible vs. irreversible) instead of three (low, medium, high), with potential irreversible effects from a well blowout occurring. With respect to health outcomes, both frameworks identified a negative effect on health, but the revised framework takes it one step further to identify it as a major negative effect. Finally, the most obvious change between the two frameworks is the determination of significance, which is not done in the initial framework. Conversely, the revised framework classifies effects of a well blowout as significant (- - -) once likelihood is considered, with a major negative effect.
Table 6.7  Comparison of Initial Framework used for the Hermosa Beach HIA and the Revised Assessment Framework for a Well Blowout

<table>
<thead>
<tr>
<th></th>
<th>Initial Framework (Hermosa)</th>
<th>Revised Assessment Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnitude</strong></td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td><strong>Reversibility/Adaptability</strong></td>
<td>Low</td>
<td>Irreversible</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>Not Determined</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Not Determined</td>
<td>Long-Term</td>
</tr>
<tr>
<td><strong>Likelihood</strong></td>
<td>Unlikely</td>
<td>Unlikely</td>
</tr>
<tr>
<td><strong>Health Effect</strong></td>
<td>Negative</td>
<td>Major (- - -)</td>
</tr>
<tr>
<td><strong>Significance</strong></td>
<td>Not Determined</td>
<td>Significant (- -)</td>
</tr>
</tbody>
</table>

6.3.3 Education Funding

The potential benefits of education funding provided as a result of the oil drilling and production project going forward was considered in the Hermosa Beach HIA. The following discussion provides insight into the assessment process that was undertaken to establish the potential benefit of education funding (Intrinsik, 2014; MRS, 2014).

“Education was identified as a community resource that residents consider important to overall quality of life. Not only does education contribute to economic measures of success (e.g. income, employment, occupation), but it has also been shown to promote social well-being indicators including increased civic engagement, reduced crime and increased social and emotional skills (OECD, 2010). Some of the major concluding statements made in the OECD report relate specifically to the relationship between education and overall health and well-being:

“A large body of literature suggests that education is strongly associated with a variety of social outcomes, such as better health, stronger civic and social engagement, and reduced crime. A smaller number of studies further suggest that education has a positive effect on most of these social outcomes. More importantly, from a policy perspective, education has been shown to be a relatively cost-effective means of improving health and reducing crime” (OECD, 2010).

The proposed Project is anticipated to influence educational funding by providing the local school district with an annual monetary contribution (for the 35-year life of the Project), as contractually required under the lease. Additional school district funding would further
enhance education programs in Hermosa Beach, and therefore improve the social and economic health outcomes among schoolchildren throughout the community.”

“With respect to potential revenues for the Hermosa Beach School District, based on production estimates completed as part of the cost-benefit analysis, it was estimated that the school district would receive net revenues of approximately $1.2-3.2 million, over the 35-year life of the Project (Kosmont 2014). Since the annual amount of School District funding from the proposed Project depends on the amount of oil produced, the Cost Benefit Analysis estimates a range that Hermosa Beach schools may receive per year. Based on the CBA Expected case the School District would receive a minimum of $10,000 per year and a maximum of $130,000 the year of peak production (average of approximately $52,000 per year). Whereas, based on the Applicant’s production estimates, the School District would receive a minimum of $10,000 per year and a maximum of $360,000 the year of peak production (an average of approximately $112,000 per year) (Kosmont 2014). This average annual contribution to the Hermosa Beach City School District would increase private funding between 4% (based on average CBA Expected) and 9% (based on average Applicant estimates). Although this contribution is modest compared to the amount of money raised by the HBEF (Hermosa Beach Education Foundation), it is available to be used at the discretion of the district and will facilitate continued provision of top quality education in Hermosa Beach for decades. “

The magnitude, reversibility, frequency, duration and likelihood have all been characterized to determine the significance with respect to health and well-being of educational funding (Table 6.8). A worked example of the decision matrix used to determine significance is shown in Figure 6.8.

<table>
<thead>
<tr>
<th>Magnitude: what is the severity of the effect on human health?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>Rationale: Education quality is a driving factor for health status; more resources could improve the system and have lasting implications for children’s health and well-being.</td>
</tr>
</tbody>
</table>

Table 6.8 Education Funding: Characterization Summary

Reversibility (and/or Adaptability): is the effect reversible; how resilient is the community to this type of change; are they able to adapt?
<table>
<thead>
<tr>
<th>Reversible</th>
<th>The effect is reversible (effect stops once exposure removed) and people will be able to recover or adapt to the change with relative ease, may require support. For positive effects, the improvement is temporary.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>The benefits would only continue so long as the funding continues to be provided, although lasting effects of temporary improvements may occur.</td>
</tr>
</tbody>
</table>

**Frequency: how often is the effect expected to occur?**

<table>
<thead>
<tr>
<th>Medium</th>
<th>The effect may occur occasionally.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>The Hermosa Beach School District would receive annual payments, with amounts varying over the life of the project.</td>
</tr>
</tbody>
</table>

**Duration: what would be the duration of the effect, if it were to occur?**

<table>
<thead>
<tr>
<th>Long-Term</th>
<th>A long-term (chronic) effect, lasting from months to years.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>Educational funding would be provided to the Hermosa Beach School District for the length of the project (35 years); the effects of better schooling would be long-term for those individuals who benefited as children.</td>
</tr>
</tbody>
</table>

**Likelihood: What is the probability of the impact occurring?**

<table>
<thead>
<tr>
<th>Probable</th>
<th>The impact will likely occur, the probability is greater than 50%.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale</td>
<td>The funding is guaranteed if the project goes forward.</td>
</tr>
</tbody>
</table>

In the Hermosa Beach HIA (Intrinsik, 2014), the health effect of education funding was identified as “positive” (as opposed to “neutral” or “negative”). The EIR makes the following statement with respect to funding (MRS, 2014):

“…the Proposed Project is projected to increase revenues to the City in relationship to resource recovery volumes, timing, commodity prices, and other factors, over the production phase of the project. Other direct revenue sources to the City if the Proposed Project is approved include oil lease property taxes, business license taxes, and school district revenues. Additional information on the financial impacts of the Proposed Project is available in the Oil Drilling and Recovery Cost Benefit Analysis or CBA. The CBA was prepared by the City as supplemental information to the FEIR and provides a comprehensive review of the financial benefits and costs to the City of the Proposed Project.”

The Cost Benefit Analysis did not make any determination of the effect or significance of this increased revenue to the Hermosa Beach School District. Under the revised Assessment Framework, education funding was found to have a “minor” positive impact based on magnitude, reversibility, frequency and duration. Ultimately, it was determined that, when likelihood was considered, educational funding was “not significant (+)” for overall effect on health. The level of uncertainty associated with this assessment was “medium” based on the qualitative scientific evidence used and available project information.
Figure 6.8  Assessment Framework Worked Example (Step 2 and 3): Educational Funding
A comparison of the results for education funding from both the original and revised assessment frameworks is provided in Table 6.9. The revised framework adds consideration of frequency and duration of education funding but also classifies the effect as “reversible” rather than high, due to changes in the definitions and classification approach. With respect to health outcomes, both frameworks identified a positive effect on health, but the revised framework takes it one step further to identify whether the positive effect is minor, moderate or major. Additionally, in the initial framework, the assessment stopped at the effect characterization (positive, negative or neutral), whereas the revised framework classifies effects of education funding as not significant (+) with a minor positive effect.

<table>
<thead>
<tr>
<th>Table 6.9</th>
<th>Comparison of Initial Framework used for the Hermosa Beach HIA and the Revised Assessment Framework for Education Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnitude</strong></td>
<td>Initial Framework (Hermosa)</td>
</tr>
<tr>
<td>Reversibility/Adaptability</td>
<td>Medium</td>
</tr>
<tr>
<td>Frequency</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Duration</td>
<td>Not Determined</td>
</tr>
<tr>
<td>Likelihood</td>
<td>Probable</td>
</tr>
<tr>
<td>Health Effect</td>
<td>Positive</td>
</tr>
<tr>
<td>Significance</td>
<td>Not Determined</td>
</tr>
</tbody>
</table>

6.3.4 Access to Recreational Resources and Greenspace

The potential benefits of increased access to recreational resources and greenspace as a result of the oil drilling and production project going forward was considered in the Hermosa Beach HIA as discussed below (Intrinsik, 2014; MRS, 2014).

“Community resources that encourage good nutrition and physical activity are instrumental in improving quality of life. For example, community garden programs funded by California Healthy Cities and Communities have provided opportunities for good nutrition and physical activity education. In Oceanside, two community gardens were established and 228 residents receive nutrition education; of these residents, 86% reported a desire to improve eating habits (Twiss et al., 2003). Furthermore, regular physical activity has been shown to have a multitude of positive health implications including (CDC, 2014):

- Weight control;
- Reducing the risk of cardiovascular disease;
- Reducing the risk of type 2 diabetes and metabolic syndrome;
• Reducing the risk of some cancers;
• Strengthening bones and muscles;
• Improving mental health and mood; and,
• Increasing the chance of living longer.”

“Hermosa is well-known for supporting an active lifestyle including a wealth of beach/park activities (i.e., surfing, volleyball, skating and skateboarding, jogging, and bicycling). Therefore, Hermosa Beach residents may be interested in using City revenues from the Project to further develop additional green spaces to further improve physical and psychological health. The Community Dialogue quality of life working committee identified the desire to increase children’s beach play areas by adding swings and slides. It is possible that the proposed Project could generate revenue to support improvements of existing parks and development of additional recreational areas.”

“The Cost Benefit Analysis found that the majority of oil and gas revenue would come from the Tidelands fund, which could be used to fund beach preservation. The amount of Tidelands revenue and the proportion of the revenue available to improve green spaces outside of the beach and coastal areas are uncertain. However, the CBA estimates that over the 35-year life of the Project the City would realize net revenues of approximately $118 million to $270 million (in 2014 dollars), of which an estimated 37% to 42% would accrue to the General Fund (i.e., not restricted to the Tidelands fund) that the City could use to fund various community improvements (Kosmont, 2014).”

The magnitude, reversibility, frequency, duration and likelihood have all been characterized to determine the significance with respect to health and well-being of increased access to recreational resources and greenspace (Table 6.10). A worked example of the decision matrix used to determine significance is shown in Figure 6.9.

Table 6.10 Recreation and Greenspace: Characterization Summary

<table>
<thead>
<tr>
<th>Magnitude: what is the severity of the effect on human health?</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>The effect is detectable and poses a minor to moderate hazard/benefit to health; health status could change from baseline.</td>
<td></td>
</tr>
<tr>
<td>Rationale: access to recreational resources and greenspace can enhance physical activity, which is a driving factor for health status; more resources being directed toward access to</td>
<td></td>
</tr>
</tbody>
</table>
recreational resources and greenspace could have a positive influence on community health and well-being.

<table>
<thead>
<tr>
<th>Reversibility (and/or Adaptability): is the effect reversible; how resilient is the community to this type of change; are they able to adapt?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reversible</strong></td>
</tr>
<tr>
<td><strong>Rationale:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency: how often is the effect expected to occur?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High</strong></td>
</tr>
<tr>
<td><strong>Rationale:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration: what would be the duration of the effect, if it were to occur?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long-Term</strong></td>
</tr>
<tr>
<td><strong>Rationale:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Likelihood: What is the probability of the impact occurring?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Probable</strong></td>
</tr>
<tr>
<td><strong>Rationale:</strong></td>
</tr>
</tbody>
</table>

In the Hermosa Beach HIA (Intrinsik, 2014), the health effect of access to recreational resources and greenspace was identified as “positive” (as opposed to “neutral” or “negative”). The EIR does not consider the potential impact of funding on community health; it simply states that the Cost Benefit Analysis identifies specific revenue that will be placed in a Tidelands fund for City use (MRS, 2014). The Hermosa HIA recommended that a community advisory group be created to ensure that expenditure of the revenue in the Tidelands fund goes toward community improvements such as recreational resources and greenspace.

Under the revised Assessment Framework, access to recreational resources and greenspace was found to have a “moderate” positive impact based on magnitude, reversibility, frequency and duration. Ultimately, it was determined that, when likelihood was considered, recreational resources and greenspace was “significant (++)” for overall effect on health. The level of uncertainty associated with this assessment was “low” based on the scientific evidence available and project information provided.
Step 2:

**Figure 6.9** Assessment Framework Worked Example (Step 2 and 3): Access to Recreational Resources and Greenspace
A comparison of the results for access to recreational resources and greenspace from both the original and revised assessment frameworks is provided in Table 6.11. The revised framework adds consideration of frequency and duration of access to recreational resources and greenspace but also changes the likelihood from possible to probable. Again, this is due to a change in the effect characterization definition for likelihood, where it was revised to focus on probability. Since the probability of funding increasing access to recreational resources and greenspace was greater than 50%, it was more acceptable to classify likelihood as probable. With respect to health outcomes, both frameworks identified a positive effect on health, but the revised framework takes it one step further to identify the level of effect. In the initial framework the assessment stopped at the effect characterization (positive, negative or neutral), whereas the revised framework classifies odour emissions effects as significant (++) with a moderate positive effect.

Table 6.11 Comparison of Initial Framework used for the Hermosa Beach HIA and the Revised Assessment Framework for Access to Recreational Resources and greenspace

<table>
<thead>
<tr>
<th></th>
<th>Initial Framework (Hermosa)</th>
<th>Revised Assessment Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnitude</strong></td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Reversibility/Adaptability</strong></td>
<td>High</td>
<td>Reversible</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>Not Determined</td>
<td>High</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Not Determined</td>
<td>Long-Term</td>
</tr>
<tr>
<td><strong>Likelihood</strong></td>
<td>Possible</td>
<td>Probable</td>
</tr>
<tr>
<td><strong>Health Effect</strong></td>
<td>Negative</td>
<td>Moderate (+ + )</td>
</tr>
<tr>
<td><strong>Significance</strong></td>
<td>Not Determined</td>
<td>Significant (+ + )</td>
</tr>
</tbody>
</table>

6.3.5 Summary of Testing Results

The Assessment Framework testing was conducted on odour emissions, well blowouts, educational funding and access to recreational resources and greenspace to capture a range of potential health outcomes and to evaluate how the framework could perform under various scenarios. The final step of the Assessment Framework involves plotting the significance against the level of uncertainty for each of the health determinants considered in the HIA. This is intended to provide a summary of the results and allow for a visual representation of the potential cumulative impacts of the proposed project. Using this approach, conclusions can be drawn regarding the overall impact on human health and well-being.
the initial testing have been plotted (Figure 6.10) to show how this step of the framework is intended to be used.

![Determination of Significance](image)

**Figure 6.10  Summary of Testing Results**

Based on this subset of results, it could be concluded that there are four determinants, two of which are not significant with respect to their impact on human health and two are significant. Of the significant determinants, one is considered to have a significant positive effect (+ +) and one a significant negative effect ( - - ). Considering the funding for increased access to recreational resources and greenspace is guaranteed if the project goes forward and the well blowout is an upset scenarios that is very unlikely to occur, it should be concluded that the overall health impact is not significant, when all factors are considered. However, using this approach to summarize and weigh the results of individual determinants in order to come to an overall conclusion can be highly subjective. That is, it is the practitioner’s professional judgement that will dictate how the final results are interpreted. Due to the
subjectivity of this approach, it will require consideration of individual ethics, value
drivers, risk attitudes and biases, all of which could influence interpretation of results
and the final conclusion overall. This concept of ethical considerations in decision-making is
further examined in Chapter 7.

6.4 Discussion and Conclusions

The revisions that were made to the original Hermosa Beach HIA framework were
substantial. The Assessment Framework was revised to adhere more closely with the
language and approach used commonly in EA practices in Canada. Although such practices
differ slightly among different jurisdictions around the world, the framework is intended to
allow for adjustment and adaptation by HIA practitioners who wish to use this cooperative
approach. Additionally, although the framework was developed with the objective of
allowing it to be incorporated into the EA process, it was also intended to allow for use in
stand-alone HIAs. This was done in order to facilitate the transition between conducting
HIAs as optional stand-alone reports, to having them integrated as part of larger regulated
impact assessment processes, which appears to be a promising new direction for the practice
of HIA. However, the primary objective of developing this Assessment Framework was to
further promote the application of tools to HIA practice with the goal of improving
consistency in assessment approach and transparency of the methods applied.

The application of the framework, including the evidence relied upon for the HIA as well as
the use of mitigation measures, will vary depending on several factors, including whether an
EA is being completed concurrently. In this case, there will be a vast amount of data and
information that can be drawn from the EA and used to facilitate assessment of health
determinants in the HIA. This is can be a major benefit to both processes, since EAs are
often criticized as not having enough consideration of human health impacts. Additionally,
the HIA benefits from the wealth of evidence and availability of pre-established mitigation
measures that are required under regulation if the project goes forward. Since any measures
identified in the EA would be legally enforceable, the HIA can be based on a scenario where
those measures are already in place. In situations where the HIA is stand-alone, the
assessment would have to be conducted assuming no mitigation. However, similar to EA, if
there are cases where potential impacts are found, mitigation can be developed to address
any issues (i.e., reduce negatives and enhance positives) and then the assessment can re-visit these scenarios to determine the effectiveness of the proposed measures. In this way, combining both the HIA and EA can ensure that people and the environment are protected through their collective recommendations and mitigation measures.

Another consideration in developing this framework, was to ensure that it could be applied to all types of assessment. Typically, HIAs follow one of three types: rapid, intermediate and comprehensive (or detailed). These assessment types fall along a spectrum that includes the amount of effort and time required for the HIA, the amount of evidence and data that will be used, stakeholder engagement considerations, and the level of detail within the evaluation itself. This framework, while attempting to streamline the HIA process and promote transparency, can be applied to all types of assessment. The one major difference with a rapid as opposed to a comprehensive HIA, would likely be the amount of evidence upon which the effect characterization is based. Therefore, the level of uncertainty with respect to the assessment and determination of significance may be higher in these cases. This is especially true in cases where the HIA is limited to identifying and discussing potential health issues at a high level but does not provide for the available time or budget to conduct a thorough evaluation or to rely on any site-specific modelled or measured data.

There may be instances where the framework does not perform in a manner that is in accordance with the practitioner’s professional opinion. In such cases, should the practitioner choose to deviate from the framework’s decision matrix, a sound justification should be provided. This is especially true in cases where the framework indicates that there is a potentially significant effect on health and well-being, but the practitioner’s assessment finds the health outcome to be not significant. Since framework development was an iterative process, intending to find a balance between adaptability for a wide range of situations, and providing consistent and transparent method of assessment, it is possible that the decision matrix will not fit all possible scenarios. The Assessment Framework was tested on a real world project (Hermosa Beach), using information and data from an EA (called an EIR in California) for four determinants of health. In doing so, the usability of the framework, applicability of the definitions, and consistency of results were evaluated. In cases where any of these factors were found wanting, the framework was further revised to improve upon the
existing approach. Although this initial testing was a valuable process, it would be useful to further test the framework under various assessment scenarios (including cases where the role of values are made explicit, as discussed in the forthcoming chapter) and apply it to a larger number of health determinants. This is a key area for future research, since the utility and effectiveness of the tool are paramount in its potential for application to HIA projects.

Overall, the Assessment Framework was developed in a way that achieved the goals of (1) aligning with an EA approach; (2) using consistent language; and, (3) devising a method for coming to an overall conclusion regarding potential impacts on human health. The one aspect of the Framework that is still largely conceptual is the final step that combines the significance and level of uncertainty for each health determinant, in order to provide a summary of results and inform an overall conclusion on the health implications of a proposed project. This aspect of the framework would benefit from being tested on a real-world HIA scenario involving a large number of health determinants. Although it could be tested on the remaining determinants from Hermosa Beach, it would be beneficial for practitioners who have not been involved in the development process to test the framework and provide feedback. As discussed, it is acknowledged that the interpretation of the results in making a final determination of potential impacts on health is somewhat subjective, especially if conducted by a single individual. However, plotting the results in this manner will enhance transparency within the HIA process and improve the practice overall, regardless of whether there are different way to interpret the outcomes. By continuing to promote transparency within HIA by developing tools with this objective in mind, it has the potential to become a robust framework for addressing health impacts, both within the EA process and as a stand-alone approach.

6.5 References


Chapter 7

Ethics in HIA

Abstract

During every step of the HIA process, decision-making aims to be based on scientific evidence and information pertinent to the assessment. However, there are several other influencing factors that are seldom acknowledged in practice. With increasing reliance on scientific methods and tools aimed at objectivity, it is important to acknowledge that personal attitudes, biases, ethical value systems, and paradigms can, both subtly and sometimes dramatically, affect the decision-making process and final outcomes. Drawing from the HIA Screening, Scoping and Assessment tools developed in this thesis, this chapter explores the influence that risk assessments, attitudes, judgment calls and worldviews can have on HIA theory and practice. It illustrates, through specific examples, how differing perceptions can affect the interpretation and implementation of the HIA process. Suggestions are made regarding how to acknowledge and address these issues within HIA practice.
7.0 The Role of Ethics, Worldviews and Bias in HIA Theory and Application

7.1 Introduction

Health impact assessment (HIA) is a process that aims to evaluate potential impacts of policies, projects and programs on health and considers the distribution of those impacts within a population (WHO, 1999). The practice of HIA was originally based on four pillars: (i) democracy; (ii) equity; (iii) ethical use of evidence; and, (iv) sustainable development (WHO, 1999). In 2006, the International Association for Impact Assessment (IAIA) revisited these and added “(v) comprehensive approach to health” as the fifth guiding principle for HIA (Tannahill and Douglas, 2012). When examining these core values upon which HIA is based, it becomes apparent that this process is built on a foundation of ethical principles. Democracy and equity both have to do with involving people in the HIA process so that it can promote distributive justice and fairness. Sustainable development is important because it considers impacts on future generations and promotes a way of thinking that is morally discerning (Stefanovic, 2000). Furthermore, “ethical use of evidence” directly acknowledges that evidence and data can be misused, and it promotes that HIA should be used not to serve the interest of one party or the other, but be applied in a way that is as morally justifiable as possible. Each of these pillars of HIA invites moral reflection in one form or another (Tannahill and Douglas, 2012; Stefanovic, 2008).

As with many processes, HIA involves a number of key decisions made on the basis of several different factors including data, evidence, political will, and social pressures, among others. Some of these factors, such as political will and social pressures, are themselves value-laden, reflecting power struggles, cultural values, biases and differing ethical views. However, there are several other factors that are often not acknowledged as playing a role in the decision-making process but have the potential to have an impact on the outcome. These include differing personalities, risk attitudes, biases, paradigms, ethics and value systems (Figure 7.1). These factors infuse the majority of our decision-making processes and yet are seldom recognized as major influences, especially in more calculative scientifically-based scenarios.
The fact is that, although HIA can be considered a scientific or technical process, it is also developed, applied and altered by human judgment calls. Interestingly, not all practitioners would agree that HIA is a science or even that it should strive to be. Rather they take the approach that HIA is an art, a social and human-centred concept that is to be changed and adapted to suit various needs, and should not rely on rigorous systematic approaches. In the book Science and Ethical Values, Glass (1965) argues that “science itself is a subjective, social, human enterprise completely dependent on its own ethical foundations.” While describing science as a social construct has come under criticism in recent years, the reality is that science remains a human endeavour and, to that extent, is not exempt from human interpretive moments (Hilgartner, 1997). With this in mind, HIA should arguably be considered as both a science and an art in order for the practice to continue to improve and evolve. Despite the move toward more objective and systematic tools, it would be remiss not to acknowledge and discuss the potential effect that these human factors can have on the HIA process and outcomes. As Glass (1965) opines: “we need a fuller, more frequent
consideration of the relations of science to ethics, to the full range of human values”. The complexity in understanding and addressing the influence of individual ethics, personality traits, biases, attitudes and viewpoints on decisions, is difficult because each of these influences can be culturally shared, as well as unique to the individual and can change over time depending on people’s experiences.

The objective of this chapter is to explore the ethical dimensions of HIA theory and application, focusing particularly on the issue of how risk attitudes, value systems, biases and differing paradigms can impact the theory and application of HIA. To demonstrate how these viewpoints can influence the decision making process, specific examples are provided using the HIA screening, scoping and assessment tools and frameworks developed as part of this Doctoral research and described in Chapters 3, 4 and 5.

7.2 Personalities and Risk Attitudes

Conflicting opinions and approaches to decision making are often related to different personalities and risk attitudes. This becomes apparent when the people involved in making decisions have extreme opposing views when it comes to their willingness to accept risk. Many choices have some level of risk associated with them, particularly when the decisions being made affect future outcomes that are not fully known or understood. There are several different risk attitudes, but of most importance are two markedly contrasting approaches: risk taking and risk aversion. In addition, one must consider how individual and corporate risk attitudes and values may not necessarily align.

7.2.1 Risk Taking vs. Risk Averse

Some individuals are willing to accept higher levels of risk, and are comfortable with high-stakes decision-making. Risk takers are often perceived as bold and do not typically adhere to ideas that promote caution. Conversely, individuals who are risk averse have a lower tolerance for risk taking and are typically less comfortable with risky endeavours. These individuals are more likely to be cautious in their decision making and favour alternatives with little to no risk involved. For example, risk averse individuals would be more likely to ascribe to the precautionary principle:
“A 1998 consensus statement characterized the precautionary principle this way: ‘when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically’. The statement went on to list four central components of the principle: taking preventive action in the face of uncertainty; shifting the burden of proof to the proponents of an activity; exploring a wide range of alternatives to possibly harmful actions; and increasing public participation in decision making” (Kriebel et al., 2001)

This principle is based on the idea that in the face of uncertainty and unknown risk, it is better to err on the side of caution and avoid potential harm. This notion has become popular amongst environmental advocates and scientists alike, likely due to the fact that at its core, it is vigilant, somewhat circumspect and preservationist in nature. However, in some cases this approach can be taken to the extreme and may impede development, particularly in the face of environmental and health impacts that are not well understood.

The concept of unknown risk within science and the ethical ramifications of differing risk attitudes is discussed in works by Shrader-Frechette and others (Shrader-Frechette, 1985; 2000; Cothern, 1996). One of the issues considered is the risk around low dose exposures and the ethical implications of assuming that thresholds exist for exposure to chemicals and radiation (Shrader-Frachette, 2000). Dr. Shrader-Frechette proposes that low dose exposures may differently affect certain individuals, such as children, the elderly and the ill; consequently, evaluating risk using a threshold approach may not be sufficiently proactive or protective (i.e., risk taking). Additionally, she suggests that if there is any chance that there are health risks even at low dose exposures, then the ramifications of using a threshold approach could be “catastrophic” to the victims (Shrader-Frechette, 2000). The issues of low dose exposures also invokes the precautionary principle, according to Shrader-Frechette:

“…ethics requires one to use the precautionary principle in situations where there is potential harm. In other words, ethics requires that, in situations of scientific uncertainty, one take precautions to protect public health and environmental welfare. To minimize false negatives rather than false positives when one cannot do both” (Shrader-Frechette, 2000).
Additionally, the concept of uncertainty in health science is considered from the perspective of assessing acceptable risk levels. Shrader-Frechette (1985) argues that the prevailing approach to calculating risks is too far on the risk-taking end of the spectrum. The idea that a cancer risk in an exposed population less than 1-in-10,000 \((10^{-4})\) to 1-in-1,000,000 \((10^{-6})\) is considered negligible, is an approach that is debatably oversimplified. Although it could be argued that risk-takers may consider \(10^{-4}\) acceptable whereas more risk averse individuals may be more comfortable with \(10^{-6}\), that still assumes that there is a level below which health risks can be considered negligible.

“As a claim about social policy, the thesis, that probabilities below \(10^{-4}\) or \(10^{-6}\) ought to be counted as zero, is question-begging. It is question-begging because it presupposed that the magnitude of some number, rather than factors such as the equity of distribution, risk-benefit trade off, or compensation, determine the acceptability of a given risk. For example, the thesis, that probabilities below \(10^{-4}\) or \(10^{-6}\) ought to be counted as zero, appears plausible only if it involves no violations of justice, and if there are no other alternatives to accepting it” (Shrader-Frechette, 1985).

In practice, elected officials, through recommendations of staff or expert panels, set the level of acceptable cancer risk in an exposed population to environmental contaminants. It is not a debate about zero risk, rather one of what is considered an acceptable cancer risk. In Canada, acceptable cancer risk levels are set at both the provincial and federal level. The federal government, through Health Canada, and the majority of provinces have set an acceptable cancer risk from environmental exposure to be \(10^{-5}\) (or 1 person exposed potentially getting cancer in a population of 100,000). However, both the provinces of Ontario and Quebec have set the acceptable cancer risk at \(10^{-6}\) (or 1 person exposed potentially getting cancer in a population of 1,000,000). The actual probability of an individual getting cancer in Canada is 2 out of 5 Canadians \((0.4)\) (Canadian Cancer Society, 2016) in their lifetime. Setting acceptable cancer risk from environmental exposure to contaminants at a much lower probability is meant to ensure that environmental exposure does not result in an unacceptable increase in probability from this exposure. Clearly Ontario and Quebec are more risk averse than their federal and provincial counterparts. In practical application, this means that
Ontarians and Quebecers would be exposed to 10-fold less concentration of environmental contaminants, reflecting narrower levels of risk tolerance.

This discussion is intended to highlight the issue around differing perspectives and ethical implications of quantitative approaches to health assessments. Health is inherently a personal issue and although there may not always be agreement among practitioners, it is important to acknowledge that differing personalities, risk attitudes and biases influence perspectives and decisions around health, and likely always will.

With respect to HIA, different risk attitudes are likely to be encountered, especially with a diverse team of practitioners and stakeholders. Having a diverse HIA team can both complicate and improve the process by bringing different views to the surface during collaborations. Where this would be most apparent is likely during the scoping stage, when trying to determine what should be included in the assessment. A person who has an aversion to risk may be extremely conservative in their selection of what should be included in an HIA, taking the attitude that if there is any possibility whatsoever of more than minimal impact, it should be fully evaluated. A person who is a risk taker may be less conservative in their assertion of what constitutes a potential impact, limiting the scope of the assessment only to those things that have the greatest potential for major effects.

In the HIA scoping tool that was developed (Chapter 4; McCallum et al., 2016b), there are key decision making points within the tool that could be impacted by whether the person applying the tool is risk taking or risk averse. For instance, an individual who is a risk taker may see certain impacts as minute enough to exclude from assessment altogether, either based on the fact that the impact is unlikely or in their view the effect is small. This can be contrasted against someone who is risk averse and may include any and all determinants that have a non-zero potential for impact. The HIA scoping tool has an initial list of over 60 health determinants; it is likely that a risk taker would end up with a smaller list of determinants and a smaller scope, whereas someone who is risk averse may have a larger scope with many more determinants to evaluate.

To provide an example, if the HIA Scoping Tool (Chapter 4) were to be used to prioritize health determinants for inclusion in an HIA of a proposed waste-to-energy (WTE) facility to
be built in a small community, the outcome may be different depending on who is conducting the scoping exercise. If the project proponent is conducting scoping, then it is more likely that impacts will be interpreted and characterized as more positive/neutral due to their risk attitudes around the project. This is likely due to their familiarity with the operation of similar facilities in communities around the world. Additionally, the proponent could be more likely to value the project and potentially underestimate the level of public concern around the issues. Since the Scoping Tool provides priority order based on characterization of impact and level of concern, there could end up being fewer top priority determinants for inclusion in the HIA. Conversely, if a community group were conducting the scoping exercise, they may be more risk averse since they will be directly affected by the project that might well be differently framed as a result, right from the start. In such communities where WTE facilities are not common, a project proposal may generate “fear of the unknown” in some community members. This would likely lead to interpretation of effects that generate a higher level of concern which, in turn, would push more determinants into a high priority group, where assessment is essentially required. However, it is important to note that scoping for HIA is dependent on several different factors, and although risk attitudes would definitely play into the decision-making process of what to include in the HIA, it would not be the only driving force. Other considerations include budget constraints, political pressures, biases, personal experiences, different value systems and other influencing factors.

Additionally, this tool relies on the user’s interpretation of specific definitions of key factors including: impact, public interest/concern and data availability. The definitions were developed such that they could be applied to a wide variety of potential determinants and project scenarios. Consequently, the definitions rely on descriptive language that could potentially be interpreted differently depending on the individual. For example, for a “highly negative impact” the definition states: “there is potential for a significant and long-term/permanent effect that could directly or indirectly diminish health.” This definition could be applied differently depending on the user’s interpretation of “significant” and to a lesser extent, “long-term”. In this case, a risk-taking user might reserve classification of a “highly negative impact” only for extreme effects. Alternately, a risk averse user may consider a wide range of potential impacts as “significant” and apply this classification to several determinants. Due to the fact that people do not often divulge their attitude towards risk,
especially in the case of HIA practice, it is vital to understand how differing outcomes can come about despite the fact that the HIA is based on assembling the same information. Since results can be so affected based on a person’s level of comfort with risk, it is advisable to have a team of multiple people conducting the HIA scoping. By engaging multiple stakeholders, each having their own views and risk attitudes, in a group setting (i.e., community meeting or workshop) potential conflicts arising due to differing views and values can be addressed in a clear and transparent manner at the onset of the HIA process.

7.2.2 Corporate/Organizational Risk Attitude

Corporate (or organizational) risk attitude describes a corporation’s (or group’s / organization’s) level of comfort with risk taking rather than that of an individual. Different types of corporations are inherently more or less willing to accept risk. For example, governments and public health agencies are mandated to serve and protect the public and therefore, may be less willing to accept high levels of perceived risk when it comes to potential health effects. However, different types of government may have different views on acceptability of risk, which can mean that depending on who is in power, their risk attitude may vary greatly. Additionally, although an individual might identify with a particular political party, their own personal values and attitudes may differ from their political leaders. This is contrasted with some private sector industries that may be more comfortable with risk-taking when it comes to potential health and environmental impacts, if they are driven primarily by a profit motive rather than health considerations. Alternatively, some private sector organizations are conscious of potential impacts, and voluntarily invest large sums to evaluate and protect health and the environment. Ultimately, it comes down to the values and judgements that are tied to being part of a group, organization or corporation. This issue of differing risk attitudes depending on corporate or group affiliations and interests is explored by Shrader-Frachette (2000), when considering tests and studies conducted on the effects of nuclear exposures:

“Practically all health studies of nuclear worker populations in the industrialized world have been funded and overseen directly or indirectly by the same agencies that have promoted military and civilian nuclear technologies. Not surprisingly, such studies of nuclear worker health and safety-with their small sample sizes and short durations have failed to produce any
evidence of harmful effects of allowable exposures to ionizing radiation. However, once medical doctors and epidemiologists, with out ties to the nuclear industry, examined radiation-worker data, they came to the opposite conclusion.”

In HIA practice, there are often a variety of stakeholders involved in making decisions. It is not uncommon for a proponent to hire a team of consultants to conduct the HIA, with another team of government or public health officials responsible for review and/or implementation. It is possible that some of the individuals on these teams have differing views than the corporate entities that they represent. For instance, a consultant who is involved in helping to carry out the HIA may be quite conservative with their attitude towards risk, whereas the corporation that is overseeing the undertaking may have a higher willingness to accept the risks associated with the undertaking. It can become complicated if an individual is expected to abandon or alter their personal risk attitude in favour of the prevailing corporate attitude.

This concept can be illustrated by taking an example from the Hermosa Beach HIA (Chapter 5), where numerous stakeholder groups and organizations were involved. This project was divisive regarding whether to lift an existing oil drilling ban for the city of Hermosa Beach, to allow for a proposed oil production project to proceed. It was interesting to observe the risk attitudes of the different groups, including the city council, public health officials, opposition groups, pro-oil groups, project proponent, and consultants. Each of the groups had its own “corporate” risk attitude that was determined by the objective or interest of the group. For example, the prevailing attitude for the community opposition group was that of risk aversion, whereas the proponent and pro-oil groups were more risk taking. The city council as a group was officially neutral, although it became clear during the process that certain councilors were risk takers, while others were more risk averse in their attitudes toward the proposed project. This showed that corporate risk attitudes and individual risk attitudes do not necessarily align.

Within consulting as well, the prevailing corporate risk attitude is not always in alignment with the personal risk attitudes of the people conducting the work. At times this can lead to disagreements regarding what approach to take in the HIA and how to interpret and
communicate results. Often the prevailing risk attitude of the group or organization takes precedent over an individual’s attitudes and values. Depending on who is conducting the HIA, this can have major implications on the assessment approach, recommendations and conclusions. For this reason, developing more consistent and transparent tools for conducting HIA will allow for clearer understanding of where risk attitudes, values and bias may have played a role.

7.3 Biases

Bias can be described as “departures from the normative rational theory that served as markers or signatures of the underlying heuristics” (Gilovich et al., 2002). Heuristics are simple rules used by individuals in order to form judgments and make decisions more efficiently; typically involving “mental shortcuts” aimed at focusing in on certain aspects of a complex problem while negating others (Lewis, 2008). Three general heuristics (availability, representativeness, and anchoring and adjustment) have been used to explain or categorize different types of bias (Gilovich et al., 2002).

Bias has the capacity to affect the HIA process, especially when it goes unnoticed or unacknowledged. The threat of bias in HIA is highlighted in the International Association for Impact Assessment Code of Conduct, which requires practitioners “to conduct professional activities with integrity, honesty, and free from any misrepresentation or deliberate bias” (IAIA, 2016) Beyond “deliberate bias,” however, the fact is that, inasmuch as we are human, we see the world always from a certain perspective. In that sense, beyond intentional misrepresentation, there are several different types of bias that can implicitly affect decision making as well. A few examples are provided below, including (i) unstated assumptions; (ii) motivational biases; and (iii) cognitive biases, along with a discussion of how they can impact HIA theory and practice. Specific examples are provided from the HIA screening, scoping and assessment tools developed by McCallum et al. (2016a; 2016b; 2016c).

7.3.1 Unstated Assumptions

One type of bias is related to unstated assumptions. In HIA, outcomes may be based on a series of assumptions that, if altered, would change results. When assumptions are not stated, interpretation of methods, results and recommendations can change, and the level of
certainty, objectivity or truth in the outcome may be misrepresented. In HIA theory, we assume that the project information and data provided to us is accurate and complete. If not, the results obtained could be inaccurate or counterproductive. Unstated assumptions can impact all steps of the HIA process. This is especially true when key decision points are reached and choices are made based on several major assumptions. If these assumptions are not explicitly acknowledged in the decision-making process, problems can arise when the basis for those decisions change.

In the case of HIA screening, a decision is made regarding whether or not to conduct and HIA on a given project, policy or program. If the decision to forgo an assessment is based on specific information or assumptions that may not be relevant under different circumstances, then it is imperative to consider whether the outcome would change with different information. Conversely, if the decision to go ahead with an HIA is based on an assumption of available funding, potential impact or other factors, it should be acknowledged that in the event one of the assumptions is incorrect, the outcome (i.e., decision to conduct an HIA) would change. In the Value vs. Investment HIA Screening Tool (McCallum et al., 2016b) the user needs to answer a series of questions that gives them an overall score for the investment required and the value obtained from conducting an HIA on a given project. If responses are based on specific assumptions, this should be stated in the “Rationale and Comments” section because if the assumptions are incorrect, that situation may change the scoring and ultimately the final recommendation about whether to proceed with the HIA.

An example of this would be a local community group considering an HIA for a proposed transportation planning project focusing on increased active transportation (i.e., walking, biking, etc.). If the community group proceeds with screening under the assumption that it will have adequate funding available, without actually securing it first, and under the belief that it will be able to influence the decision-making process, it could misrepresent the screening results. These two assumptions alone could tip the Value vs. Investment Screening Tool in favour of conducting an HIA because it would lead to a lower investment score and a higher overall value score. Without knowing for sure whether these assumptions are true, an HIA could be considered a good option for this proposed project. This could lead to public notification of the HIA as well as initiation of the assessment, only for proponents to later
find out that funding wasn’t secured and/or the HIA will have little influence over the
decision-making process.

The importance of stating assumptions also applies to HIA scoping. In the scoping tool
developed by McCallum et al. (2016c) (Chapter 4) an attempt was made to systematize the
scoping process to enhance the transparency and consistency of the process. The tool relies
on a user’s appraisal of certain characteristics to determine a priority order for evaluating
health determinants. One of the major unstated assumptions is that the information being
relied upon for the HIA is complete and accurate. Often, if this is not the case, there would
be major flaws in the assessment. An example of this is the potential for air quality impacts
resulting from chemical emissions. If during scoping, data is provided on the emission of a
few pollutants and the HIA practitioner assumes that these are the only chemicals emitted,
they may underestimate the potential impact on health. This could, in turn, under-prioritize
the determinant and potentially allow it to be excluded from assessment. However, if the
practitioner states this as an assumption explicitly, there is an opportunity for the assumption
to be confirmed or denied and the scoping can be revised accordingly. This is especially
important in cases where there is limited information or incomplete data sets are available.

One deficiency within current HIA practice is that limitations and uncertainties are often not
explicitly acknowledged throughout the HIA process. It would be useful if HIA followed the
example of HHRA and provided a section to discuss all assumptions and evaluate how they
may affect the outcome. Explicit discussion of assumptions is essential to improving the
effectiveness and transparency of the process.

7.3.2 Motivational Biases

Motivational biases “include conscious or subconscious distortions of judgments and
decisions because of self-interest, social pressures, or organizational context” (Montibeller
and von Winterfeldt, 2015). Motivational biases are unique to the individual which means
that there can be conflicting interests when involving different parties in the decision-making
process. For example, in HIA there are a number of different stakeholders typically involved
in the process including proponents, project managers, public health and government
officials, practitioners, community members and other stakeholders. Within these groups,
there are not only motivational biases related to professional positions and affiliations but each individual may also have implicit personal biases. In cases where the different stakeholders have differing interests, which is often the case with the types of projects and policies being evaluated using the HIA process, there can be dissatisfaction with the outcome when it does not benefit an individual or group’s agenda.

As much as practitioners strive for objectivity in their evaluations, value neutrality is largely impossible when applying human efforts. This is because everyone has inherent and often subconscious biases that ultimately affect their decision-making processes. There are several different types of motivational bias including (Montibeller and von Winterfeldt, 2015):

- **Affect Influenced** – “occurs when there is an emotional predisposition for or against a specific outcome or option that taints judgements”.
- **Confirmation** – “occurs when there is a desire to confirm one’s belief, leading to unconscious selectivity in the acquisition and use of evidence”.
- **Desirability of a Negative Event or Consequence** – “occurs when there is a desire to be cautious, prudent, or conservative in estimates that may be related to harmful consequences”.
- **Desirability of Options / Choice** – “This bias leads to over- or underestimating probabilities, consequences, values, or weights in a direction that favors a desired alternative”.

All of these different types of motivational bias can play a role in the HIA process. Typically, HIAs are conducted by community groups, public health professionals, consultants, and in some cases by a project proponent. It is important to consider that each of these groups has their own potential motivation and may have different preconceived notions regarding the “optimal” outcome. For example, a project proponent may want a certain outcome to ensure that their project is approved, which could influence their decision making throughout the HIA process. Conversely, community groups may be opposed to the proposed initiative, especially if they are concerned about potential health and environmental impacts directly affecting them or their livelihood. This can lead to biases favouring negative outcomes with the intentional or unintentional aim of delaying or halting the project. Alternatively, landowners and others who have the potential to benefit from proposed projects, either
monetarily or otherwise, may be biased towards positive outcomes and pushing the project forward.

An example of how motivational bias can impact the HIA process can be seen in the way assessment methods are interpreted and applied. Even using tools that are developed for the purpose of increased objectivity cannot completely eliminate the fact that applying those tools can be subject to some interpretation. How a practitioner interprets a specific definition or set of data can influence their results and the outcome of the HIA itself. A specific example of this can be illustrated using the assessment framework developed by McCallum et al. (2016a; Chapter 5). The HIA assessment framework relies on specific definitions to characterize magnitude, likelihood and adaptability. These characteristics are then used to apply a decision-making framework that determines whether there is a negative, positive or neutral effect. If the person or team conducting the HIA have confirmation bias, they may consciously or subconsciously choose to interpret data and characterize impacts in such a way that supports their desired or expected outcome.

One way to mitigate such biases is to have a diverse team involved in the decision-making around the HIA process and have multiple practitioners conducting the evaluation. This will help to minimize results being influenced in favour of a specific bias. Where this is not possible, it may be advisable to have a third party, who has less obvious vested interest in the outcome, to mediate and critically analyze the assumptions that are driving the HIA. One way to achieve this is to have the HIA process include both a public comment period and/or a formal peer-review process. The public comments provide an outlet for potential concerns or issues to be addressed in the HIA, while increasing stakeholder engagement and involvement in the process. A peer-review process ensures that an expert, who is responsible for ensuring the HIA is high quality and without obvious bias, formally evaluates the HIA.

### 7.3.3 Cognitive Biases

Cognitive biases are “a systematic pattern of deviation from norm or rationality in judgment, whereby inferences about other people and situations may be drawn in an illogical fashion” (Haselton et al., 2005) There are several types of cognitive bias but the two that are discussed here in relation to HIA theory and practice are anchoring and availability.
Anchoring describes a type of cognitive bias that occurs when a person is steadfast in a particular position, often as a result of the first piece of information received, and will not consider other options or change their view (Chociolko, 1995). This is an important type of bias to consider when dealing with community members and other affected stakeholders in the HIA process. Often HIAs are conducted on projects that are contentious and cause strong opposition or polarized views among affected members of the public. An example of this is illustrated in the case of the Hermosa Beach Oil Drilling and Production Project (Chapter 5). This proposed project created a lot of contention among community members, some of whom were pro-oil and others were opposed. Although it is unfair and unrealistic to suggest that anyone with a strong opinion is exhibiting anchoring bias, those individuals who are not open to hearing evidence or information that could challenge their position, or if they hear compelling evidence and refuse to take it into consideration, may be anchored in their position.

In cases where a person or group will not change their position no matter what, practitioners and proponents may not want to invest large amounts of time and resources to improving the situation because it is unlikely to yield any change. Contrastingly, there are individuals who are concerned but want to understand the issues and hear the evidence for and against the proposal before they make up their mind. These are the people who can be assisted by additional stakeholder engagement activities, especially those that allow them to provide meaningful input into the process.

Another common type of cognitive bias is called availability, which occurs when the probability or likelihood of an event affects the way it is interpreted (Chociolko, 1995; Stefanovic, 2008). Typically, it causes common, less dramatic events to be underestimated and rare, dramatic events to be overestimated. This can occur among HIA practitioners, decision-makers and members of the public alike. One clear example of this type of bias can be taken from the Hermosa Beach HIA (McCallum et al., 2015; Chapter 5). One of the potential impacts evaluated as part of the HIA was the possibility of a well blowout. In all oil drilling and development projects, there is the possibility of a well blowout that would result in a large explosion and possibility of major damage and human casualties. Oil drilling projects typically also result in consistent noise and odour issues. Despite the fact that the
noise and odour issues were almost certain to occur and persist over time, “a well blowout is a very low probability event, predicted to occur once in 323 years during drilling and once in 604 127 years during non-drilling periods if the wells are pressurized” (McCallum et al., 2015b) it was a major focus of discussion at public meetings. Realistically, constant excess noise and odour would impact more people on a regular basis but the impacts were underestimated, whereas the possibility of a well blowout was overestimated.

Collectively, cognitive biases can affect the way people interpret, process and deliver information. Anchoring and availability are only two of many different types of cognitive bias that could influence decision-making. Identifying potential biases that practitioners, community members and other stakeholders may possess, can improve the HIA process by attempting to mitigate some of these biases, where possible, or managing the way the process is carried out with these influences in mind.

7.4 Ethical Value Systems

There are many different types of ethical values systems including: utilitarianism, deontology, virtue ethics, natural law, social contract theory, and others (Fieser, 2016). The two value systems that will be focused on here are utilitarian and deontology, for two reasons: (1) they are two common viewpoints held by society, and (2) they represent two ends of a spectrum that allow for clear illustration of differing values and how they can impact decision-making.

7.4.1 Utilitarian vs. Deontology

The Utilitarian value system is based on the concept of the “greatest good for the greatest number”, which can be considered in terms of “greatest happiness” or “greatest welfare” (Bentham, 1970; Mill, 1863; Stefanovic, 2015). This idea that the appropriate action or decision is the one that results in the greatest benefit for the largest number of people is a common approach in decision making: “it is frequently utilized because it is deemed to be most efficient and fair, satisfying the demands of distributive justice, particularly when it comes to large-scale environmental decisions that affect a large population” (Stefanovic, 2015). For example, proposing a new landfill in the outskirts of a city will produce waste management benefits for many people, while causing drawbacks for a small number of
individuals who have to live in close proximity to the landfill itself. Utilitarian ethical values would suggest that building the landfill is the right option, because more people will benefit than if the landfill is not constructed; thus providing the greatest good to the greatest number.

The Deontological value system is based on the idea of duty and that all people have inherent rights (Stefanovic, 2015; Fieser, 2016). This value system places emphasis on the inherent rights of all individuals and acknowledges that one person should not be sacrificed for the benefit of others. Under this system, building a landfill that would affect any individual’s human rights is not ethical, despite the alleged benefit to the greater good: “This underlying divergence between utilitarian efficiency of the greater good, on the one hand, and a deontological belief in principles of human rights—is commonly observed and often helps to explain what is at the root of many stakeholder conflicts” (Stefanovic, 2012; 2105).

The concept of distribution of effects within a population, is a key component of HIA theory and practice. An HIA is intended to not only characterize the type of effect, but also to identify those groups or individuals who may be disproportionately impacted. As discussed, one of the pillars of HIA is equity:

“Equity in health implies that ideally everyone should have a fair opportunity to attain their full health potential and, more pragmatically, that none should be disadvantaged from achieving this potential, if it can be avoided” (Whitehead, 1992).

This concept of equity and distribution of effects is intended to be a key component of HIA; however, the way it is addressed is highly variable. The Society of Practitioners of HIA equity working group has developed “Equity Metrics for HIA Practice (Version 1)”, which provides guidance in an effort to develop “a more intentional and thorough approach to addressing equity impacts” (SOPHIA, 2016). Although the practice is still evolving, and equity is a focus of current discussion and research among practitioners, it is far from perfect. One common way to look at equity issues associated with policy or project proposals is to identify vulnerable groups that could be disproportionately impacted. These groups can include children, the elderly, pregnant women, aboriginals, people with illnesses, and those living in poverty, among others. Since the selection of these groups and method of evaluation is dependent on the HIA practitioner(s), personal biases and values systems can play a role.
Even when all parties involved have the best intentions, personal views and beliefs can influence decision-making in many ways. Given this reality, it is important to acknowledge and address the possibility and influence of bias impacting decision-making where possible.

“It is important to recognize that values and assumptions impact every phase of decision making, no matter how logical, linear and objective that process appears. For instance, value judgements very much shape the first step in the decision-making process, where project objectives, problems and opportunities are identified and bounded” (Stefanovic, 2012).

After screening to determine whether to conduct an HIA, the assessment must be scoped, including identifying objectives, selecting determinants and placing boundaries on the process. Practitioners who ascribe to different ethical value systems may make different decisions regarding these key factors. For example, the utilitarian and deontological approaches would likely have different objectives for the HIA overall:

- **Utilitarian**: The objective of the HIA is to identify the best possible option for the proposal project (or policy) that results in maximum benefits to the largest number of people. Ex. Building a new highway that will give thousands of people access to additional job opportunities and services offered in a nearby city.

- **Deontological**: The objective of the HIA is to identify whether the proposed project (or policy) will result in impacts that infringe on anyone’s inherent rights, including the opportunity to attain good health. Ex. Building a new highway will disproportionately impact those individuals who will have to live adjacent to it, causing them to be exposed to higher levels of pollution and noise.

It is important to note that neither of these value systems is inherently “right” or “wrong”; they are different world views that have their own set of criteria for justifying differing moral conclusions.

Another way that differing ethics can impact the HIA process is when drawing conclusions. The HIA conducted for the Hermosa Beach oil drilling and production project found both positive and negative impacts based on the results of the assessment (Chapter 5). Overall, it was concluded that:
“With the exception of upset conditions, the negative health outcomes have been largely
nuisance-related (e.g., odor, aesthetics) without irreversible health impacts. The majority of
the health determinants, that had been examined, have revealed that the project would have
no substantial effect on the health of the community. Overall, based on the proposed
mitigation measures in the EIR and additional recommendations provided in the HIA, the
authors conclude that the project will have no substantial effect on community health in
Hermosa Beach” (McCallum et al., 2015b).

This conclusion is more closely aligned with a utilitarian value system. By suggesting that
the negative impacts are minimal and intimating that the positives balance the outcome, the
HIA is relying on the principle of the greatest good for the greatest number. Although the
assessment approach was based on utilitarian ideals, there were community groups arguing
for the duties and rights of all Hermosa Beach residents to “keep Hermosa Hermosa” and
maintain the integrity of the community and natural landscape by upholding the oil ban. The
scenario surrounding the Hermosa Beach HIA provided a unique opportunity to demonstrate
how differing value systems, and viewpoints can play into a complex process involving a
variety of stakeholders.

7.5 Paradigms

Paradigms can be described as “commonality of perspective” that binds together ideas and
outlooks and, in science, provides a foundation for further practice (Barter and Bebbington,
2012). Although there is a spectrum of paradigms, two opposing worldviews that are
arguably relevant to HIA are the anthropocentric and ecocentric paradigms.

7.5.1 Anthropocentric vs. Ecocentric

Anthropocentrism considers humans as the centre of importance and sole source of value,
with nature being separate and valued only instrumentally as a means to a human-focused
end. This is in stark contrast to the ecocentric paradigm that views nature as having inherent
value and focuses on maintaining ecological integrity as a whole (Barter and Bebbington,
2012; Kortetmäki). Historically, anthropocentric views prevailed, with human needs and
desires taking priority over environment. More recently, there has been a shift towards
environmental consciousness where the inherent value of ecosystems themselves is being
recognized (Gagnon Thompson and Barton, 1994). Additionally, the interconnectivity among humans and their environment, including our complete dependence on finite natural resources, has become a pressing issue. It can be argued that environmental stewardship is a key component of both anthropocentrism and ecocentrism; however, the underlying reason for preserving resources is different:

“Both ecocentrics and anthropocentrics express environmental concern and an interest in preserving natural resources, but their motives for this interest are distinguishable. Anthropocentrics support conservation because human comfort, quality of life, and health can be dependent on the preservation of natural resources and a healthy ecosystem… Ecocentrics, on the other hand, support environmental issues because they see nature as worth preserving regardless of the economic or lifestyle implications of conservation. To ecocentrics, nature has a spiritual dimension and intrinsic value that is reflected in their experiences in nature and feelings about natural settings” (Gagnon Thompson and Barton, 1994).

Over the past few decades a higher environmental consciousness has evolved, resulting in an increase in environmental legislation and regulations, and the inclusion of environmental impacts in assessment of development projects. One example is the widespread use of Environmental Impact Assessment (EIA) in both Canada and the United States. More recently, HIA has been discussed as an important addition to the EIA process to fully understand the impacts of development projects and policy initiatives on human health. However, based on the definition of HIA and the reality of the practice to date, the process has focused on human health and tends to provide little to no consideration of impacts on ecological health as it might be valued in and of itself, independently of human interests. This suggests that HIA is currently an anthropocentric practice, focusing on human health and discounting ecosystem health. To be sure, at times HIA does consider ecological considerations but most often that occurs from an anthropocentric perspective, where environmental impacts are valued purely instrumentally inasmuch as they influence human health and well-being.
The definition of holistic health “takes into account the whole individual, one's own
responsibility for one's well-being, and the total influences—social, psychological,
environmental—that affect health, including nutrition, exercise, and mental relaxation”
(Medical Dictionary, 2016). This is not fundamentally different from the World Health
Organization’s (WHO) definition of health that is a “state of complete physical, social and
mental well-being” (WHO, 1948), which is the foundation of HIA. In order to adequately
account for all potential influences on physical, social and mental health and well-being, the
environment as a whole might be considered when assessing health impacts, both in terms of
the complexity of such impacts on human health but, some might argue, also in terms of the
health of non-human animals and even ecosystems as a whole.

One case that demonstrates the important link between health and environment is from the
First Nations communities in Canada. First Nations people tend to follow an ecocentric
paradigm, where nature has inherent value and importance (Parkes, 2011). When conducting
assessments in these communities, it would be remiss not to include consideration of
ecosystem health, since it plays such a large role in their health, and spiritual well-being
(Friendship and Furgal, 2012). The Yukon Chief Medical Officer of Health acknowledged
that traditional knowledge and a deeply rooted relationship with the environment play a key
role in evaluating environmental risks to these communities: “when it came back to what are
the determinants of these issues or problems it always came back to traditional knowledge,
that we have to go back to traditional knowledge, traditional ways of eating, traditional ways
of living on the land, traditional ways of social networks; it’s clearly something that is seen
as a very strong fabric” (Friendship and Furgal, 2012).

This understanding of traditional ecological knowledge (TEK) is essential to framing
discussions of First Nations health. In HIA, it is imperative that local, indigenous
communities are directly engaged in the scoping and assessment process to ensure that key
health determinants are considered within the context of their own culture and worldviews.
These will likely include aspects of the environment and ecological systems that are typically
not considered in HIA, such as wildlife and traditional foods, cultural practices and the
natural environment (i.e., trees, water bodies, etc.). Nevertheless, they are strong influences
on human health and well-being. In fact, it could be argued that the relationship between
human societies and the natural world has a larger influence on human health and well-being than is typically acknowledged in the western world. Although HIA has generally been conducted with a human-centred focus, it is an area of practice that could be improved upon by including aspects of ecosystem health, especially inasmuch as they relate to human impacts (i.e., natural resources, ecosystem services, wildlife). This is particularly important when involving First Nations and other aboriginal communities who have a strong bond with the natural environment and identify with a holistic view of health and wellness.

7.6 Conclusion

The HIA process is one that has been developed and applied by individuals that have inherent biases, risk attitudes, values, ethical perspectives and paradigms that have the potential to affect their decision-making. For this reason, although striving for objectivity within HIA practice is a noble goal, it can never be truly value-neutral: “as long as science is a human activity, carried out by individual men [sic] and by groups of men [sic], it must at bottom remain inescapably subjective” (Glass, 1965). However, acknowledging that these factors can affect how HIA stakeholders (e.g., practitioners, proponents, government and health officials, and community members, among others) interpret information, apply tools and make choices when conducting an HIA, is vital to making the process transparent and effective.

Attitudes, biases and differing world views have the potential to impact HIA during every step of the process, most notably during screening, scoping and assessment steps, where major decisions are made regarding how the HIA will be conducted and what will be included. Specific examples of scenarios where these factors could influence the process were provided, drawing from recently developed screening, scoping and assessment tools. Collectively, these examples suggest that although there is a need for more consistent approaches within HIA and more transparent methodologies, the practice will never be completely devoid of interpretive frameworks or even bias. This demonstrates that even though a tool is developed with objectivity and transparency in mind, there will always be a “human” factor. Therefore, the author strongly suggested that HIAs include a section to discuss any assumptions, areas of uncertainty and potential biases that could have impacted
the process. This section should also provide a discussion of how these factors may have influenced the HIA process and outcome, and how this was taken into account.

Finally, it is suggested that although including various stakeholders with different backgrounds and interests may add complexity to the process, it may also allow for conflicting views and personal values to be acknowledged and addressed throughout the HIA process. By including an open and upfront discussion of potential “human” influences on HIA, the practice becomes more transparent and accessible to the decision-makers who rely on these assessments for information and expertise. Approaching HIA as both an art and a science that requires continuous improvement and objectivity, while acknowledging the multitude of social and cultural influences, is imperative in achieving a common and effective approach to HIA practice.

7.7 References


Chapter 8

Discussion and Conclusions
8.0 Tying It All Together: Achievements, Limitations, Future Research, and Conclusions

8.1 Discussion

The fact that development and implementation of new projects and policies can lead to many different types of effects, including those on the environment and human health, means that there is a need for effective ways of assessing these impacts. From an environmental perspective, several countries around the world have adopted EA processes to address this need.

However, when it comes to health, assessment is limited at best. One of the ways that health impacts, including social, economic and cultural considerations, can be addressed is through HIA. Although HIA is not a new concept, it has not been approached in a consistent manner, which leads to confusion and wariness of the process. For these reasons, this thesis has focused on development of transparent and systematic methods and tools for conducting HIA, to improve the practice and promote inclusion of health in assessing impacts of projects and policies.

In order to ensure that the research was approached in a way that was itself systematic and transparent, the thesis first presented a literature search that identified specific deficiencies in a number of areas relating to HIA. That process revealed that further research and development was required on a number of issues, from the need of consistent scoping to integration of HIA within existing regulatory frameworks and tools, such as EA.

The following sections discuss the complexity of health and assessing health outcomes, and the relevance of the research, including key achievements. A critical analysis of limitations of the research, as well as next steps and opportunities for future research are provided.

8.1.1 The Complexity of Health

One key point to consider in a critical analysis and discussion of health and HIA is the inherent complexity of health as a notion. The word “health” may have a series of widely regarded definitions but, inevitably, health means different things to different people. At an
individual level, health is an interesting paradox that is seldom thought of when it is present (i.e., when a person is healthy), yet can be all-consuming when it is absent (i.e., when a person is sick) (Gadamer, 1996). Further, what can be defined as “healthy” for each individual is unique and constantly changing depending on biological, physical, social, economic and cultural influences. For example, if we assume that health includes all influences on the state of the mind and body, then a person who finds themselves socially isolated or culturally unfulfilled, may not be “healthy”. However, individuals tend to identify the state of health as relating largely to the presence or absence of disease and/or ailments rather than overall wellbeing.

Although this purely physical view of health has been a prevailing notion, it is not in alignment with the WHO definition of health which focuses on physical, social and mental health and well-being, and “not merely the absence of disease and infirmity” (WHO, 1948). The all-encompassing nature of this definition is both its strength and its weakness. The strength is that it includes all potential influences on health and well-being and challenges the idea that health is only physical. The weakness is that it provides an unattainable goal since achieving complete physical, mental and social well-being is virtually impossible. Where the WHO definition of health is most useful is in its acknowledgement of a broader range of health determinants, and in its ability to provide a working target for population health.

When considering health, it is important to understand the scale within which you are working. Discussing and assessing health at an individual level, a sub-group level, a community level or a population level (e.g., regional, national, global) is very different and requires unique considerations and approaches. Ideally, health should always be considered within its socio-economic and environmental context. For example, when assessing potential health implications of broad strategic planning, health considerations should be more high-level (e.g., population level trends, long-term effects, cultural considerations and the physical, social and economic environment in which the assessment is being conducted). This approach can be contrasted with assessment of individual health which is more focused on specific influences and outcomes relating to a person’s health status over time. In the environmental field, community or population level health is typically the focus, unless specific case studies are being considered.
Beyond diffing scales, there are also different power relationships and cultural contexts that influence how health impacts might be interpreted. Subtle values, perceptions and paradigms can shape the HIA conversation from start to finish, including the assessment and interpretation of health effects. The fact is that HIA is more than simply a calculative product but is also a qualitative process that requires a sensibility on the part of practitioners to ensure that principles of equity and democracy define both the implementation of the tool and its subsequent evaluation of success or failure.

Applying these concepts to HIA is imperative since the complexities of health and assessing health outcomes should guide the full process. The tools that have been developed as part of this thesis are intended to draw out the nuances around such interpretations of health and identify where differing approaches and thought processes may influence the process, even as we acknowledge that no such assessment is ever perfectly definitive or absolute. In totality, these methods and tools have been designed to increase transparency not only to streamline and clarify an inconsistent process, but to foster a comprehensive discussion of health and the factors that influence it. Without identifying the context around the HIA, and taking a step back to understand the entire picture with respect to health, the results and recommendations may be limited in their usefulness and application.

8.1.2 Relevance and Achievements

Overall, this research has both improved upon aspects of HIA, while also developing new methods and tools for conducting HIA. Where existing tools were adequate, the research did not attempt to “re-invent the wheel”; rather it focused on aspects that were missing or could be improved.

In addition to addressing specific knowledge gaps, there were key themes that influenced this research. One of the universal themes throughout the thesis is the need to develop more systematic and transparent HIA methods. There has been widespread concern that HIA assessment processes are often subjective and unscientific. The current research provided tools to reduce such arbitrary judgments and increase transparency and reliability of recommendations. Another consistent theme within this thesis is the practicality of the methods being developed. New methods and tools are only useful if they are practical and
efficient. In cases where the methodology was too cumbersome, or the process was too lengthy, the approach was re-visited and streamlined to improve efficiency.

One of the overarching goals of this doctoral research was to identify ways in which to apply theoretical concepts to a multitude of “real-world” projects. This meant developing transparent, user-friendly and practical tools that could be applied to actual HIA scenarios. In doing so, there is the potential for these methods to extend beyond academic research and be useful to practitioners and decision-makers around the world. This goal was an underlying component to all of the research objectives addressed within the thesis.

During development of new approaches a detailed understanding of existing methods and tools that are currently available is required. Due to the interest in HIA guidance and practice over the past few decades, there is a large volume of work to evaluate. Additionally, since HIA is conducted in many countries around the world, in order to adequately understand the state of the practice, international advancements must also be considered. For this reason, a comprehensive literature review and gap analysis were undertaken at the outset of conducting this research to gain an understanding of HIA at a global level. Additionally, when developing specific tools, a search for specific methodological approaches was carried out to highlight further needs.

Another challenge in developing tools that aim to be systematic and transparent is to do so in a way that is as objective as possible. For example, in developing the HIA Screening Tool, it was important to ensure that the questionnaire and scoring were neutral in tone, rather than leading the user to favoring one specific answer. Additionally, assigning a points system to each of the potential responses introduced the possibility that different answers could potentially be weighted in such a way that was biased toward a certain outcome. In order to ensure that the tool overall, as well as the scoring system specifically, were effective in reaching an outcome that was rational and justifiable, it was fully tested. An international group of experts, including HIA practitioners, government officials, and public health professionals, who would be expected to use such a tool, participated in the testing. Despite some variability in the results, it was clear that the tool was ultimately effective in its ability to derive a consistent conclusion for each case study scenario.
Not only was developing a neutral and objective set of methods and tools important; there was also a need to provide tools that could be applied to a wide range of potential scenarios. Ideally, the tools were intended for use on a multitude of projects and policies across various sectors. To this end, the development process had to be iterative, testing and re-testing various approaches and methods that could be easily applied to diverse scenarios. Although efforts were made to achieve development of highly applicable methods, it was also acknowledged that there will always be unique situations that the tools cannot adequately address. Therefore, for each of the HIA tools developed as part of this thesis, components were included to allow the user to adapt the process to suit their needs. For example, although the scoping tool was created to identify a specific priority order for determinants, it also allows for deviation from that order. If the users deem it necessary, they can provide an alternate assignment of priority (e.g., from a priority 2 to a priority 1) if they provide a rationale and justification for doing so. In this way, the tool maintains consistency, while being flexible enough to adapt to unique situations.

This concept of incorporating some flexibility into the model was also applied to other tools, such as the use of decision-trees. The decision-trees were utilized to allow for a transparent and systematic method of determining health impacts and outcomes. However, it was acknowledged that some situations might arise where the conclusion reached in the decision tree, based on specific effect characteristics (i.e., magnitude, frequency, duration etc.), may not be judged to be suitable for various reasons. To address this challenge, in such cases where the user disagrees with the outcome, it was suggested that an alternate conclusion regarding health effects could be made; however, a sound rationale should be provided.

The use of decision-trees in the development of HIA tools was challenging but found to be highly effective. This approach was useful in its ability to show a large range of potential pathways to different outcomes, which allows the decision-makers and other stakeholders who read and interpret the HIA to see exactly how a conclusion was reached. Whether or not they agree with the conclusions, stakeholders are able to follow and understand how the HIA was conducted and how the outcomes and recommendations came to be. This is a major advantage for HIA practice because of the multitude of stakeholders who may be relying on the HIA to gain information and/or to facilitate decision-making.
Overall, there were a number of significant findings and advancements in the field of HIA made through completion of this doctoral work. In accordance with the identified research objectives, several novel approaches to conducting key steps of the HIA process were developed and applied to case studies and real-world projects. This research is timely, and highly relevant to the HIA community and to decision makers worldwide. The following are several key achievements associated with this doctoral research in advancing the field of HIA, including:

I. **Advancement of the field of HIA through development of several new methods and tools:** The tools that were developed address key gaps in HIA research and practice by providing a consistent, systematic and transparent approach to various steps of the HIA process, including screening, scoping and assessment.

II. **Successful testing and application of tools to case studies and real-world projects:** Several of the HIA tools that were developed were successfully tested using case studies and/or real-world application to projects, proving that they work in achieving their intended function. In developing and testing these tools, the research objectives that were developed in this thesis were achieved.

III. **HIA Community interest in the research:** Since publication of four chapters, positive responses have been received from the HIA community. In addition, the work has been cited, and the screening and scoping tools applied to an on-going Waste-to-Energy project through Metro Portland in Portland, Oregon. Finally, requests have been received from researchers in Australia to obtain and apply these HIA tools to some of their upcoming projects. This level of interest is promising for future research and development within the field of HIA and provides further opportunity for international collaboration.

IV. **Garnering attention from academics, government decision-makers and public health officials:** As the research progressed, an invitation was extended to give a presentation (March, 2016) on HIA to several key government officials from various departments including Health Canada EA Branch, the Canadian Environmental Assessment Agency, Canadian Nuclear Safety Commission, Department of Fisheries...
and Oceans, Transport Canada, Parks Canada, Environment and Climate Change Canada, and the First Nations and Inuit Health Branch among others. Additionally, Public Health Ontario requested a seminar on HIA as part of their Occupational and Environmental Health Seminar Series (October, 2016). These requests indicate that this research has garnered considerable interest and advanced the role of HIA in decision-making.

8.1.3 Limitations

Despite the timely nature of this research and its relevance and applicability to the field of HIA, there are some limitations. Given that the majority of this doctoral work was focused on addressing a need for improved methods and tools in HIA, the limitations are largely associated with the tool development and testing process. For example, in the HIA Screening Tool (Chapter 3) the method of scoring and plotting value and investment was based on a predetermined linear relationship (Figure 1: top left); however, there are several different potential relationships when conducting multi-objective analysis. To address this issue, it is possible for a practitioner to use a different approach when weighing the value against investment by assuming that a different relationship exists than the one applied when the tool was developed. However, the alternate approach that is used should be explicitly stated and an explanation provided for the deviation from the original tool.

With respect to the Systematic HIA Scoping Tool (Chapter 4), although efforts were made to make the tool as broadly applicable as possible, its utility could be limited, especially in situations where there is very little project information or the scope is straightforward with only one or two determinants. The tool was developed in order to provide a method of prioritizing health determinants based on characterizing specific factors, including potential impact, public concern and data availability. However, in some cases, certain pieces of information that are required for the tool to function may not be available. Additionally, the tool may be more useful in cases where there are a high number of determinants to consider, rather than just a few. In cases where the scope is minimal, application of the tool may not be necessary. One final limitation is that this tool has yet to be tested on a real world HIA scenario. Although it has been demonstrated that the tool functions as expected, and does
provide a clear and transparent method of prioritizing health determinants, further testing and implementation could uncover weaknesses.

Similarly, a limitation of the revised Assessment Framework is that it was developed with the intention of integration into the EA process, but this has yet to be demonstrated through real-world application. Although the framework is based on successfully re-testing determinants from the Hermosa Beach project, it would be prudent to apply this framework to a new HIA process within an EA. If the framework can be practically applied both to stand-alone HIAs and within EA processes, then it will have addressed two major gaps within the field of HIA. As it stands, the assessment framework has demonstrated its ability to be used in HIA, but it is still to be confirmed through further testing, whether or not it can be successfully integrated into EA.

8.1.4 Next Steps and Future Research

There remain several areas where this work could be extended, and other areas require further research and development. Based on findings from the literature review (Chapter 2), several key gaps in HIA knowledge and practice were identified. From these gaps a specific set of objectives were identified, each of which was addressed within the thesis:

- **Objective I: To identify clear HIA triggers through a streamlined HIA screening process.** This objective was achieved through development and successful testing of the HIA Screening Tool to identify situations where an HIA is appropriate and includes consideration of the practicality of the process through value vs. investment principles (Chapter 3).

- **Objective II: To develop a transparent and systematic approach to HIA scoping.** This objective was achieved through development of the systematic HIA Scoping Tool that uses a transparent and consistent approach to identifying, prioritizing and scoping an HIA, including budgetary considerations (Chapter 4).

- **Objective III: To develop a method of assessment that is transparent and systematic in its approach to identifying and evaluating health impacts (positive and negative).** This objective was achieved through development of an initial HIA
assessment framework that was successfully tested on a real-world oil drilling project in Hermosa Beach (Chapter 5).

- **Objective IV**: To improve the HIA process to allow for better integration within existing legislated EA processes. This objective was achieved through revision and case testing of the initial assessment framework to improve upon the methodology and better align the processes within the EA framework (Chapter 6).

- **Objective V**: To acknowledge and identify uncertainties within HIA practice and methodology, including subjective aspects of decision-making and tool development. This objective was achieved through identification of specific “human” aspects of HIA that can influence the process and outcomes, including a critical analysis these aspects in relation to the methods and tools that were developed as part of this thesis (Chapter 7).

Collectively, these objectives addressed several of the research needs identified in the literature review of HIA methodology and practice. Table 1 summarizes the extent to which this doctoral work addresses major gaps identified in the field of HIA.

**Table 8.1  Gaps in HIA research and advancements from the PhD research**

<table>
<thead>
<tr>
<th>Identified Gap (from Chapter 2)</th>
<th>Addressed in PhD research?</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) The lack of consistency and the nature of HIA triggers</td>
<td>Yes</td>
<td>HIA Screening Tool (value versus investment)</td>
</tr>
<tr>
<td>(ii) Consistent scoping and stakeholder engagement approaches needed</td>
<td>Partial</td>
<td>Systematic HIA Scoping Tool (prioritizing determinants)</td>
</tr>
<tr>
<td>(iii) Use of evidence and transparency in decision-making</td>
<td>Partial</td>
<td>Transparency in HIA methods and tools</td>
</tr>
<tr>
<td>(iv) Reproducibility of assessment methods lacking</td>
<td>Yes</td>
<td>Assessment Framework</td>
</tr>
<tr>
<td>(v) Consistent monitoring and evaluation protocols needed</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>(vi) Integration of HIA within existing regulatory frameworks</td>
<td>Yes</td>
<td>Revised Assessment Framework for EA integration</td>
</tr>
</tbody>
</table>

Regarding the need for consistent scoping and stakeholder engagement activities, more work remains to be done. That being said, the topic of stakeholder engagement could constitute a thesis unto itself. Although some resources are available for engaging stakeholders in HIA, there is no consistent and widely-accepted approach to addressing stakeholder engagement. Therefore, this aspect of HIA practice remains highly variable and more work in this area
needs to be done. Specifically, future research should consider: (i) the types of stakeholders vital to the HIA process; (ii) effective methods of building relationships and fostering communication; (iii) methods for obtaining meaningful and useful information from individuals and groups; (iv) how stakeholder values impact the HIA process; and, (v) how to best incorporate stakeholder information into the HIA in a way that truly impacts the process and outcomes.

While this doctoral thesis focused on developing systematic and transparent HIA methods, the fact is that the use of evidence in HIA remains an issue and is highly variable within the practice. HIAs are conducted on such a wide range of projects and policies that further research is required around the different types of data that should be used in an HIA, depending on the level of detail (rapid, intermediate, comprehensive) and types of determinants being considered. Special consideration should be given to addressing situations where adequate data is not available.

The one gap that was identified in the literature review that has yet to be addressed on any level is the need for consistent protocols for monitoring and evaluation. As the last two steps of HIA, they are often not included at all, and when they are included, they lack rigour and consistency. Future research could focus on the impact of the evaluation step and whether the process can be improved until HIA evolves into a standard and consistent practice. As for monitoring, it is highly dependent on the HIA and specific recommendations that were made. It is also dependent on budget and resource constraints. Additional research in this area should focus on how to make monitoring protocols consistent, efficient and impactful.

Expanding upon the present research, further testing of the screening, scoping and assessment tools is a logical next step. Applying the tools individually and in combination to a variety of real-world applications that include large and small-scale projects and policy initiatives would allow for further refinement and improvement. Additionally, applying the revised Assessment Framework to an EA process that integrates HIA would provide an adequate test case for the framework and act as a demonstration of the benefits and pitfalls of merging these two assessment processes. Given that the future of HIA is leaning toward
tying it into existing processes that are already established and regulated in many countries around the world, this is a timely and logical step in the evolution of HIA practice.

8.2 Conclusions

In developing a series of HIA tools that achieve the goal of promoting consistency and transparency within HIA methodology, while being efficient and practical in their application, this research project has addressed one of the major gaps in HIA research and practice. Further, the testing and application of these tools show promise in promoting further application in the future. The fact that the research has garnered attention from the HIA community and decision-makers across Canada is encouraging.

Additionally, the development of a platform for integration of HIA and EA addresses a current need within Canada and abroad. Currently, the Government of Canada is undertaking a review of the Canadian Environmental Assessment Act (2012). The Minister of Environment and Climate Change is specifically mandated to review the EA process to introduce new and fair processes that lead to “robust oversight and thorough environmental assessments” and also to ensure “decisions are based on science, facts and evidence and serve the public’s interest” (Government of Canada, 2016). This presents a rare opportunity to provide input into legislation that could promote health as an element of the EA process. From this perspective, the current research that has been conducted is both timely and relevant.

The field of HIA continues to evolve in its theory and application. Through continued support from governments, researchers, practitioners and communities, HIA has the potential to be applied as a powerful decision-making tool. This research has hopefully provided a foundation for the continued development and application of methods and tools to foster a more consistent approach to HIA practice. Through this work, now and in the future, the main goal continues to be the development of HIA as a reliable, consistent, systematic and transparent method of evaluating potential impacts on human health and well-being.
8.3 References


Case Study #1: WTE Facility in small Canadian town

A large-scale industrial waste-to-energy (WTE) facility is proposed for placement on the outskirts of a small middle-class town in Canada. The proposed project site is immediately adjacent to residential homes and a school with a daycare; however, there are also two other potential sites that are being considered as part of the decision-making process. The facility will process municipal waste and will create chemical emissions that will be released via a stack after being treated by pollution control technology. A relatively new type of WTE process is being considered, so the impacts are not well understood. Some modeled data are available on these chemical emissions as well as traffic volumes and noise levels. The facility will employ 200 tradespeople during construction and 25-40 full-time staff for the duration of operations which are expected to last 30 years. Local residents are extremely concerned about health impacts from this project and have called for an HIA to be completed before the project is approved so it can influence many aspects of the decision-making process. The local health authority is interested in pursuing an HIA; however there is a limited amount of public health information available for a baseline assessment. The developer has offered to provide a modest budget to cover an intermediate assessment (to be conducted by hired consultants with some community input), including extensive stakeholder engagement (public meetings, workshops, etc.), and multiple peer-reviewers which are being demanded by the public and local officials. There is a local opposition group protesting the project and local media outlets have covered the controversy. However, although the local governing council is interested in the impacts of this facility, they also have other higher priorities on their political agenda, such as improving the local school system.

Case Study #2: Addition of a bike lane to streets in an urban US city

Last year a major road in an urban city in the US has added bike lanes to one of its major streets in an affluent area of the city prone to traffic congestion but with no known vulnerable populations. Now the local officials want to know what the health impacts of the decision were on community health by conducting a rapid HIA with a single peer-reviewer to enhance credibility. There is a very limited budget for this HIA that may or may not be enough, and little to no public interest. There will be minimal stakeholder engagement and no comment period. The city officials want to include the construction phase in the HIA to evaluate whether the benefits of having the bike lanes outweigh the impacts of construction emissions (diesel, dust, noise, etc.). There is some baseline public health and traffic data available along with community member testimonies about the benefits and drawbacks of the new lanes. Improving traffic congestion and promoting active transportation are among the city’s highest priorities and they are considering whether to pursue similar projects in the future.

Case Study #3: Large Gold Mine in remote African village

A large gold mine is being proposed near a remote African village. The mine site has been selected and construction is set to commence within six months; however, the final operational design has not yet been approved. The local community has concerns regarding health issues and have been active in demanding environmental and health assessments be conducted. The proponent has offered to provide the necessary funding for a detailed HIA, including community engagement activities, including public comments and responses and multiple peer-reviewers. There is currently no baseline health data, so it will need to be collected and the scale of impacts is largely unknown. The local authorities are in favour of the mining project going ahead, citing community benefits and jobs as the major reasons; however, they also have political interests in the project. The village closest to the site is very poor, with the majority of residents lacking access to adequate food, water and shelter. Although a skilled-labour workforce will be brought in for mine operations, the proponent has committed to training any locals interested in gaining employment.
The proponent has also promised to provide health care and a new school for the community; however, the mining operations will no doubt have a negative environmental impact on air pollution.

**Case Study #4: Highway expansion to reduce congestion between two major cities**

The government has initiated an expansion project along a major highway to reduce congestion between two major cities, thereby reducing idling time and air pollution. After construction began a local health official suggested that an HIA be conducted to evaluate health impacts on a handful of rural middle-class towns within approximately 10 km of the highway. Although the HIA could affect construction practices (i.e., limitation of dust, truck traffic) it will not impact the scope of the highway expansion itself since it has already been approved and is underway; however, it could impact future projects. The health official championing the HIA is requesting a detailed assessment with community workshops and a peer-review process; however, there is little to no public interest/concern. Due to the location of the highway there are no communities adjacent to the expansion project and no vulnerable populations. There is also limited public health data available. Currently, there is also no confirmed funding for this HIA, although the public health official is hopeful that something will come through since the expansion somewhat aligns with their health agency’s mandate to assess health and transportation.

**General Feedback:**

Once you have completed the HIA Screening for each of the above case studies please take a minute to respond to the following general questions regarding the clarity, ease of use and applicability of the tool overall.

1. In your opinion, how user friendly is the tool?
2. Were there any places in the tool you would have liked additional clarification or detail?
3. Would you use this tool to facilitate HIA Screening in your profession?
4. Would you be open to being contacted by the researcher to further discuss your feedback and suggestions for improvement?
Development of an HIA Screening Tool: Value vs Investment

The following is an HIA Screening Tool that was developed based on a need for a tool that clearly and consistently determines whether HIA is a viable option, what type of HIA is being considered, and whether HIA is practical from an investment versus value perspective. Please record your responses.

SECTION A: Is HIA a viable assessment option?

The first step in this screening tool evaluates the key components of the proposed initiative (e.g., project/policy/program) to identify whether HIA is a viable assessment option. Circle the appropriate response in the flow chart below. If you determine that HIA is a viable option, proceed to Section B. If you determine that HIA is not a viable option, no further screening is necessary. If you determine that HIA is a viable option, but other types of assessments could be considered, proceed with the screening with this in mind.
SECTION B: What type of HIA is most applicable if one is to be undertaken?

The second step in this screening tool involves identifying the type of HIA that would be undertaken. This is considered an important aspect of the tool since ‘HIA’ has been used as a blanket term for many different types of assessment approaches, objectives and methods. Before deciding to initiate an HIA, it is important to have a clear understanding of what type of HIA is suitable and what the end-product will look like. This is vital since there have been issues with the process of HIA not being carefully defined, which leads to stakeholders having conflicting expectations of the process. It is important that those involved in the screening process have a clear and consistent idea of what they are committing to should they decide to proceed with an HIA. This tool intends to provide a clear foundation for ensuring that decision makers are on the same page when they are discussing whether or not to conduct an HIA.

There are four key aspects that will help to determine the type of HIA that will be conducted if it goes forward: (I) What is the overall approach to the HIA? (II) What types of evidence will be used as the basis for the HIA? (III) What level of stakeholder engagement can be expected? (IV) What is the anticipated level of effort required to conduct the HIA? In this Section, each of these questions is posed below with three optional answers. For each question, check the box that most closely aligns with the type of HIA that would be carried out for the proposed project/policy. Each combination of answers helps to define a different ‘type’ of HIA. This exercise will help to provide a foundation for answering questions throughout the screening tool and provide a clear description of what ‘HIA’ means during discussions about whether or not to proceed with the assessment. However, this section is only intended to provide a general overview of the type of HIA to be undertaken. If it is decided that an HIA will be completed for the proposed project/policy, then a detailed scoping exercise should be conducted to further define the process.

Once you have selected one response for each question (i.e., check one box per row), proceed to Section C.
I. What approach will be used in the HIA?

- **TECHNICAL**
  - The HIA will be a technical document that is conducted and written in the style of a scientific report.
  - The language will be geared toward a technical audience; however, a plain language summary can be included.
  - The HIA will generally follow a scientific methodology in its use of data and analytical techniques.

- **NON-TECHNICAL**
  - The HIA will be a non-technical document that is conducted and written in the style of a narrative or written commentary.
  - The language will not be technical, plain.
  - The HIA will generally follow a qualitative, rather than quantitative methodology in its use of evidence and analytical techniques.

- **HYBRID**
  - The HIA will contain both technical and non-technical aspects.
  - The report will be written in the style of a scientific document but with non-technical summaries, figures and supplementary materials.
  - The HIA will contain both technical and non-technical methods including a hybrid of data and analytical techniques.

II. What evidence-base will be relied upon for the HIA?

- **QUANTITATIVE**
  - The HIA and associated recommendations will be largely based on the collection, analysis, and assessment of quantitative data.
  - Numerical data (concentrations, exposure levels, health/census data, meta-analyses, etc.) will be the primary focus of the assessment, including screening using quantitative health benchmarks and targets.

- **QUALITATIVE**
  - The HIA and associated recommendations will be largely based on the collection, analysis, and assessment of qualitative data.
  - Non-numerical evidence (interviews, commentary, focus groups, literature reviews, etc.) will be the primary focus of the assessment, including aboriginal traditional knowledge and oral histories.

- **SEMI-QUANTITATIVE**
  - The HIA and associated recommendations will be based on the collection, analysis, and assessment of a combination of quantitative and qualitative data.
  - Both numerical and non-numerical evidence will be used in the HIA where appropriate.

III. What is the expected level of community involvement in the HIA process?

- **INFORM**
  - Community members play a passive role in the HIA process.
  - The community is informed about the HIA approach and findings but do not contribute to the process.
  - The community has little to no control over the HIA scope, methods, assessment or recommendations.

- **CONSULT**
  - The community plays an active role in certain aspects of the HIA process.
  - The community is consulted with respect to specific parts of the HIA (typically, the scope of the assessment) and may be allowed to provide public comments on the final report.
  - The community has some control over the HIA.

- **CONTROL**
  - The community plays an active role throughout the entire HIA process.
  - The community has full control over the HIA scope, methods, assessment and recommendations.
  - The community may decide to seek out expert advice or assistance but it is at their discretion.

IV. What is the anticipated level of effort required for the HIA?

- **RAPID**
  - The HIA consists of a general desktop exercise in evaluating potential impacts; low-level of detail.
  - Existing and readily available data sources used.
  - Non-complex health issues assessed.
  - Takes 1 full-time equivalent (FTE) assessor ≤1-3 months (Estimated cost of HIA: $10,000-$50,000).

- **INTERMEDIATE**
  - The HIA consists of a site-specific exercise in evaluating potential impacts; moderate-level of detail.
  - Existing sources and site-specific data used (modelled).
  - Non-complex to moderately complex health issues assessed.
  - Takes 1 full-time equivalent (FTE) assessor 3-6 months (Estimated cost of HIA: $50,000-$100,000).

- **DETAILED**
  - The HIA consists of an in-depth exercise in evaluating potential impacts; high-level of detail.
  - Existing sources, site-specific data (modelled and collected).
  - Moderate to highly complex health issues assessed.
  - Takes 1 full-time equivalent (FTE) assessor >6 months (Estimated cost of HIA: > $100,000).
The next step of this HIA screening tool is intended to provide a simple analysis of the investment required to conduct the HIA versus the potential value of the process to determine the practicality of conducting an HIA for the project/policy proposal. Select one response for each of the following questions pertaining to the investment required to conduct the HIA and the potential value obtained. The results will be plotted to provide guidance on whether or not an HIA is recommended. This section is intended to provide a consistent set of questions by which to decide whether to conduct an HIA, from a practical (i.e., value vs investment) perspective. Regardless of the results obtained, proceed to Section D.

**SECTION C: Is an HIA practical from an investment vs value perspective?**

DETERMINING HIA INVESTMENT

**QUESTION 1. What is the anticipated level of assessment required for the HIA from Section B?**

- Rapid desktop assessment – provides a broad overview of potential impacts, ideally used on small-scale projects or local policies with little impact expected (1 point)
- Intermediate assessment – provides a more comprehensive assessment of impacts; ideally used for medium-scale projects or policies with some more complex impacts expected (2 points)
- Detailed assessment – provides an in-depth site-specific evaluation of impacts; ideally used for large-scale projects or far-reaching policy initiatives with complex impacts and interactions expected (3 points)

Rationale & Comments: ____________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

**QUESTION 2. How much baseline public health data exists for the area / population impacted by the proposal?**

- Baseline data is not required (0 points)
- A sufficient amount of public health data is available to conduct a thorough baseline health assessment (e.g., data available on: general health status; lifestyle factors including physical activity, drug and alcohol use; chronic diseases; access to health care; emergency room visits; mortality; injuries; and socio-demographics); no additional data collection is required (1 points)
- A limited amount of public health data available to conduct a partial baseline health assessment (e.g., some data available on: general health status, lifestyle factors, socio-demographics but none on specific disease incidence/prevalence, mortality/morbidity); some additional data collection may be required (2 points)
- No public health data is available; data collection may be required in order to conduct a baseline assessment (3 points)

Rationale & Comments: ____________________________________________________________
____________________________________________________________________________________

**QUESTION 3. What level of stakeholder/community engagement is anticipated for the HIA? Note:**

*Stakeholders can include members of the community, general public, government or health agency officials, politicians, NGOs and others that would likely be involved in the process through engagement activities.*

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- None (0 points)
- Low – minimal interaction with a limited number of relevant stakeholders; no community outreach (1 point)
- Medium – some community/stakeholder outreach including a public information session, workshop or community meeting (2 points)
- High – extensive community/stakeholder outreach including public surveys, community meetings, workshops, open houses, key informant interviews etc. (3 points)

**Rationale & Comments:** ________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

**QUESTION 4. Is the available budget/resources sufficient to conduct an appropriately-scoped HIA? Note: a ‘sufficient’ budget is defined as having enough funding and resources readily available to conduct the HIA (as defined in Section B).**

- Yes – budget/resources are sufficient to conduct the type of HIA identified in Section B (1 point)
- Maybe – budget/resources may not be sufficient to conduct the type of HIA identified in Section B (2 points)
- No – budget/resources are not nearly sufficient to conduct the type of HIA identified in Section B (3 points)

*Note: if you selected “no” consider re-visiting Section B to identify whether a less rigorous type of HIA could be substituted, given budget restrictions. Alternatively, depending on the outcome of the screening exercise this may be used to justify additional budgetary/resource allocation.*

**Rationale & Comments:** ________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

**QUESTION 5. Will the HIA be subject to a peer-review process that could have additional schedule and/or budget implications (e.g., time for review, responding to comments, revising HIA, etc.)?**

- No – the HIA will only be subject to an internal HIA review (1 point)
- Yes – the HIA will be subject to an external peer-review process; 1 reviewer (2 points)
- Yes – the HIA will be subject to an external peer-review process; multiple reviewers, or stakeholder/public comments that will be required to be addressed prior to finalizing the assessment (3 points)

**Rationale & Comments:** ________________________________________________________________
____________________________________________________________________________________

Add up the points from your responses to Question 1-5 to obtain your total HIA “investment” score.

**HIA INVESTMENT = __________ points**

**UNCERTAINTY ANALYSIS (HIA INVESTMENT):** Overall, what is your level of certainty regarding the responses provided for Question 1-5?

- High – very certain regarding the accuracy of all of the above responses (1 point)
DETERMINING HIA VALUE

QUESTION 6: How important is the proposal to current priorities in the applicable government or health agency? For example, is the proposal related/aligned to a current political agenda, local mandate or master plan?

- Not important – does not align with any government or health agency priorities (1 point)
- Somewhat important – generally aligns with government or health agency priorities (2 points)
- Very important – specifically identified by government or health agency as a high priority (3 points)

Rationale & Comments: ____________________________________________________________
________________________________________________________________________________
________________________________________________________________________________

QUESTION 7. To what extent could conducting an HIA influence the decision-making process?

- The HIA could influence future decision making processes through evaluation of historical conditions, but may not have an immediate impact (e.g., retrospective HIA) (1 point)
- The HIA could influence certain aspects of decision-making with respect to a policy/project initiative that is currently being implemented (e.g., concurrent HIA) (2 points)
- The HIA could influence the terms and scope of a proposed policy/project and heavily influence the decision-making process (e.g., prospective HIA) (3 points)

Rationale & Comments: ____________________________________________________________
________________________________________________________________________________

QUESTION 8. Based on the preliminary information available, to what extent could the proposal impact any of the determinants of health, including physical, social or economic aspects of health and well-being?

- The impacts are expected to be positive (i.e., provide an overall benefit to health) with some potential for negligible negative impacts (1 point)
- Some negative impacts may be expected; however, they are anticipated to be minor (i.e., no possibility of severe or long-term health issues or fatality) without assessment and/or mitigation (2 points)
- Negative impacts are expected and could be major (i.e., possibility of severe or long-term health issues or fatality) without assessment and/or mitigation (3 points)

Rationale & Comments: ____________________________________________________________
________________________________________________________________________________

QUESTION 9: Does the proposal have the potential to impact vulnerable or at-risk populations (e.g., children, elderly, sick, homeless, aboriginal groups, etc.)?

- No – there are no vulnerable populations within the community (1 point)
- Yes – there are vulnerable populations within the community; however, it is unlikely that they would be impacted by the proposal (2 points)
- Yes – there are vulnerable populations within the community that are likely to be affected by the proposal (3 points)

Rationale & Comments: ________________________________________________
__________________________________________________________________
__________________________________________________________________

QUESTION 10. What is the socioeconomic status of the area/region that will be affected by the policy/project? Note: Average is defined as the national average household income level.

- Upper – Community annual household income levels are above the national average (1 point)
- Middle – Community annual household income levels are similar to the national average (2 points)
- Lower – Community annual household income levels are below the national average (3 points)
- Developing Country – the HIA is to be undertaken on a policy/project in a developing country where many people don’t have access to basic human needs (3 points)

Rationale & Comments: ________________________________________________
__________________________________________________________________
__________________________________________________________________

Add up the points from your responses to Question 6-10 to obtain your total HIA “value” score.

HIA VALUE = ____________ points

UNCERTAINTY ANALYSIS (HIA VALUE): Overall, what is your level of certainty regarding the responses provided for Question 6-10?

- High – very certain regarding the accuracy of all of the above responses (1 point)
- Medium – somewhat certain regarding the accuracy of most of the above responses (2 points)
- Low – uncertain regarding the accuracy of most of the above responses (3 points)

To determine whether an HIA is practical from the perspective of comparing the investment required versus value obtained, complete the following steps:

- Determine your HIA investment vs value results by plotting the ‘HIA Investment’ score on the x-axis and the ‘HIA Value’ score on the y-axis of the graph provided below.
- Then determine your total uncertainty score by taking the sum of your HIA investment uncertainty score and your HIA value uncertainty score and dividing by two:
  - Total Uncertainty = (HIA Investment Uncertainty + HIA Value Uncertainty) / 2
- Draw a circle around your data point that represents your total uncertainty. For example, if your HIA Investment Uncertainty is 2 and your HIA Value Uncertainty is 1 then, using the above...
equation \[(2+1) / 2 = 1.5\), your total uncertainty is 1.5 and you would draw a circle around your data point that has a radius of 1.5 on the graph below.

- Note: The uncertainty scoring provides a quantitative estimation of the uncertainty associated with the HIA investment vs value analysis. The value is intended to provide the user with a visual representation of the variability in their potential results; similar to error bars (+/-) used to show variability in bar graphs.

- Once you have plotted your results (including uncertainty; see example below in red) on the graph determine whether the data point falls above or below the center line. Above the line an HIA is practical from a value vs investment perspective (Value>Investment); below the line HIA may not be practical (Value<Investment). When your results fall within the middle section of the graph (indicated by dotted lines) the investment required and value obtained from conducting the HIA are fairly even (value = investment); therefore, additional discussion may be warranted before deciding whether or not to proceed.

- Regardless of your results, continue on to Section D.
Despite the fact that in the majority of situations it is appropriate to apply the HIA screening tool to facilitate decision-making about whether to proceed with an HIA, there may be extenuating circumstances that fall outside of the process.

This follow-up set of questions is intended to serve as a ‘double-check’ and to provide the user with examples of instances where HIA may or may not be necessary regardless of the results of the screening tool. It is not intended to provide any answers, it is simply to facilitate additional discussion before the final decision is made. Check all that are applicable:

**CONSIDER CONDUCTING AN HIA IF ANY OF THE FOLLOWING ARE TRUE:**

- [ ] Overwhelming public concern and/or political pressure to conduct HIA
- [ ] The health impacts are potentially cumulative, complex and/or not well understood
- [ ] There are severe, fatal, and/or irreversible health outcomes
- [ ] There are major social justice or equity issues associated with the proposal
- [ ] The HIA could impact the provision of basic human needs/rights
- [ ] The HIA aligns with the proponents corporate social responsibility

**CONSIDER NOT CONDUCTING AN HIA IF ANY THE FOLLOWING ARE TRUE:**

- [ ] The impacts are limited, well-understood and easily mitigated
- [ ] An HIA was recently conducted on the same type of proposal and is of high quality
- [ ] The HIA has no potential to impact the decision-making process now or in the future
- [ ] The time and budget/resources are too restrictive (note: rapid HIA could be an option here)
- [ ] There is a more appropriate type of assessment that could be conducted instead

**Notes & Comments:**

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
The final section of the HIA Screening Tool is a culmination of all of the previous sections. At this point, all those involved in the process of deciding whether or not to conduct an HIA on the proposal should review and compare their screening results. The following are key discussion points to consider for each section:

Section A: Did everyone come to the same conclusion about whether HIA is a viable assessment option? If not, why? Can these differences be remedied? Can a consensus be reached?

Section B: Did everyone have the same expectations regarding the type of HIA to be conducted? If not, why? Can the group come to a consensus about the expected end-product?

Section C: Did everyone come to the same general conclusion (i.e., HIA recommended vs HIA not recommended)? If not, how different were the scores? How much uncertainty is associated with the proposal? Can changing the type of HIA (Section B) remedy any issues?

Section D: Regardless of the results in Section C, are there any circumstances that promote or prohibit an HIA? Did the group agree on these outlying issues? Can a consensus be reached about whether to go forward with an HIA for the proposal?

It is typical for individual biases, differing interpretations and personal judgements to lead people to different conclusions. This is the time to discuss any inconsistencies or issues and to get clarifications when needed. Ideally, together the group will decide on a course of action (i.e., whether to proceed with an HIA) and will finalize that decision below.

### HIA SCREENING CONCLUSION

- [ ] Proceed with HIA
  Rationale:
  __________________________________________________________
  __________________________________________________________
  __________________________________________________________

- [ ] Do not proceed with HIA
  Rationale:
  __________________________________________________________
  __________________________________________________________
HIA Screening Tool: Answer Sheet

RESULTS FOR TEST CASE #1:

**Section A:** Please check one based on your results
- A Health Impact Assessment (HIA) is a viable assessment option
- An HIA is a viable assessment option; however, consider other assessment types
- An HIA is not a viable assessment option

**Section B:** Please check one from each row based on your results
- Technical
- Non-technical
- Hybrid
- Quantitative
- Qualitative
- Semi-quantitative
- Inform
- Consult
- Control
- Rapid
- Intermediate
- Detailed

**Section C:** Please fill out the number of points allocated based on your results
Investment: Q1__; Q2__; Q3__; Q4__; Q5__ (Total Investment score = _____); Uncertainty = ___
Value: Q6__; Q7__; Q8__; Q9__; Q10__ (Total Value score = _____); Uncertainty = ___

Based on your scores check one of the following:
- HIA Recommended (Value ≥ Investment)
- HIA Not Recommended (Value < Investment)

**Section D:** Please check any/all that apply and comment on whether it influenced your previous results
*CONSIDER CONDUCTING AN HIA IF ANY OF THE FOLLOWING ARE TRUE:*
- Overwhelming public concern and/or political pressure to conduct HIA
- The health impacts are potentially cumulative, complex and/or not well understood
- There are severe, fatal, and/or irreversible health outcomes
- There are major social justice or equity issues associated with the proposal
- The HIA could impact the provision of basic human needs/rights
- The HIA aligns with the proponents corporate social responsibility

*CONSIDER NOT CONDUCTING AN HIA IF ANY THE FOLLOWING ARE TRUE:*
- The impacts are limited, well-understood and easily mitigated
- An HIA was recently conducted on the same type of proposal and is of high quality
- The HIA has no potential to impact the decision-making process now or in the future
- The time and budget/resources are too restrictive (note: rapid HIA could be an option here)
- There is a more appropriate type of assessment that could be conducted instead

Comments:

**Section E:** Please check one of the following based on your results
- Proceed with HIA
- Do not proceed with HIA

Comments:
RESULTS FOR TEST CASE #2:

Section A: Please check one based on your results
__ A Health Impact Assessment (HIA) is a viable assessment option
__ An HIA is a viable assessment option; however, consider other assessment types
__ An HIA is not a viable assessment option

Section B: Please check one from each row based on your results
__ Technical
__ Non-technical
__ Hybrid
__ Quantitative
__ Qualitative
__ Semi-quantitative
__ Inform
__ Consult
__ Control
__ Rapid
__ Intermediate
__ Detailed

Section C: Please fill out the number of points allocated based on your results
Investment: Q1 __; Q2 __; Q3 __; Q4 __; Q5 __ (Total Investment score = _____); Uncertainty = ____
Value: Q6 __; Q7 __; Q8 __; Q9 __; Q10 __ (Total Value score = _____); Uncertainty = ____

Based on your scores check one of the following:
__ HIA Recommended (Value ≥ Investment)
__ HIA Not Recommended (Value < Investment)

Section D: Please check any/all that apply and comment on whether it influenced your previous results
CONSIDER CONDUCTING AN HIA IF ANY OF THE FOLLOWING ARE TRUE:
__ Overwhelming public concern and/or political pressure to conduct HIA
__ The health impacts are potentially cumulative, complex and/or not well understood
__ There are severe, fatal, and/or irreversible health outcomes
__ There are major social justice or equity issues associated with the proposal
__ The HIA could impact the provision of basic human needs/rights
__ The HIA aligns with the proponents corporate social responsibility

CONSIDER NOT CONDUCTING AN HIA IF ANY THE FOLLOWING ARE TRUE:
__ The impacts are limited, well-understood and easily mitigated
__ An HIA was recently conducted on the same type of proposal and is of high quality
__ The HIA has no potential to impact the decision-making process now or in the future
__ The time and budget/resources are too restrictive (note: rapid HIA could be an option here)
__ There is a more appropriate type of assessment that could be conducted instead

Comments:

Section E: Please check one of the following based on your results
__ Proceed with HIA
__ Do not proceed with HIA

Comments:
RESULTS FOR TEST CASE #3:

Section A: Please check one based on your results
__ A Health Impact Assessment (HIA) is a viable assessment option
__ An HIA is a viable assessment option; however, consider other assessment types
__ An HIA is not a viable assessment option

Section B: Please check one from each row based on your results
__ Technical  ___ Non-technical  ___ Hybrid
__ Quantitative ___ Qualitative ___ Semi-quantitative
__ Inform    ___ Consult    ___ Control
__ Rapid ___ Intermediate ___ Detailed

Section C: Please fill out the number of points allocated based on your results
Investment: Q1 __; Q2 __; Q3 __; Q4 __; Q5 __ (Total Investment score = _____); Uncertainty = ___
Value: Q6 __; Q7 __; Q8 __; Q9 __; Q10 __ (Total Value score = _____); Uncertainty = ___

Based on your scores check one of the following:
__ HIA Recommended (Value ≥ Investment)
__ HIA Not Recommended (Value < Investment)

Section D: Please check any/all that apply and comment on whether it influenced your previous results
CONSIDER CONDUCTING AN HIA IF ANY OF THE FOLLOWING ARE TRUE:
__ Overwhelming public concern and/or political pressure to conduct HIA
__ The health impacts are potentially cumulative, complex and/or not well understood
__ There are severe, fatal, and/or irreversible health outcomes
__ There are major social justice or equity issues associated with the proposal
__ The HIA could impact the provision of basic human needs/rights
__ The HIA aligns with the proponents corporate social responsibility

CONSIDER NOT CONDUCTING AN HIA IF ANY OF THE FOLLOWING ARE TRUE:
__ The impacts are limited, well-understood and easily mitigated
__ An HIA was recently conducted on the same type of proposal and is of high quality
__ The HIA has no potential to impact the decision-making process now or in the future
__ The time and budget/resources are too restrictive (note: rapid HIA could be an option here)
__ There is a more appropriate type of assessment that could be conducted instead

Comments:

Section E: Please check one of the following based on your results
__ Proceed with HIA
__ Do not proceed with HIA

Comments:
RESULTS FOR TEST CASE #4:

Section A: Please check one based on your results
__ A Health Impact Assessment (HIA) is a viable assessment option
__ An HIA is a viable assessment option; however, consider other assessment types
__ An HIA is not a viable assessment option

Section B: Please check one from each row based on your results
__ Technical __ Non-technical __ Hybrid
__ Quantitative __ Qualitative __ Semi-quantitative
__ Inform __ Consult __ Control
__ Rapid __ Intermediate __ Detailed

Section C: Please fill out the number of points allocated based on your results
Investment: Q1 __; Q2 __; Q3 __; Q4 __; Q5 __ (Total Investment score = ___); Uncertainty = ___
Value: Q6 __; Q7 __; Q8 __; Q9 __; Q10 __ (Total Value score = ___); Uncertainty = ___

Based on your scores check one of the following:
__ HIA Recommended (Value ≥ Investment)
__ HIA Not Recommended (Value < Investment)

Section D: Please check any/all that apply and comment on whether it influenced your previous results
CONSIDER CONDUCTING AN HIA IF ANY OF THE FOLLOWING ARE TRUE:
__ Overwhelming public concern and/or political pressure to conduct HIA
__ The health impacts are potentially cumulative, complex and/or not well understood
__ There are severe, fatal, and/or irreversible health outcomes
__ There are major social justice or equity issues associated with the proposal
__ The HIA could impact the provision of basic human needs/rights
__ The HIA aligns with the proponents corporate social responsibility

CONSIDER NOT CONDUCTING AN HIA IF ANY OF THE FOLLOWING ARE TRUE:
__ The impacts are limited, well-understood and easily mitigated
__ An HIA was recently conducted on the same type of proposal and is of high quality
__ The HIA has no potential to impact the decision-making process now or in the future
__ The time and budget/resources are too restrictive (note: rapid HIA could be an option here)
__ There is a more appropriate type of assessment that could be conducted instead

Comments:

Section E: Please check one of the following based on your results
__ Proceed with HIA __ Do not proceed with HIA

Comments:
GENERAL FEEDBACK

Once you have completed the HIA Screening for each of the above case studies please take a minute to respond to the following general questions regarding the clarity, ease of use and applicability of the tool overall.

1. In your opinion, how user friendly is the tool?

2. Were there any places in the tool you would have liked additional clarification or detail?

3. Would you use this tool to facilitate HIA Screening in your profession?

4. Would you be open to being contacted by the researcher to further discuss your feedback and suggestions for improvement?
HEALTH IMPACT ASSESSMENT (HIA) SCREENING TOOL: A VALUE vs. INVESTMENT APPROACH

The following is an HIA Screening Tool that was developed based on a need for a tool that clearly and consistently determines whether HIA is a viable option, what type of HIA is being considered, and whether HIA is practical from an investment versus value perspective. Please read all instructions.

SECTION A: Is HIA a viable assessment option?

The first step in this screening tool evaluates the key components of the proposed initiative (e.g., project/policy/program) to identify whether HIA is a viable assessment option. Circle the appropriate response in the flow chart below. If you are uncertain about the answer, employ the precautionary principle and err on the side of caution when impacts are unknown. If you determine that HIA is a viable option, proceed to Section B. If you determine that HIA is not a viable option, do not proceed through the tool, no further screening is necessary. If you determine that HIA is a viable option, but other types of assessments could be considered, proceed with the screening with this in mind.

A Health Impact Assessment (HIA) is a viable option.
A Health Impact Assessment is a viable option; however, consider other assessment types.
A Health Impact Assessment (HIA) is not a viable option. Stop Screening.
The second step in this screening tool involves identifying the type of HIA that would be undertaken. This is considered an important aspect of the tool since ‘HIA’ has been used as a blanket term for many different types of assessment approaches, objectives and methods. Before deciding to initiate an HIA, it is important to have a clear understanding of what type of HIA is suitable and what the end-product will look like. This is vital since there have been issues with the process of HIA not being carefully defined, which leads to stakeholders having conflicting expectations of the process. It is important that those involved in the screening process have a clear and consistent idea of what they are committing to should they decide to proceed with an HIA. This tool intends to provide a clear foundation for ensuring that decision makers, including major stakeholders, are on the same page when they are discussing whether or not to conduct an HIA.

There are three key aspects that will help to determine the type of HIA that will be conducted if it goes forward: (I) What types of evidence will be used as the basis for the HIA? (II) What level of stakeholder engagement can be expected? (III) What is the anticipated level of effort required to conduct the HIA? In this Section, each of these questions is posed below with three optional answers. For each question, check the box that most closely aligns with the type of HIA that would be carried out for the proposed project/policy. Each combination of answers helps to define a different ‘type’ of HIA. This exercise will help to provide a foundation for answering questions throughout the screening tool and provide a clear description of what ‘HIA’ means during discussions about whether or not to proceed with the assessment. However, this section is only intended to provide a general overview of the type of HIA to be undertaken. If it is decided that an HIA will be completed for the proposed project/policy, then a detailed scoping exercise should be conducted to further define the process.

Once you have selected one response for each question (i.e., check one box per row), proceed to Section C.
### I. What evidence-base will be relied upon for the HIA?

<table>
<thead>
<tr>
<th>QUANTITATIVE</th>
<th>QUALITATIVE</th>
<th>SEMI-QUANTITATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The HIA and associated recommendations will be largely based on the collection, analysis and assessment of quantitative data.</td>
<td>- The HIA and associated recommendations will be largely based on the collection, analysis and assessment of qualitative data.</td>
<td>- The HIA and associated recommendations will be largely based on the collection, analysis and assessment of a combination of quantitative and qualitative data.</td>
</tr>
<tr>
<td>- Numerical data (concentrations, exposure levels, health/census data, meta-analyses, etc.) will be the primary focus of the assessment; including screening using quantitative health benchmarks and targets.</td>
<td>- Non-numerical evidence (interviews, commentary, focus groups, literature reviews etc.) will be the primary focus of the assessment; including aboriginal traditional knowledge and oral histories.</td>
<td>- Both numerical and non-numerical evidence will be used in the HIA where appropriate.</td>
</tr>
</tbody>
</table>

### II. What is the expected level of community involvement in the HIA process?

<table>
<thead>
<tr>
<th>INFORM</th>
<th>CONSULT OR PARTNER</th>
<th>CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Community members play a passive role in the HIA process.</td>
<td>- The community plays an active role in certain aspects of the HIA process.</td>
<td>- The community plays an active role throughout the entire HIA process.</td>
</tr>
<tr>
<td>- The community is informed about the HIA approach and findings but do not contribute to the process.</td>
<td>- The community is consulted with respect to specific parts of the HIA (typically, the scope of the assessment) and may be allowed to provide public comments on the final report.</td>
<td>- The community has significant control over the HIA scope, methods, assessment and recommendations.</td>
</tr>
<tr>
<td>- The community has little to no control over the HIA scope, methods, assessment or recommendations.</td>
<td>- The community has some control over the HIA.</td>
<td>- The community may decide to seek out expert advice or assistance but it is at their discretion.</td>
</tr>
</tbody>
</table>

### III. What is the anticipated level of effort required for the HIA?

<table>
<thead>
<tr>
<th>RAPID</th>
<th>INTERMEDIATE</th>
<th>DETAILED</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The HIA consists of a general desktop exercise in evaluating potential impacts, low-level of detail.</td>
<td>- The HIA consists of a site-specific exercise in evaluating potential impacts; moderate-level of detail.</td>
<td>- The HIA consists of an in-depth exercise in evaluating potential impacts; high-level of detail.</td>
</tr>
<tr>
<td>- Existing and readily available data sources used.</td>
<td>- Existing sources and site-specific data used (modelled).</td>
<td>- Existing sources, site-specific data (modelled and collected).</td>
</tr>
<tr>
<td>- Non-complex health issues assessed.</td>
<td>- Non-complex to moderately complex health issues assessed.</td>
<td>- Moderate to highly complex health issues assessed.</td>
</tr>
<tr>
<td>- Takes 1 full-time equivalent (FTE) assessor &lt;1-3 months (Estimated cost of HIA: $10,000-$50,000).</td>
<td>- Takes 1 full-time equivalent (FTE) assessor 3-6 months (Estimated cost of HIA: $50,000-$100,000).</td>
<td>- Takes 1 full-time equivalent (FTE) assessor &gt;6 months (Estimated cost of HIA: &gt; $100,000).</td>
</tr>
</tbody>
</table>
SECTION C: Is an HIA practical from an investment vs value perspective?

The next step of this HIA screening tool is intended to provide a simple analysis of the investment required to conduct the HIA versus the potential value of the process to determine the practicality of conducting an HIA for the project/policy proposal. Select one response for each of the following questions pertaining to the investment required to conduct the HIA and the potential value obtained. The results will be plotted to provide guidance on whether or not an HIA is recommended. This section is intended to provide a consistent set of questions by which to decide whether to conduct an HIA, from a practical (i.e., value vs investment) perspective. Regardless of the results obtained, proceed to Section D.

DETERMINING HIA INVESTMENT

QUESTION 1. What is the anticipated level of assessment required for the HIA from Section B?

- Rapid desktop assessment – provides a broad overview of potential impacts, ideally used on small-scale projects or local policies with little impact expected (1 point)
- Intermediate assessment – provides a more comprehensive assessment of impacts; ideally used for medium-scale projects or policies with some more complex impacts expected (2 points)
- Detailed assessment – provides an in-depth site-specific evaluation of impacts; ideally used for large-scale projects or far-reaching policy initiatives with complex impacts and interactions expected (3 points)

Rationale & Comments: ____________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

QUESTION 2. How much baseline public health data exists for the area / population impacted by the proposal?

- Baseline data is not required (0 points)
- A sufficient amount of public health data is available to conduct a thorough baseline health assessment (e.g., data available on: general health status; lifestyle factors including physical activity, drug and alcohol use; chronic diseases; access to health care; emergency room visits; mortality; injuries; and socio-demographics); no additional data collection is required (1 points)
- A limited amount of public health data available to conduct a partial baseline health assessment (e.g., some data available on: general health status, lifestyle factors, socio-demographics but none on specific disease incidence/prevalence, mortality/morbidity); some additional data collection may be required (2 points)
- No public health data is available is available; data collection may be required in order to conduct a baseline assessment (3 points)

Rationale & Comments: ____________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

QUESTION 3. What level of stakeholder/community engagement is anticipated for the HIA? Note: Stakeholders can include members of the community, First Nations, general public, government or health agency officials, politicians, NGOs and others that would likely be involved in the process through engagement activities.
None (0 points)
- Low – minimal interaction with a limited number of relevant stakeholders; no community outreach (1 point)
- Medium – some community/stakeholder outreach including a public information session, workshop or community meeting (2 points)
- High – extensive community/stakeholder outreach including public surveys, community meetings, workshops, open houses, key informant interviews etc. (3 points)

Rationale & Comments: ________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

QUESTION 4. Is the available budget/resources sufficient to conduct an appropriately-scoped HIA? Note: a ‘sufficient’ budget is defined as having enough funding and resources readily available to conduct the HIA (as defined in Section B).

- Yes – budget/resources are sufficient to conduct the type of HIA identified in Section B (1 point)
- Maybe – budget/resources may not be sufficient to conduct the type of HIA identified in Section B (2 points)
- No – budget/resources are not nearly sufficient to conduct the type of HIA identified in Section B (3 points)

Note: if you selected “no” consider re-visiting Section B to identify whether a less rigorous type of HIA could be substituted, given budget restrictions. Alternatively, depending on the outcome of the screening exercise this may be used to justify additional budgetary/resource allocation.

Rationale & Comments: ________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

QUESTION 5. Will the HIA be subject to a peer-review process that could have additional schedule and/or budget implications (e.g., time for review, responding to comments, revising HIA, etc.)?

- No – the HIA will only be subject to an internal HIA review, or the reviewer is an individual (e.g., civil servant) that does not require additional investment (1 point)
- Yes – the HIA will be subject to an external peer-review process; 1 reviewer (2 points)
- Yes – the HIA will be subject to an external peer-review process; multiple reviewers, or stakeholder/public comments that will be required to be addressed prior to finalizing the assessment (3 points)

Rationale & Comments: ________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Add up the points from your responses to Question 1-5 to obtain your total HIA “investment” score.

HIA INVESTMENT = ____________ points

UNCERTAINTY ANALYSIS (HIA INVESTMENT): Overall, what is your level of certainty regarding the responses provided for Question 1-5?
DETERMINING HIA VALUE

QUESTION 6: How important is the proposal (i.e., project/policy) to current priorities in the applicable government or health agency? For example, is the proposal related/aligned to a current political agenda, local mandate or master plan? In cases with conflicting priorities, provide a rationale below.

- Not important – does not align with any government or health agency priorities (1 points)
- Somewhat important – generally aligns with government or health agency priorities (2 points)
- Very important – specifically identified by government or health agency as a high priority (3 points)

Rationale & Comments: __________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

QUESTION 7. To what extent could conducting an HIA influence the decision-making process?

- The HIA could influence future decision making processes through evaluation of historical conditions, but may not have an immediate impact. For example, a new project/policy has already been implemented and can’t be changed, but similar initiatives in the future could be altered based on findings (e.g., retrospective HIA) (1 point)
- The HIA could influence certain aspects of decision-making with respect to a policy/project initiative that is currently being proposed or implemented. For example, certain aspects of the current project/policy are unchangeable, such as siting, but others could be influenced prior to implementation (e.g., concurrent HIA) (2 points)
- The HIA could influence most aspects of the terms and scope of a proposed policy/project and heavily influence the decision-making process. For example, a newly proposed project/policy is initiated with little to no components having been decided, so findings could influence many aspects of the proposal prior to implementation (e.g., prospective HIA) (3 points)

Rationale & Comments: __________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

QUESTION 8. Based on the preliminary information available, and to the best of your knowledge, to what extent could the proposal potentially impact any of the determinants of health, including physical, social or economic aspects of health and well-being? If impacts are completely unknown, err on the side of caution and select the third option.

- The impacts are expected to be positive (i.e., provide an overall benefit to health) with some potential for negligible negative impacts (1 point)
- Some negative impacts may be expected; however, they are anticipated to be minor (i.e., no possibility of severe or long-term health issues or fatality) without assessment and/or mitigation (2 points)
Negative impacts are expected and could be major (i.e., possibility of severe or long-term health issues or fatality) without assessment and/or mitigation (3 points)

Rationale & Comments: _____________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

QUESTION 9: Does the proposal have the potential to impact vulnerable or at-risk populations (e.g., children, elderly, sick, low-income, homeless, aboriginal groups, etc.)?

- No – there are no vulnerable populations within the community (1 point)
- Yes – there are vulnerable populations within the community; however, it is unlikely that they would be impacted by the proposal (2 points)
- Yes – there are vulnerable populations within the community that are likely to be affected by the proposal (3 points)

Rationale & Comments: _____________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

QUESTION 10: What is the socioeconomic status (SES) of the area/region that will be affected by the policy/project? In cases with mixed SES communities, select the lowest group to potentially be impacted. For example, in a community with a mix of both upper and middle classes, select middle to account for possible equity issues. Note: Average is defined as the national average household income level.

- Upper – Community annual household income levels are above the national average (1 point)
- Middle – Community annual household income levels are similar to the national average (2 points)
- Lower – Community annual household income levels are below the national average (3 points)
- Developing Country – the HIA is to be undertaken on a policy/project in a developing country where many people don’t have access to basic human needs (3 points)

Rationale & Comments: _____________________________________________________________
_________________________________________________________________________________

Add up the points from your responses to Question 6-10 to obtain your total HIA “value” score.

HIA VALUE = ________ points

UNCERTAINTY ANALYSIS (HIA VALUE): Overall, what is your level of certainty regarding the responses provided for Question 6-10?

- High – very certain regarding the accuracy of all of the above responses (1 point)
- Medium – somewhat certain regarding the accuracy of most of the above responses (2 points)
- Low – uncertain regarding the accuracy of most of the above responses (3 points)
To determine whether an HIA is practical from the perspective of comparing the investment required versus value obtained, complete the following steps:

- Determine your HIA investment vs value results by plotting the ‘HIA Investment’ score on the x-axis and the ‘HIA Value’ score on the y-axis of the graph provided below.

- Then determine your total uncertainty score by taking the sum of your HIA investment uncertainty score and your HIA value uncertainty score and dividing by two:
  
  \[
  \text{Total Uncertainty} = (\text{HIA Investment Uncertainty} + \text{HIA Value Uncertainty}) / 2
  \]

- Draw a circle around your data point that represents your total uncertainty. For example, if your HIA Investment Uncertainty is 2 and your HIA Value Uncertainty is 1 then, using the above equation \( (2+1) / 2 = 1.5 \), your total uncertainty is 1.5 and you would draw a circle around your data point that has a radius of 1.5 on the graph below.

  - Note: The uncertainty scoring provides a quantitative estimation of the uncertainty associated with the HIA investment vs value analysis. The value is intended to provide the user with a visual representation of the variability in their potential results; similar to error bars (+/-) used to show variability in bar graphs.

- Once you have plotted your results (including uncertainty; see example below in red) on the graph determine whether the data point falls above or below the center line. Above the line an HIA is practical from a value vs investment perspective (Value>Investment); below the line HIA may not be practical (Value<Investment). When your results fall within the middle section of the graph (indicated by dotted lines) the investment required and value obtained from conducting the HIA are fairly even (value = investment); therefore, additional discussion may be warranted before deciding whether or not to proceed.

- Regardless of your results, continue on to Section D.
Despite the fact that in the majority of situations it is appropriate to apply the HIA screening tool to facilitate decision-making about whether to proceed with an HIA, there may be extenuating circumstances that fall outside of the process.

This follow-up set of questions is intended to serve as a ‘double-check’ and to provide the user with examples of instances where HIA may or may not be necessary regardless of the results of the screening tool. It is not intended to provide any answers, it is simply to facilitate additional discussion before the final decision is made. Check all that are applicable:

CONSIDER CONDUCTING AN HIA IF ANY OF THE FOLLOWING ARE TRUE:

☐ Overwhelming public concern and/or political pressure to conduct HIA
☐ The health impacts are potentially cumulative, complex and/or not well understood
☐ There are severe, fatal, and/or irreversible health outcomes
☐ There are major social justice or equity issues associated with the proposal
☐ The HIA could impact the provision of basic human needs/rights
☐ The HIA aligns with the proponents corporate social responsibility

CONSIDER NOT CONDUCTING AN HIA IF ANY THE FOLLOWING ARE TRUE:

☐ The impacts are limited, well-understood and easily mitigated
☐ An HIA was recently conducted on the same type of proposal and is of high quality
☐ The HIA has no potential to impact the decision-making process now or in the future
☐ The time and budget/resources are too restrictive (note: rapid HIA could be an option here)
☐ There is a more appropriate type of assessment that could be conducted instead

\(^a\) This does not necessarily mean an HIA should not be conducted; however, it may allow for a more limited scope of assessment that focuses on site-specific impacts and engaging local stakeholders.

Notes & Comments: ________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
The final section of the HIA Screening Tool is a culmination of all of the previous sections. At this point, all those involved in the process of deciding whether or not to conduct an HIA on the proposal should review and compare their screening results. This section can be done in a group discussion format, when applicable. The following are key discussion points to consider for each section:

Section A: Did everyone come to the same conclusion about whether HIA is a viable assessment option? If not, why? Can these differences be remedied? Can a consensus be reached?

Section B: Did everyone have the same expectations regarding the type of HIA to be conducted? If not, why? Can the group come to a consensus about the expected end-product?

Section C: Did everyone come to the same general conclusion (i.e., HIA recommended vs HIA not recommended)? If not, how different were the scores? How much uncertainty is associated with the proposal? Can changing the type of HIA (Section B) remedy any issues?

Section D: Regardless of the results in Section C, are there any circumstances that promote or prohibit an HIA? Did the group agree on these outlying issues? Can a consensus be reached about whether to go forward with an HIA for the proposal?

It is typical for individual biases, differing interpretations and personal judgements to lead people to different conclusions. This is the time to discuss any inconsistencies or issues and to get clarifications when needed. Ideally, together the group will decide on a course of action (i.e., whether to proceed with an HIA) and will finalize that decision below.

**SECTION E: Final Recommendation and Conclusions**

The final section of the HIA Screening Tool is a culmination of all of the previous sections. At this point, all those involved in the process of deciding whether or not to conduct an HIA on the proposal should review and compare their screening results. This section can be done in a group discussion format, when applicable. The following are key discussion points to consider for each section:

Section A: Did everyone come to the same conclusion about whether HIA is a viable assessment option? If not, why? Can these differences be remedied? Can a consensus be reached?

Section B: Did everyone have the same expectations regarding the type of HIA to be conducted? If not, why? Can the group come to a consensus about the expected end-product?

Section C: Did everyone come to the same general conclusion (i.e., HIA recommended vs HIA not recommended)? If not, how different were the scores? How much uncertainty is associated with the proposal? Can changing the type of HIA (Section B) remedy any issues?

Section D: Regardless of the results in Section C, are there any circumstances that promote or prohibit an HIA? Did the group agree on these outlying issues? Can a consensus be reached about whether to go forward with an HIA for the proposal?

It is typical for individual biases, differing interpretations and personal judgements to lead people to different conclusions. This is the time to discuss any inconsistencies or issues and to get clarifications when needed. Ideally, together the group will decide on a course of action (i.e., whether to proceed with an HIA) and will finalize that decision below.

**HIA SCREENING: FINAL DECISION**

- [ ] Proceed with HIA
  Rationale/Comments:

- [ ] Do not proceed with HIA
  Rationale/Comments: