Assessing the Potential of Integrating the Health Impact Assessment in Normative Architectural Practice in Order to Promote Population Health and Health Equity in Design Decision-Making

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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ABSTRACT

Scientific research has demonstrated that the design of the built environment can negatively contribute not only to 'mortality' (life/death) outcomes in populations, but also to 'morbidity' (overall health and well-being) outcomes. Moreover, the design of the built environment has been shown to enable inequitable distribution of deleterious health impacts across particularly vulnerable, sub-populations, including low-income individuals and families, newcomers, and racialized groups. Public health organizations, who are charged with improving population health and health equity outcomes, have neither the capacity nor the position to effectively influence the public's health alone. Based on the mechanisms through which an individual or a population's health is determined, there exists an opportunity for architectural designers to contribute to promoting population health and health equity through architectural design. Of the values considered within normative architectural practice, however, public health in aggregate—in particular, the impact of design decisions on building end-user- and community-health and well-being—is generally not one. Further, the design decision-making models and tools used in normative architectural practice are limited in their ability to address complex public health problems. If architectural designers are to contribute more effectively to improving the public's health and well-being by promoting population health and health equity through architectural design, then the design decision-making models and tools used in normative architectural practice must be reinvented, and the discourse of the architectural discipline, widened.

The Health Impact Assessment (HIA) of today is a structured, scientific and contextual evidence-informed public health tool that aims to prioritize the public's health in policies, plans, programs, and projects—particularly in those outside of the health sector. It has been regularly employed across diverse disciplinary and political settings to examine the population health and/or health equity impacts of a wide-range of decisions, especially including urban- and transportation-planning design decisions. HIAs have yet to be employed in most architectural practice to evaluate the population health and/or health equity impacts of architectural design decisions. A scoping review of seven case study HIAs—all focused on modifying the built environment—was conducted to assess the potential of integrating the HIA in normative architectural practice in order to promote population health and health equity in design decision-making. Though limitations in the investigation exist, findings suggest that the HIA has strong potential to be an effective tool in normative architectural practice, enabling improved decision-making quality and facilitating the consideration of population health and health equity in design decision-making; in turn, enabling health promotion through architectural design. HIA integration, however, will necessitate a voluntary shift in practice, which would be best supported by buy-in from architectural clients, improvements to existing regulatory frameworks, and commitment from the architectural community at-large to collaborate intersectorally and to up-skill.

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CHAPTER 1
Introduction

1.1 Some Working Public Health Terminology

Population Health—David Kindig, American doctor and population health academic, and Greg Stoddart, population health academic and a pioneer of health economics in Canada, define *population health* as, "the health outcomes of a group of individuals, including the distribution of such outcomes within the group" (Kindig & Stoddart, 2003, p. 381). Public health organizations across Canada[1] are tasked with improving population health. However, it has been widely acknowledged that many of the upstream solutions necessary to influence downstream population health outcomes are beyond the influence of the public health sector (National Collaborating Centre for Determinants of Health [NCCDH], 2011; NCCDH, 2012). The Canadian National Collaborating Centre for Determinants of Health (2011; 2012)—a federally-supported organization established to assess, report, and take action on determinants of health and health inequities—explains that if population health is to be promoted, intersectoral support is required.

Wider Determinants of Health—The World Health Organization (2006)—the organization responsible for directing international health for countries associated with the United Nations—defines health as, "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". That is, an individual's or a population's health status is shaped by a variety of factors—beyond genetics and access to medical care alone (Braveman & Gottlieve, 2014; Schulz & Northbridge, 2004; Stokols 1992; Wilkinson & Marmot, 2003). Health is determined by:

- **individual characteristics and behaviours**—genetic makeup, psychological dispositions, health behaviours (e.g. dietary choices, physical activity level), etc.;
- **social environment**—historical conditions, legal codes, social networks, etc.;
- **economic environment**—distribution of wealth, employment opportunities, community investment etc.; and,

[1] Canadian health services are largely separated between curative-care focused on the health of individuals (i.e. medical care), and protective-, preventative-, and promotional-care focused on the health of populations (i.e. public health). In his recent op-ed, American journalist Nicholas Kristoff (2020) illustrated the distinction between the two, "if you get lung cancer, surgeons operate to save your life, but public health professionals keep you from smoking in the first place. If you get the coronavirus, a doctor will treat you; public health aims to keep the pandemic from getting near you".

- **physical environment (natural and built)**—water supply, climate, land-use mix, transportation systems, housing, access to medical care etc. (see Figure 1.) (Schulz & Northbridge, 2004; Stokols, 1992).

In order to leverage, as well as bring focus to, the impact of the non-individual factors on health, the public health community has identified the social, economic, and physical factors—or *determinants*—as the 'wider determinants of health' (Bambra et al., 2010; Quigley et al., 2006). Efforts to promote population health must be rooted in a comprehensive understanding of health (Stokols, 1992).

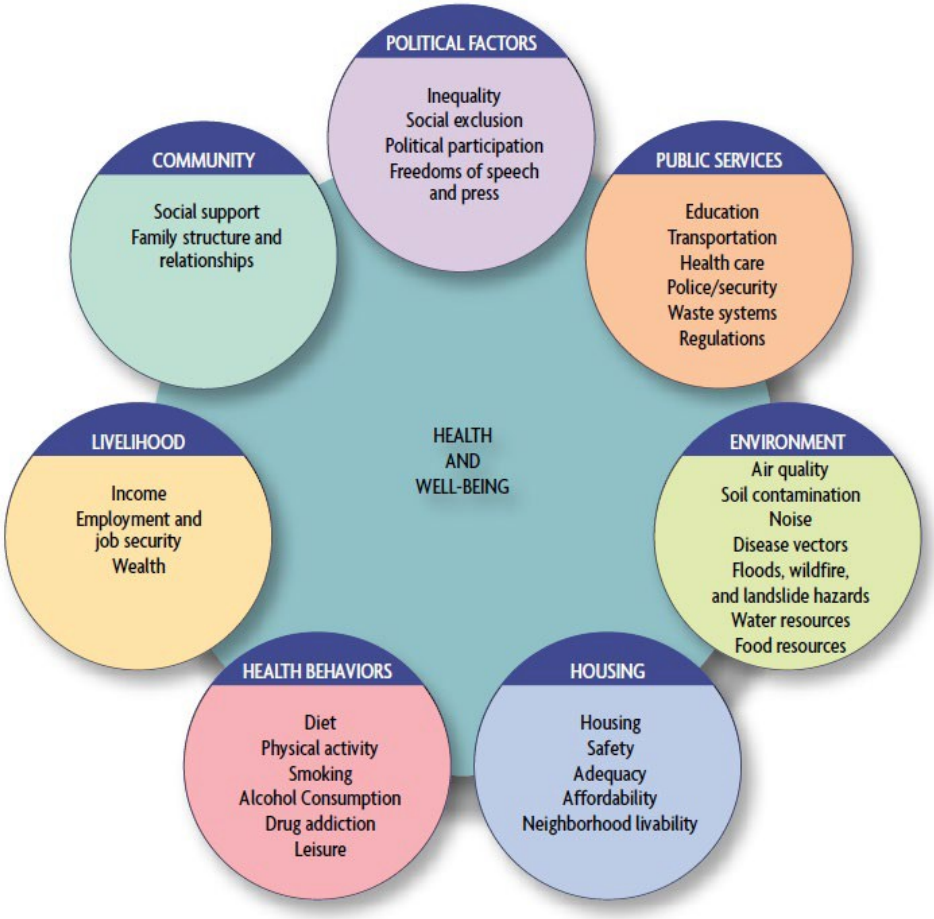


Figure 1. Determinants of Health—this figure illustrates the wide-ranging factors that determine an individual's or a population's health. As illustrated, health and well-being are determined by many factors beyond genetics and access to medical care. (source: Bhatia, 2011). Reprinted with permission from the publisher.

Health Equity—According to the Ontario Ministry of Health and Long-Term Care (2018)—the ministry responsible for governing Ontario health services—health risks, vulnerabilities, and resources are not shared equally across populations. Public Health Ontario—the governmental agency responsible for taking action on public health in Ontario—explains that the wider determinants of health, including income, social position, racial and gender discrimination, educational attainment, and physical environmental, create marked differences in the health status of sub-populations (Ontario Agency for Health Promotion and Protection (Public Health Ontario) [PHO], n.d.). Generally, health improves as social position improves (Bambra et al., 2010; MHLTC, 2018). Systemic (i.e. patterned) differences in health status are known as 'health inequities' (MHLTC, 2018). Health inequities, by definition, are avoidable and unjust: if the conditions and resources fundamental to positive health outcomes were distributed fairly throughout society, all persons would be able to experience good health, despite the wider determinants of health (MHLTC, 2018). As such, the World Health Organization (2006) advocates that, "the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition" (p. 1). Consequently, efforts to promote population health must also include targeted strategies to mitigate harms and maximize benefits for vulnerable sub-populations, such as low-income individuals and families, newcomers, racialized groups, older adults, and children.

Health Promotion—According to Health Canada (2001)—the federal institution responsible for maintaining and improving the health of all Canadians—public health organizations take comprehensive action along a health continuum from promotion to prevention to protection in order to improve population health and health equity outcomes. *Health promotion* seeks to empower populations to achieve positive health—not simply to reduce incidence of ill-health. Whereas *health prevention* seeks to avert the development and spread of specific diseases in populations, and *health protection* seeks to limit health risks, diseases, and unsafe or unhealthy behaviours in populations—refer to Table 1. for further clarification on the distinctions between the three approaches. According to Haifa Husni Madi, Director of Health Protection and Promotion at the WHO Regional Office of Eastern Mediterranean (ROEM), and Syed Jaffar Hussain, Regional Advisor for Healthy Lifestyle Promotion at the WHO ROEM, health promotion was first conceptualized in the 1970s, and subsequently resulted in a shift in a public health practice (Madi & Hussain, 2008).

Promotion	Prevention	Protection
• **Promotion** seeks to empower populations to achieve positive health—not simply to reduce incidence of ill-health. • Public health practitioners support others (e.g. individuals, groups, or other sectors) in identifying available levers to facilitate positive health in themselves and/or their communities.	• **Prevention** seeks to avert the development and spread of specific diseases in populations. • By developing normative, evidence-informed recommendations, public health practitioners actively work to reduce or eliminate an individual's or a population's likelihood of exposure to specific diseases.	• **Protection** seeks to limit health risks, disease, and unsafe or unhealthy behaviours in populations. • By developing protective mechanisms (e.g. legislation, policies, and programs), public health practitioners passively work to maintain health by limiting opportunities for individuals or populations to encounter health risks, exposure to disease, and/or act in unsafe or unhealthy ways.
For example:	For example:	For example:
• Public health organizations throughout Canada promote physical activity guidelines that specify physical activity targets (in terms of level, duration, and frequency) for various age groups.	• During the present global COVID-19 pandemic, Public Health Ontario introduced physical distancing recommendations as a measure to actively reduce transmission of the virus between individuals.	• The 'Smoke-Free Ontario Act, 2017' is an Ontario-wide policy intervention that restricts individuals from smoking or vaping in public spaces in order to reduce an individual's—and in turn, a population's—exposure to second-hand smoke (i.e. an environmental hazard).

Table 1. Distinctions Between Health Promotion, Health Prevention, and Health Protection—this table describes the differences between approaches to addressing health. Public health organizations take comprehensive action along a health continuum from promotion to prevention to protection in order to improve population health and health equity outcomes. (source: table by author; information sourced from Madi & Hussain, 2008).

1.2 Overview of the Thesis Research Context

> *In reality, architecture has become too important to be left to architects [alone]. A real metamorphosis is necessary to develop new characteristics in the practice of architecture and new behaviour patterns in its authors: therefore, all barriers between builders and users must be abolished, so that building and using become two different parts of the same process*
>
> —Giancarlo de Carlo, *Architecture's Public*

The more direct impacts of the physical environment on individual and population health outcomes have generally been accepted for some time in normative architectural practice. However, the more indirect impacts of upstream social factors, mediated by the physical environment, on downstream individual and population health and health equity outcomes are seemingly less recognized or addressed in practice today. Commenting on the awareness of these factors by the health sector itself, sociologist and health services historian Howard Waitzkin (1981) explains, "the social origins of illness have been largely forgotten and then rediscovered with each succeeding generation" (p. 77).

Recognition of the influence of social factors, such as socioeconomic status, on health outcomes originated in the 19th century, and is largely attributed to the work of Friedrich Engels, Rudolf Virchow, and Salvador Allende (Waitzkin, 1981). Throughout the 1840s, in particular, Engels and Virchow began to describe the impact of early capitalism on health outcomes within a European context (Waitzkin, 1981). Despite a lack of health-related training, Engels documented the health of factory workers in Europe. Waitzkin (1981) describes of Engels' work:

> for working-class people, the roots of illness and early death lay in the organization of economic production and in the social environment. British capitalism, Engels argued, forced working-class people to live and work under circumstances that inevitably caused sickness. This situation was not hidden, but was well known to the capitalist class that controlled society (p. 79).

In particular, Engels investigated the associations between the design of housing developments for the working-classes and exposure to environmental toxins and infectious disease. As well, he studied health outcomes related to workers' lack of access to healthy foods and healthcare, the structural influences on alcoholism, and workplace accidents and injuries (Waitzkin, 1981). As a medical student, Virchow set out in 1847 to develop evidence-based recommendations to reduce the spread of Typhus in Upper Silesia—a region of East Prussia that, at the time, was home to particularly low-income individuals and families (Waitzkin, 1981). As Waitzkin (1981) explains:

> [Virchow] described the available diet in detail, expressed indignation about the continuing hunger, and began to draw a connection between hunger and disease:

> 'it is rather certain that hunger and Typhus are not produced apart from each other but that the latter has spread so extensively only through hunger.' Inadequate housing conditions also predisposed to transmission of disease (p. 84).

Subsequently, Virchow began to consider the multifactorial causes of disease. Decades later in the early 20th century, Allende, who was a trained physician, educator, and politician, began to address the impact of 'capitalist imperialism' and 'under-development' on health outcomes in Chile. Waitzkin (1981) suggests that, "Allende recognized very early that the health problems of Chilean people derived in large part from the country's economic and political conditions" (p. 90). According to Waitzkin (1981), Allende's interest in the social origins of health influenced much of his political activism. Through their complementary efforts, Engels, Virchow, and Allende recognized that upstream social factors play a particularly profound role in influencing downstream health outcomes; health outcomes could be improved through positive social change.

Since the time of Engels, Virchow, and Allende, science has improved theoretical understanding of the mechanisms through which health is determined. As a result of more recent scientific, empirical evidence, it is now known with greater certainty that the design of the built environment can negatively contribute to not only 'mortality' (life/death) outcomes in populations, but also to 'morbidity' (overall health and well-being) outcomes. Moreover, the design of the built environment has been shown to enable the inequitable distribution of deleterious health impacts across particularly vulnerable, sub-populations—as compared with the general population. By the sheer complexity of the mechanisms through which an individual or a population's health is determined, public health organizations, who are charged with improving population health and health equity outcomes, have neither the capacity nor the position to effectively influence the wider determinants of health alone. Based on theoretical understandings of these mechanisms, there exists an opportunity for architectural designers[1] to contribute to promoting population health and health equity through architectural design. However, of the values considered within typical or 'normative' architectural practice, public health in aggregate—in particular, the impact of design decisions on building end-user-[2] and community-health and well-being—is generally not at the top of the list, if it is even there at all.

[1] When I refer to 'architectural designers', I intend to refer to Architects and architectural designers. The title of 'Architect' is reserved for those who are licensed to practice architecture. Not all designers who work on architectural projects are licensed, however.

[2] The Canadian Handbook of [Architectural] Practice refers to 'users' and 'occupants' separately. However, its authors provide no meaningful distinction between the two terms. By 'users', I believe the authors intend to refer to individuals or parties who may have a vested interest in the building (e.g. financial, rental agreement, etc.). I refer to this group instead as 'building stakeholders'. By 'occupants', I believe the authors intend to refer to those who occupy the building day-to-day. I refer to as this group instead as 'end-users'.

1.3 General Objective of Normative Architectural Practice

Architectural design is an applied enterprise, and can be considered to be a problem-solving activity. In the most simplified scenario, an architectural designer—typically supported by a team of designers, engineers, and specialist consultants—is presented with a series of site and budgetary conditions and specific programmatic requirements by a client or property owner, and challenged to propose a built solution that responds to these specifications, and adheres to regulatory requirements, such as land-use zoning, public safety, and functional standards. The problem-solving activity becomes: what is the optimal (best) architectural design solution to achieve the intended outcome(s)—beyond the aesthetic concerns of a beautiful building? One could argue that the objective of normative architectural practice is not to develop and construct the optimal design solution, but rather to develop and construct a satisfactory design solution that addresses all the conditions, requirements, and constraints described above in the time allotted. Achieving the optimal design solution in any given architectural project is likely to be an impossible task. That is not the intent of this thesis. Architectural designers, by adjusting some of the ways in which they practice, can develop design solutions that fall somewhere in between 'satisfactory' and 'optimal', and in turn, can enable buildings to contribute more effectively to population health and health equity promotion.

1.4 Thesis Objectives

1.4.1 Overview

The primary argument of this thesis is that if architectural designers are to contribute more effectively to improving the public's health and well-being by promoting population health and health equity through architectural design, then the design decision-making models and tools used in normative architectural practice must be reinvented, and the discourse of the architectural discipline, widened.

Normative architectural practice is typically without the design decision-making models or tools necessary to assess the potential health impacts of design decisions on population health or health equity outcomes. Worden and colleagues (2014)—who together have backgrounds spanning public health, medicine, geography, and green building—conducted a study to identify and assess the breadth of health-related credits in the LEED 2009 green building certification system. In support of their study, they emphasized the growing interest of the public health and design communities in leveraging the design of the built environment in order to improve population health outcomes. Further, they explained that research to date has largely focused on evaluating the connections between health and features of the built environment. In their review of the LEED 2009 green building certification system, they identified that while each LEED credit category does include 'health-related language', there are inconsistencies in the health-related terminology and the strategies used to address health within

and across LEED credit system variants (Worden et al., 2014). The terminology and strategies used in the LEED credit system for existing buildings differs from that of the LEED credit system for healthcare facilities, for example. Moreover, Worden and colleagues (2014) identified that health-related credits generally focus on environmental determinants, such as indoor air-quality; broader health determinants are generally less-represented. These findings, they suggest, are problematic in that the inconsistencies in the health-related terminology and the strategies used to address health pose potential challenges if or when attempting to link healthy building design with public health practice. Ultimately, Worden and colleagues (2014) suggest that with improved methods and tools, together the public health and design communities can facilitate a shift in design practice from that of doing no harm to empowering populations to achieve positive health.

Though, as evidenced by the prevailing, peer-reviewed literature, there has been substantially more investigation into strategies to enable urban- and transportation-planners to address health in the design of the built environment and to translate scientific, empirical health evidence into decisions related to the design and construction of larger-scale land-use, public space, and infrastructure projects. There has, however, been little discussion surrounding the role that architectural designers can play in the realization of such health-promoting environments, or the methods and tools to inform design decision-making; a disciplinary expansion that would enable architectural designers to become more effective champions of healthy buildings and communities.

The Health Impact Assessment (HIA) of today is a structured, scientific and contextual evidence-informed public health tool that aims to prioritize the public's health in policies, plans, programs, and projects—particularly in those outside of the health sector (Quigley et al., 2006). It has been regularly employed across diverse disciplinary and political settings to examine the population health and/or health equity impacts of a wide-range of decisions, especially including urban- and transportation-planning design decisions. HIAs have yet to be employed in most architectural practice to evaluate the population health and/or health equity impacts of architectural design decisions—though there may be instances when such an evaluation has been requested by a client or regulatory body, or when an individual architect chooses to prioritize public health as part of the overall project mission. Could the HIA tool enable architectural designers to work alongside the health sector to promote population health and health equity in architectural design and practice?

1.4.2 The Three Kinds of Health Assessments

According to HIA expert Martin Birley, there are three kinds of health assessments: *health risk assessments*, *health needs assessments*, and *health impact assessments* (Birley, 2011). The *health risk assessment* seeks to identify and assess potential harms related to a proposal (a proposed policy, plan, program, or project) on the future occupational health and safety of an incoming workforce. While the focus of the health risk assessment is primarily restricted

to the health of future workers, there can be some consideration of a proposal's impact on the surrounding community in order to protect a community's health (but not necessarily to *promote* a community's health). A health risk assessment, for example, might be conducted to assess the negative health impacts associated with the erection of a nuclear powerplant on the workers who will ultimately inhabit the plant; the health risk assessment might also consider the impact of the plant on the surrounding community more generally. The *health needs assessment* considers the current or 'baseline' health status of an existing community, independent of a proposed policy, plan, program, or project in order to better understand what actions might be taken to improve local residents' overall health and well-being. Finally, the *health impact assessment* considers the future health impact of a proposal on both those directly and indirectly affected, in order to minimize any potential negative health impacts and to maximize any potential health benefits related to a proposal (Birley, 2011). Though nuanced, each of these health assessments has a distinct objective and methodological approach. The focus of this thesis is on the health impact assessment.

1.4.3 An Overview of the Health Impact Assessment (HIA)

The HIA has been described by the World Health Organization as, "a combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, effects of a policy, plan, program, or project on the health of a population and the distribution of those effects within the population" (as cited in Quigley et al., 2006, p. 1). It is a prospective decision-support tool that enables decision-makers to: (1) anticipate the potential impact of a proposal on population health and health equity outcomes; (2) identify actions to address health impacts; and, (3) inform decision-making in support of health (Kemm, 2012; Quigley et al., 2006). The HIA tool (or collection of tools) typically considers a comprehensive definition of health in order to address health determinants impacting population groups beyond individual factors alone (Kemm, 2012). Furthermore, it enables non-health-sector professionals to prioritize health in decision-making, which, in turn, can support health promotion and protection (Quigley et al., 2006). Thus, reducing the burden on the health sector, which alone cannot influence many of the wider determinants of health.

1.4.4 The Step-Wise Process of the HIA

Despite differences in terminology within HIA research and practice, it is generally accepted that there are six steps in the HIA process (referred to as 'phases' herein). These phases include:

- **Screening**—the purpose of this phase is to: **(1)** clearly describe the assessment objectives; and, **(2)** systematically evaluate the value and feasibility of conducting an HIA.
- **Scoping**—the purpose of this phase is to: **(1)** define the limits of the assessment; **(2)** develop hypotheses concerning the connections between the

proposal and health; **(3)** identify health impacts to be assessed; and, **(4)** outline how each subsequent phase will be conducted.

- **Assessment**—the purpose of this phase is to validate, characterize, and prioritize health impacts utilizing a mixed-methods[3] approach.
- **Recommendations**—the purpose of this phase is to develop pragmatic, scientific and contextual evidence-informed recommendations to mitigate negative or maximize positive health impacts.
- **Reporting**—the purpose of this phase is to disseminate HIA methods, findings, and recommendations to those involved in or impacted by a proposal.
- **Evaluation and Monitoring**—the purpose of this phase is to compare actual outcomes against anticipated outcomes.

1.4.5 The Four Forms of HIA

According Ben Harris-Roxas, HIA expert, academic, and researcher, and Elizabeth Harris, Director of the Centre for Health Equity Training, Research, and Evaluation at the University of New South Wales, there are primarily four forms of HIA: *mandated*, *decision-support*, *advocacy*, and *community-led* (Harris-Roxas and Harris, 2011). *Mandated* HIAs are generally conducted to address a regulatory or statutory requirement, and may be integrated with other types of impact assessment, such as an environmental impact assessment. This form of HIA typically identifies and assesses negative health impacts. *Decision-support* HIAs are generally conducted voluntarily by, or in agreement with, the proposal proponent in order to prioritize health in decision-making. This form of HIA typically identifies and assesses both negative and positive health impacts. *Advocacy* HIAs are generally conducted voluntarily as well, but they are completed by informed organizations or groups outside of the decision-making process. This form of HIA aims to identify and assess potentially 'under-recognized' health impacts and, in turn, influence the decision-makers responsible for a proposal. *Community-led* HIAs are generally initiated through local community action. This form of HIA is conducted by the affected populations themselves, typically with assistance of HIA practitioners, in order to ensure public participation and that community concerns are addressed in decision-making (Harris-Roxas and Harris, 2011). Each of these different forms of HIA practice have unique features, methods, and challenges.

[3] A mixed-methods approach builds upon the inherent weaknesses of quantitative and qualitative approaches. When combined, as in a mixed-methods approach, the two approaches supplement the information learned from the other and provide those involved in HIA practice with a more complete understanding of a proposal's impact (NCCHPP, 2019). Further, a mixed-methods approach strengthens HIA findings and recommendations (Harris et al., 2007). Refer to Appendix 'A', Section A-3 for further insight into quantitative, qualitative, and mixed-methods approaches.

1.4.6 The Types of Effects Considered in HIA Practice

HIAs consider both project-specific effects (or 'impacts') as well as cumulative effects. Project-specific effects are those effects that result as a direct consequence of a proposal. Whereas, cumulative effects are those effects that cannot be tied to one particular project or activity; cumulative effects are additive and generally develop over time. The Government of Canada (2019) explains, "examples of cumulative environmental effects include the incremental loss of prairie wetlands caused by agricultural practices, the degradation of Great Lakes water quality by persistent toxic chemicals, global warming caused by the build-up of green house gases in the upper atmosphere, and loss of biodiversity". Those involved in an HIA will not only anticipate the plausible, project-specific effects resulting from a proposal, but will also account for the cumulative effects surrounding a proposal by developing a community health and environmental profile, which will describe the existing, baseline conditions of the affected community. Scientific and contextual evidence-informed recommendations are ultimately generated in HIA practice to improve the project-specific effects related to, and cumulative effects surrounding, a proposal.

1.4.7 Temporal Considerations

The health impacts associated with any place-based project, such as an architectural project, can vary throughout a project's lifecycle—from design through construction, operation, and renovation, demolition, or decommissioning (Birley, 2011). According to Birley (2011) not only can the health impacts of a proposal's design be scrutinized, but so too can the design process itself. The *Design Stage* can last many years and leave local residents in a state of uncertainty, unsure how the proposal will impact their future lives (Birley, 2011). The *Construction Stage* poses many health risks, such as exposure to cancer-causing construction materials, which can be particularly harmful to the health of the construction workers, those nearby, and the environment (U.S. National Library of Medicine [USNLM], 2019). As well, the interruption of a sidewalk or street network by construction has been linked to decreased levels of physical activity, and, in turn, increased incidence of overweight and obesity. When a new housing development, for example, has reached the *Operation Stage* there will likely be an influx of people, concentrated in a particular area, which can have many effects on the health of residents, both old and new (Birley, 2011). For example, if additional resources, such as access to healthcare or healthy food options, have not been allocated in advance to meet increased demand, existing resources can become strained and residents' health, negatively impacted. Further, when a building or infrastructure project is demolished, decommissioned, or renovated, the *Demolition Stage* can release toxins embodied in older materials, such as asbestos or formaldehyde, into the environment (USNLM, 2019). Those involved in an HIA will together determine the 'Temporal

Scope' of the assessment to establish the breadth of health impacts of a place-based project or related policy to be assessed in relation to time.

1.4.8 Thesis Research Questions and Methodology

A *scoping review* [4] of seven case study HIAs—all focused on modifying the built environment—was conducted in this thesis to assess the potential of integrating the HIA in normative architectural practice in order to promote population health and health equity in design decision-making. The specific research questions (see RQ following) pursued in this thesis include:

RQ 1: **(a)** In what ways could integration of the HIA's more scientific and evidence-informed methodology improve the quality of decision-making in normative architectural practice **in general**? **(b)** Would such integration press normative architectural practice toward a more scientific model of empiricism and away from its more heuristically- and iteratively-informed practical empiricism?

RQ 2: More limited in scope, but more realistic is the question: How could the improved decision-making quality realized by integrating the HIA in normative architectural practice plausibly promote population health and health equity in design decision-making?

Summary study reports, documented in situ, from each of the seven case study HIAs were reviewed in order to understand how the tool has been used in practice to improve population health and health equity outcomes related to urban development decisions, and to evaluate the applicability and transferability of the HIA to promote health more generally across architectural practice and design. To further illustrate the envisioned potential of integrating an HIA into normative architectural practice, a fictional project has been described that demonstrates the steps architectural designers could take when implementing an HIA in such an architectural project.

1.4.9 HIA Case Studies Reviewed

The HIAs case studies examined were completed in 2016 and located throughout the United States, in communities experiencing an assortment of health concerns and diverse environmental conditions. Assessments focused on proposals for design-related policies or plans, or discrete design projects. Table 2. identifies each of the HIA case studies reviewed, and describes the objectives and particulars of each assessment.

[4] The scoping review as well as its methodological justification in this thesis are further detailed in Chapter 4 'Thesis Methodology'.

HIA Name; Location; Designation; Built Condition; Citation.	Objective of Assessment	Design Intervention	Primary Spatial Scale(s) Addressed
Omaha Street Connections and Development Review Processes; Omaha, Douglas County, Nebraska; City; Suburban; (Douglas County Health Department, 2016).	The City of Omaha's master plan encouraged increased street connectivity. However, the construction of new street connections was often met with resistance by residents. This HIA sought to: • identify and assess the health impacts of increased street connections; and to, • determine how best to engage residents in the development review process.	• street elements • street network	• neighbourhood • city
Hoboken Stormwater Management; Hoboken, Hudson County, New Jersey; City; Urban; (Carnegie et al., 2016).	The City of Hoboken was looking to address chronic flooding through the adoption of a city-wide stormwater management plan. This HIA sought to: • identify and assess the health impacts of chronic flooding, including combined sewer system backup issues; and to, • identify and assess the health impacts of the proposed green infrastructure design interventions.	• green infrastructures • green infrastructure network	• neighbourhood • city
Colorado School-Based Health Centres; Colorado Springs, El Paso County, Colorado; City; Urban/Suburban mix; (Rothwell et al., 2016).	The Children's Hospital of Colorado (CHCO) proposed utilizing School-Based Health Centres (SBHCs) as a means of impacting child physical activity and mental health. This HIA sought to: • identify and assess the health impacts of SBHCs on physical activity and mental health outcomes in school-aged children; • assess existing SBHCs in order to inform future implementation strategies; and to, • inform how CHCO could implement a concept for School-Based Resource Centres based on their findings of SBHCs.	• building program	• building • city
Liberty Street Design; Liberty, Clay County, Missouri; City; Suburban; (Ilabaca-Somoza et al., 2016).	Current policy in the City of Liberty favours a street grid design over cul-de-sacs and favours sidewalks on two sides of a street. This HIA sought to: • identify and assess the impacts of street design on health outcomes—in particular, the impacts of grid versus cul-de-sac configurations, including on first responder response times; and to, • identify and assess the health impacts of sidewalk design on health outcomes; in particular, the impacts of sidewalks located on one versus two sides of a street.	• street elements • street network	• neighbourhood • city

Pasadena Infill Development; Pasadena, Harris County, Texas; City; Suburban; (Cummings et al., 2016b).	Within the City of Pasadena there is need for a shift from greenfield to infill development and for increased housing options. City officials proposed four updated residential ordinances to facilitate these needs. The ordinances outlined design standards and regulations of different types of residential development: townhouses, patio-home subdivisions, and multi-family. This HIA sought to: • identify and assess the short- and long-term health impacts of the proposed ordinances on health outcomes of residents.	• housing types • land-use mix, infill development	• building • city
Carpentersville Intersection Design: Carpentersville, Kane County, Illinois; Village; Suburban; (Wade et al., 2016).	During peak hours, congestion at a well-trafficked intersection within the Village of Carpentersville was problematic. The Carpentersville Old Town Plan recommended that improvements to the intersection be made to address the health and safety of all users. This HIA sought to: • identify and assess the health impacts of two design options (a signalized intersection versus a single-lane roundabout) on the health outcomes of drivers, pedestrians, cyclists and nearby residents.	• street elements	• neighbourhood
East Aldine Town Centre Design; East Aldine, Harris County, Texas; Management District; Suburban; (Cummings et al., 2016a).	East Aldine Management District had developed a master plan for a new town centre, which included a variety of social and community services as well as retail spaces. The initial proposal was developed without consideration for the health. This HIA sought to: • identify and assess the health impacts of the proposed town centre on health outcomes; and to, • forecast revenues generated by the proposal, which could support public services.	• district master plan	• neighbourhood

Table 2. Overview of HIA Case Studies—this table identifies each of the HIA case studies reviewed in this thesis. As well, it describes the particulars of each of the HIAs, including their locations, objectives, design intervention-types under assessment, and the primary spatial scales addressed through each assessment. HIA case studies were located throughout the United States. The HIAs were used to assess the health impacts of design interventions across many design scales. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

1.5 Contributions to Architectural Theory and Practice

This thesis contributes to advancing architectural theory and practice, as well as HIA theory and practice, by:

- re-evaluating the role of buildings in contemporary society, including the implications of this;
- describing the decision-quality elements in architectural design decision-making in normative architectural practice;
- describing the limitations of existing design decision-making models and tools in normative architectural practice to: **(1)** address complex, societal problems in general and to address complex, public health issues in particular, and **(2)** ensure the likelihood of achieving high-quality architectural design solutions in the face of uncertainty;
- reviewing leading HIA guidance to identify HIA 'best practices';
- identifying the breadth of design interventions assessed using the HIA, the resources required to conduct assessments (e.g. funding, time, staff, expertise, etc.), and the methods used in practice to inform design decision-making; and,
- assessing the applicability and transferability, or 'potential', of the HIA to be routinely integrated within normative architectural practice.

1.6 Thesis Structure

The thesis itself is structured into seven primary chapters and supplementary appendices. The content of each chapter and appendix is as follows:

Chapter 1.0 Introduction
This chapter provides readers with the working public health terminology necessary to understand this thesis; introduces the problem this thesis attempts to address and the health impact assessment tool; identifies the particular research questions pursued within this thesis; identifies the contributions of this thesis to architectural theory and practice; and, outlines the thesis structure.

Chapter 2.0 Background and Literature Review
This chapter describes the requisite information required to understand the mechanisms through which the wider determinants of health influence population health outcomes and generate health inequities, and outlines the public health approaches to improving population health and health equity outcomes. This chapter also provides a critical review of the literature to identify the limitations of existing design decision-making models and tools in normative architectural practice to: **(1)** address complex, societal problems in general and to address complex, public health issues in particular, and **(2)** ensure the likelihood of achieving high-quality architectural design outcomes in the face of uncertainty. As well, this chapter describes how public health practices have been transformed; outlines current evidence-informed decision-making models used in public health

practice; and, anticipates the potential implications of employing public health approaches in normative architectural practice.

Chapter 3.0 Potential Solution
This chapter describes the origins, principles, and characteristics of the HIA, as well as the demonstrated value of the HIA in urban development practices outside of normative architectural practice. Note: this chapter provides a high-level overview of the HIA process. For in-depth description, refer to 'Appendix A'.

Chapter 4.0 Thesis Methodology
This chapter outlines and justifies the methods employed to answer the thesis research questions.

Chapter 5.0 Scoping Review: methods, findings, and discussion
This chapter describes and discusses the scoping review findings extracted from seven case study HIAs related to urban development. Note: this chapter provides a high-level overview of the characteristics of each assessment, the resources required, and the methods undertaken by appraisers. For in-depth description, refer to 'Appendix B'.

Chapter 6.0 Integration of the HIA in Normative Architectural Practice
This chapter demonstrates the steps architectural designers might take when implementing an HIA through the description of a fictional architectural design project—the design of a condominium.

Chapter 7.0 Conclusion
This chapter summarizes the conclusions drawn from the scoping review to answer the thesis research questions and suggests potential benefits of the HIA to architectural designers and to the architectural community at-large beyond the promotion of population health and health equity. As well, this chapter stresses the importance of developing disciplinary coherence and rigour within the architectural discipline itself.

Appendix A Detailed HIA Best Practices
This appendix describes HIA best practices in detail.

Appendix B Detailed Scoping Review Findings
This appendix describes scoping review findings in detail.

Note: for a complete understanding of the HIA process and its idiosyncrasies, I urge readers to review the material in the appendices—even if it may be a little dry for some.

CHAPTER 2

Background and Literature Review

2.1 The Mechanisms Through Which the Wider Determinants of Health Influence Population Health Outcomes

According to public health and medical researchers and academics Schulz and Northbridge (2004) and Braveman and Gottlieb (2014), the wider determinants of health enable or restrict an individual's or a population's exposure and access to[1] health risks, vulnerabilities, and resources. Scientific research suggests that exposure and access—or lack thereof—to health risks, vulnerabilities and resources can both directly and indirectly impact health outcomes (Braveman & Gottlieb, 2014; Schulz & Northridge, 2004). Each of these impacts, direct and indirect, will be described in turn.

Direct Impacts—are those that are immediately apparent. For example, traffic control, planning, and engineering flaws in street design can present unconsidered hazards to local residents, which can result in death or injury. Each year in the United States, pedestrian-vehicular collisions account for 6,000 pedestrian deaths and 110,000 injuries (Frumkin, 2002). An absence of traffic-calming interventions as part of a neighbourhood design strategy for speed control, such as speed bumps on local streets, increases the frequency and severity of pedestrian-related accidents (Brown et al, 2017).

Indirect Impacts—are those that become evident over time. The wider determinants of health can, for instance, influence an individual's health behaviours (i.e. lifestyle choices). For example, a truism such as close proximity to parks and recreation facilities has been associated with increased levels of physical activity in individuals (Kaczynski & Henderson, 2007). This may appear self-evident, however, the connections bear more precise evidence gathering to encourage politicians to fund parks, for example. In general, positive health behaviours, such as engagement in physical activity, can decrease the likelihood of contracting cancer (Schulz & Northbridge, 2004). As well, chronic exposure to negative social and environmental stressors (e.g. financial insecurity or natural disasters) can also result in biological 'wear-and-tear', including cellular, tissue, and organ damage (Braveman & Gottlieb, 2014; McEwen, 2005; Schulz &

[1] 'Exposure to' implies contact with health risks, vulnerabilities, or resources (e.g. street trees or air pollutants). Jarvis and colleagues (2020), academics and public health and forest and conservation science researchers, suggest that—as it relates to green space, for example—exposure is, typically, a measure of 'proportion' within a certain physical area (e.g. proportion of green space within a 100m radius of one's house). Whereas, 'access to' implies ability or inability to engage with health resources (e.g. parks or recreation centres). Jarvis and colleagues (2020) suggest that—as it relates to green space, for example—access is, typically, a measure of 'proximity'.

Northridge, 2004). Research suggests that the biological mechanism responsible for these changes is 'allostatic overload' (Braveman & Gottlieb, 2014). When exposed to stressors, the body's regulatory system produces an inflammatory, physiological response—referred to as 'allostasis'—to cope in the short-term. However, as explained by neuroendocrinologist Bruce McEwen (2005), if exposure to stressors persists over a longer period of time, so can the allostatic response, resulting in allostatic overload. Allostatic overload can predispose an individual to negative health outcomes, such as cardiovascular disease or stroke (McEwen, 2005). Furthermore, molecular biologist Daniel Notterman and sociologist Colter Mitchell (2015) suggest that chronic exposure to negative social and environmental stressors can interfere in the expression or suppression of certain genes—referred to as 'epigenetic processes'. Adversity experienced in early childhood has been linked to epigenetic changes that can lead to negative health outcomes, such as poor mental health and obesity (Notterman & Mitchell, 2015).

Based on findings to date, it is clear that the wider determinants of health can influence population health outcomes through a variety of mechanisms, both directly and indirectly, and are related in part to the quality of the designed environments surrounding people.

2.2 The Mechanisms Through Which the Wider Determinants of Health Generate Health Inequities

The wider determinants of health operate as an interconnected system—with determinants arrayed across various levels of society (macro, meso, and micro). Dynamic interactions between levels influence health outcomes, and produce and perpetuate health disparities. The 'Social Determinants of Health and Environmental Health Promotion' model[2], developed by Schulz and Northridge (2004), describes the holarchical nature of these interactions (see Figure 2.).

Macro-Level Determinants—refer to the broad natural environment, as well as the social ecosystem: the interwoven system of institutions, orders, and ideologies that influence the distribution of wealth, power, and opportunity in society. Such ecosystems institutionalize and fix patterns of deeply held inequality based on social position, race, ethnicity, gender, and age. For example, political agendas, regulatory and legal codes (such as land-use zoning), human rights doctrines, and often racist, cultural beliefs on the part of non-Black populations have produced, over decades, spatial concentrations of low-income, African American populations throughout the United States.

Meso-Level Determinants—refer to the built environment and social context that shape a community at the local level. They are broadly created and structured by the macro-level determinants at a higher level, and enable or restrict exposure

[2] This description of Schulz and Northbridges' model has been modified (only very slightly) from their original description to improve clarity for an architectural audience.

or access to the essential resources to support health. For example, low-income communities are often without the social or material resources necessary to influence local policies governing economic investment or urban development. Residents' inability to effect local change at a district- or neighbourhood-level can result in unfavourable conditions for maintaining health (e.g. lack of affordable housing, inefficient public transportation networks, etc.). Such spatial concentrations of poverty and lack of resources needed to improve conditions can be perpetuated when communities have chronic inadequate resources, all of the above further contributing to health disparities and poor public health outcomes.

Micro-Level Determinants—refer to the stressors that small groups like families or individuals are exposed to, the level of social integration and support between individuals, and individual health behaviours. These are, in turn, influenced by the meso-level determinants. For example, lower-income communities without sufficient political or social capital and leverage, may have inferior plumbing infrastructure, which can result in exposure to environmental toxins—similar to the water crisis that occurred in Flint, Michigan in 2014.

2.3 The Interplay of Scales: Macro, Meso, and Micro

The interplay between macro-, meso-, and micro-level determinants is dynamic in that one determinant-level can both influence and be influenced by another scale of determinant (Schulz & Northbridge, 2004). For example, in 1975 approximately one percent of the children in a community in Harlem, New York City experienced severe injuries as a result of falling through open windows (Schulz & Northbridge, 2004). Together, local physicians, residents, and landlords petitioned for a law to be instituted, requiring the installation of guards in apartment windows. Successful in their pursuit, the injury rates in children in that community due to such falls decreased by 96% over the following two years (Schulz & Northbridge, 2004). In this instance, the community united to influence a meso-level determinant: housing design. The City building codes, a macro-level determinant, were eventually amended, necessitating retroactive alterations to housing design by landlords (Schulz & Northbridge, 2004). In summary, the dynamic interactions between macro-, meso-, and micro-level determinants contribute to inequitable distribution of health risks, vulnerabilities, and resources—causing health disparities across populations (Schulz & Northbridge, 2004). However, just as they sustain health disparities, the dynamic interactions between macro-, meso-, and micro-level determinants can similarly be leveraged to eliminate them (Schulz & Northbridge, 2004).

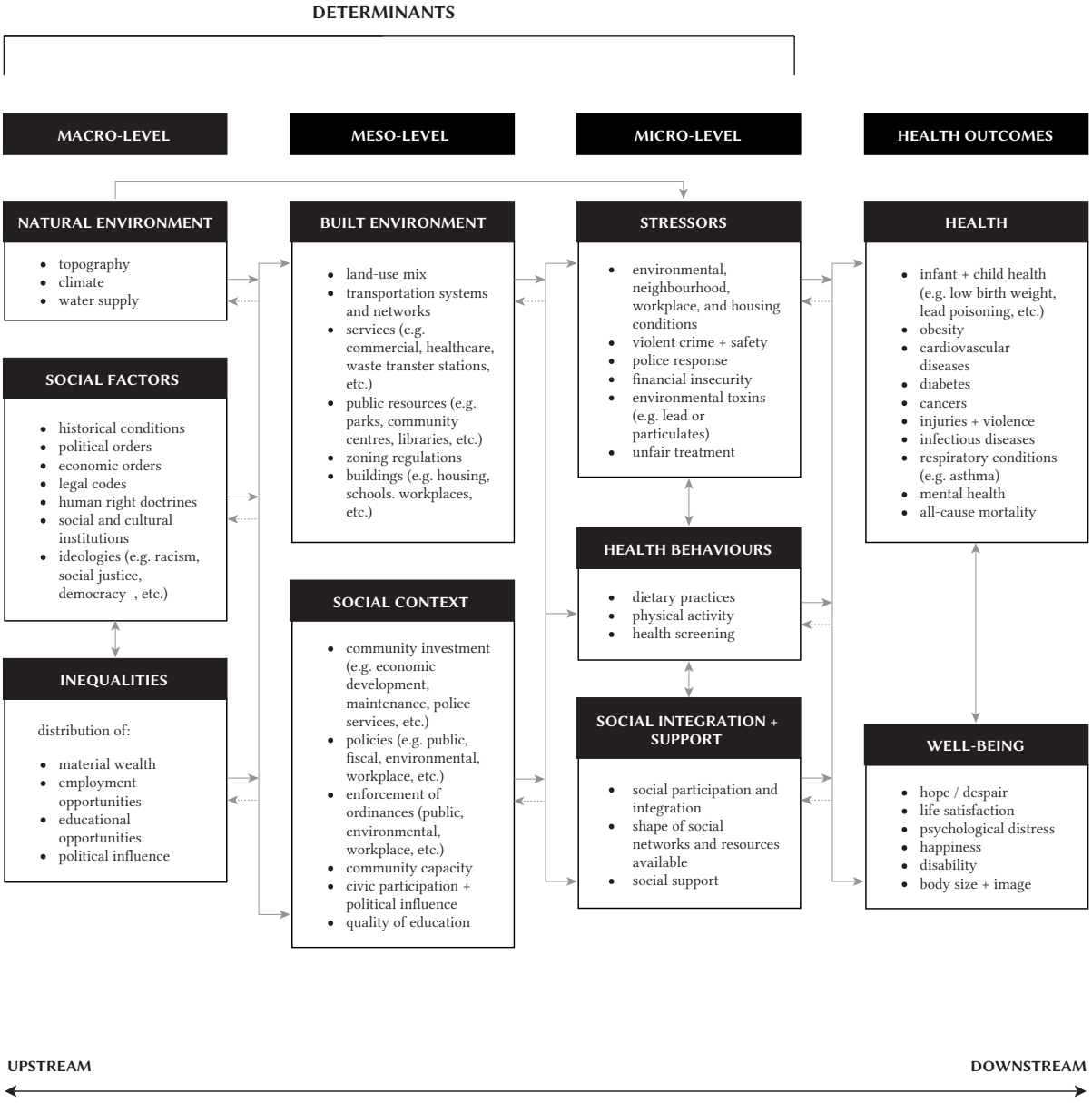


Figure 2. Connections Between Macro-, Meso-, and Micro-level Determinants of Health and Health Outcomes—this figure illustrates the mechanisms through which the wider determinants of health influence population health outcomes and generate health inequities. Upstream macro-, meso-, and micro-level determinants ultimately impact the downstream health outcomes of individuals and populations—often in more nuanced ways than one might anticipate. (source: adapted from Schulz & Northbridge, 2004). Reprinted with permission from the publisher.

2.4 Public Health Approaches to Improving Population Health and Health Equity Outcomes by Leveraging the Wider Determinants of Health

Public health practitioners utilize a variety of approaches to improve population health and health equity outcomes, and are described below.

Population-Based Health Approach—According to Health Canada (2001), a population-based health approach focuses on improving the health of entire groups of people (as opposed to individuals) by addressing the myriad factors outside of medical care that determine a population's health status and enable health disparities to exist across populations. To apply a population health approach, public health organizations work to:

- identify and address the upstream (or underlying) causes affecting downstream health outcomes;
- base public health decisions on a variety of quantitative and qualitative evidence sources, including—but not limited to—scientific evidence;
- employ a combination of complementary intervention strategies;
- collaborate intersectorally and across all levels of government (i.e. federal, provincial or territorial, and local);
- engage the public directly; and,
- ensure accountability for health outcomes by monitoring and evaluating changes to population health following implementation of public health interventions (Health Canada, 2001).

Health Canada (2001) explains that the outcomes of a population-based health approach include:

> A healthier population [that is better able to make] more productive contributions to overall societal development, requires less support in the form of healthcare and social benefits, and is better able to support and sustain itself over the long-term. Actions that bring about positive health also bring wider social, economic, and environmental benefits for the population at-large. They include a sustainable and equitable healthcare system, strengthened social cohesion and citizen engagement, increased national growth and productivity, and improved quality of life (p. 1).

Health Equity Approach—According to the Ontario Ministry of Health and Long-Term Care (2018), in order to reduce health disparities between the general population and more disadvantaged groups, public health practitioners are expected to, "continuously identify and address systemic and institutional factors affecting health equity, including the underlying causes" (p. 8), and apply the concept of *proportionate universalism*. To apply the concept of proportionate universalism, public health organizations work to improve the health of entire populations by focusing efforts between sub-population groups, proportionate to their levels need and disadvantage. The Ontario Ministry of Health and Long-Term Care (2018) explains, "while some programs are universal (e.g.

immunization), there will be groups within the general population that require additional resources and targeted actions to fully realize the intended health benefit" (p. 10). By assessing the differential impact across populations, and targeting sub-populations proportionate to their levels of need and disadvantage, the overall health of the whole population can be elevated.

Evidence-Informed Approach—the terms 'evidence-informed' and 'evidence-based' are often used interchangeably. However, there exists an important distinction between the two. 'Evidence-informed' generally refers to actions derived from (or 'informed by') a combination of quantitative and qualitative empirical evidence, including (but not limited to) scientific evidence. Whereas, 'evidence-based' generally refers to actions derived from (or 'based on') the most rigorous—typically quantitative—scientific evidence. Evidence-informed public health has developed out of evidence-based medicine, which gained traction in the 1990s. Regarding evidence-based approaches in clinical practice (i.e. medical care), scientist and academic, M. Gail Woodbury, and registered nurse and academic, Janet L. Kuhnke, suggest that arguments against evidence-based approaches claim they are more restrictive than evidence-informed approaches (Woodbury & Kuhnke, 2014). Further, clinical practice, in particular, should not solely rely on the most rigorous, scientific evidence, which is developed with the primary intent to limit any and all bias; lessons learned from practice should also be taken into consideration. That is not to say, however, that any form of practical knowledge will suffice. Carol Estabrooks, academic and applied health services researcher, explains that practical knowledge should be derived through qualitative studies (as cited in Woodbury & Kuhnke, 2014). Public health practice, as I will later detail, generally relies on evidence-informed approaches.

2.5 The Scale and Range of Architectural Practice

Interventions to address the wider determinants of health at the meso-level, typically the scale of land development and neighbourhood and architectural design, have potential to significantly improve population health outcomes and contribute to reducing or eliminating health disparities. That is, meso-level interventions can not only influence micro-level determinants, but also push back at and potentially transform macro-level determinants (Schulz & Northbridge, 2004). For instance, building adequate low- to moderately-priced housing (i.e. a meso-level intervention), targeted toward low-income families, can aid in reducing exposure to the social and environmental stressors (i.e. micro-level determinants) described above. This can be accomplished while also undermining fundamental social inequities (i.e. macro-level determinants), ultimately improving health outcomes, balancing health disparities, and arriving at better social equity—a potential further stressor. The United Nations (2018) anticipates a 13% increase in urban living by 2050—from 55 to 68% of the world's population. Given the global shift toward urbanization, meso-level urban-planning and architectural design interventions have the power to positively impact the health of a great number of people (as cited in Sarkar et al., 2014).

Although there is hope and a promise for meso-level interventions to be far-reaching, the public health sector, which is charged with addressing the wider determinants of health, does not have significant influence over many of these determinants. Architectural designers, on the other hand, play a critical role in the design and construction of buildings, as well as the streets and publics spaces they immediately surround. These designed components contribute to shaping a neighbourhood as a whole.

By simply adjusting their practice, architectural designers have the potential to directly influence a number of the meso-level determinants that have been demonstrated, through scientific study, to impact population health and health equity outcomes. Though outside the direct impact of normative architectural practice, architectural designers also have the potential to suggest more general policy and regulatory transformations at higher political, economic, and social levels. Thus, despite their having limited ability to affect broader urban-planning policy and land-development economics, architectural designers do possess enough decision-making at their level of work to impact some downstream population health and health equity outcomes by incorporating new ideas and pushing back against the larger-scale limitations of urban-planning and economic approaches.

2.6 The Current State of Scientific Evidence Supporting the Associations Between Health, Well-being, and the Design of the Built Environment

Though gaps in scientific understanding exist, there is arguably enough scientific, empirical evidence available to inform the design of buildings and localized public space in order to promote population health and health equity. As noted in the published literature, disciplines making significant contributions to establishing the connections between health, well-being, and the design of the built environment include: Environmental Behaviour Studies, Environmental Psychology, Environmental Design, Public Health, Epidemiology, Urban-Planning, Leisure Studies, Neuroscience, and related sub-disciplines. The scientific research has, for instance, focused on investigating the health impacts of particular building types, such as healthcare settings, housing, occupational environments, and educational and recreational facilities. As well, studies have been conducted to understand how the design of the built environment can impact the health of certain sub-population groups—such as children, youth, and older adults—and the interactions between generations, different cultural groups, and the general population. Researchers have also investigated the health impacts of many different built environment characteristics and determinants at a variety of scales, including:

- indoor and outdoor air quality, water quality, humidity and temperature;
- land-use patterns, access to green space, and transportation networks;

- physical activity, travel distance, street connectivity, biking and pedestrian facilities, and wayfinding/network signage;
- urban design, community gardens, public art, and street lighting;
- safety and traffic-related injuries;
- housing quality and type, aesthetics, and neighbourhood design;
- social networks or establishing a 'sense community';
- indoor and outdoor social environments, amenities, and destinations;
- passive surveillance;
- noise, crowding, privacy, and personal space;
- urban development design review processes; and, more.

As general acceptance of these relationships increases and gaps in the literature are identified, more scientific, empirical evidence is sure to be generated.

2.7 Acknowledging the Nuanced, Deleterious Impacts of Buildings and Their Immediate Surroundings on the Wider Determinants of Health

The architectural community is generally aware of the more evident, deleterious impacts of buildings and their immediate surroundings on the wider determinants of health. Poor ventilation (air quality) can pose risks to respiratory health in building end-users, for example. However, the architectural community, for reasons that I will not begin to speculate here, is seemingly less informed of the more nuanced, deleterious impacts of buildings and their immediate surroundings on the wider determinants of health, which ultimately influence the downstream health outcomes of building end-users and surrounding communities. As a result of scientific, empirical evidence, for example, we now know with greater certainty that:

- the particular design of a stair can encourage or discourage engagement in physical activity by able-bodied end-users—physical activity is a health determinant; and,
- the particular arrangement and size of spaces can encourage or discourage intergenerational connections: relationships that can contribute to the development of social capital amongst the building end-users and the surrounding community—strength of social support networks is another health determinant.

Theoretically, this scientific, empirical evidence could be rigorously gathered, analyzed, and used to inform design decisions. Based on the best scientific information available and the stated health priorities of the project, architectural designers could then develop design strategies or guidelines, for example, on a project-to-project basis to be adapted and implemented in their work. Further, the outcome of their scientifically-informed design 'hypotheses' could then be rigorously evaluated following building construction and operation, and used to

guide future architectural projects. This describes what is more commonly known as 'Evidence-Based Design'. The limitations of so-called 'evidence-based design'[3] methods—which are largely used in specialized architecture practice, such as in healthcare design—to promote population health and health equity will be later detailed.

2.8 Describing the Limitations of Existing Design Decision-Making Models and Tools in Normative Architectural Practice

In order to elucidate limitations of existing design decision-making models and tools in normative architectural practice to: **(1)** address complex, societal problems in general and to address complex, public health issues in particular, and **(2)** ensure the likelihood of achieving high-quality architectural design outcomes in the face of uncertainty, the following are described in turn:

- a new role for architecture in contemporary society, and the implications of this proposition;
- the fundamentals of decision-making;
- decision quality elements in design decision-making in normative architectural practice;
- the complexity of population health and health equity promotion in design decision-making; and,
- the decision-analysis methods necessary to address complex problems.

Together, they explain the limitations inherent in the design decision-making models and tools used in normative architectural practice to contribute more effectively to complex, societal problems in general through architectural design, and to promoting population health and health equity in particular.

2.9 A Note on the Literature Review Methodology

However odd or surprising, there is limited information or literature to be found identifying or reflecting upon design decision-making processes in normative architectural practice in particular, or regarding design more generally. As Philip D. Plowright, registered architect, academic, and Editor-in-Chief of ENQ: the ARCC Journal of Architectural Research, explains (2014):

> Knowing the design process is important. Strangely, though the design process is embedded in every project and is at the heart of the education and business practices of architects, the exact nature of that process is often obscure. It is under-documented, often invisible, and explained to students in anecdotes and one-off conversations. Why is this? There are many reasons—some historical, some

[3] I believe that the term 'evidence-based', in this case, has been used imprecisely. Given that evidence-based design promotes the consideration of a variety of evidence-types, including both contextual evidence and the best scientific evidence, I would refer to this design approach instead as 'evidence-informed design'.

> cultural, and some traditional. In general, the reasons relate to the type of knowledge in architectural design, as in all design fields, which is *tacit*. Tacit knowledge is knowledge which is difficult to document and transfer. It might be knowledge that is taken for granted so never examined; it might take too many resources to record as it contains many variances a complex information; or the knowledge might be so subtle that it resists documentation. Tacit knowledge is often transferred through the master-apprentice format of education. This is the format we find in architecture, where knowledge is transferred through personal experience, narrative, and hands-on practice (p. 2).

In order to understand design decision-making processes, the following published literature was primarily consulted and critically reviewed:

- '**Philosophy of Architecture**' and '**Philosophy of Technology**'—entries that are included in the Stanford Encyclopedia of Philosophy, which is an online database of peer-reviewed, philosophical papers routinely maintained by experts in the field through Stanford University.
- '**The Ten Books on Architecture'**—a translation of the Vitruvius' text by Morris Hickey Morgan, academic and classical philology researcher, under the direction of Herbert Langford Warren, once practicing architect and academic, and originally published in 1914. Vitruvius was an Ancient Roman architect who remains to be a strong influence in the architectural discipline today.
- '**Design Method and the Scientific Method**'—a paper written by Nigel Cross—academic, design researcher, and major contributor to the development of 'design thinking'—and his colleagues in 1980 for the Design Research Society Conference.
- '**The Canadian Handbook of Practice: 2nd Edition**'—a reference document for practicing Architects in Canada, written and edited by Canadian Architects and published in 2009 by the Royal Architectural Institute of Canada.
- '**Architecture's Public**'—a lecture originally given in 1969 by Italian architect Giancarlo de Carlo, and included in compilation of essays discussing public participation in architecture, which was published in 2005.
- '**Designerly Ways of Knowing**'—a paper written by Nigel Cross and published in 1982.
- '**Revealing Architectural Design: Methods, Frameworks, and Tools**'—a book written by Philip D. Plowright, registered architect, academic, and Editor-in-Chief of ENQ: the ARCC Journal of Architectural Research, and published in 2014.
- '**Implementation of Evidence-Based Design (EBD) by Non-Healthcare Design Practitioners**' and '**The Challenges of Integrating Evidence-Based Design**'—papers written by Caren S. Martin, interior designer, academic, and evidence-based design researcher, and published in 2014 and 2009, respectively.
- '**Foundations of Decision Analysis'**—a textbook written by Ronald A. Howard—academic, engineer, and pioneer of the field of decision-analysis—and Ali E. Abbas—academic, engineer, and decision-analysis researcher—and

published in 2016. This text provided insight into the fundamentals of decision-making and the basis from which to compare the decision quality elements that ought to be included in complex, decision-making with the existing decision quality elements in normative architectural practice.

This information has been supplemented with lessons learned from my own experiences working as an architectural designer and as an architectural visualization business-owner in the architecture, engineering, and construction industry. As well, my supervisor, Val Rynnimeri, has provided further insight from his professional and academic experiences. Until the architectural discipline begins to better empirically analyze, articulate, and document how architectural designers assess the impact and effectiveness (or appropriate-ness) of one design solution over another, I fear that the discipline as a whole will never be able to do away with the persistent, mythical, media stereotype of the Architect as creative artist or honest craftsperson who is guided by her intuition.

2.10 A New Role for Buildings in Contemporary Society

In general, the greater role of a building in society—beyond the structural, functional, and aesthetic concerns—is ill-defined. This role, however, will determine the type and quality of decision elements in design decision-making necessary to fulfill the intended objective(s). Identification of the greater role of a building in society is ultimately a philosophical pursuit. According to the Stanford Encyclopedia of Philosophy, the philosophy of architecture is largely under-developed as compared with other artforms, such as literature, painting, film, or comics. Contemporary philosophical debates, while limited, have focused on classifying what architecture is—in particular, "whether architecture always, only sometimes, or never is an artform" (Fisher, 2016). Discussion of what architecture 'is' should, in my opinion, raise the questions: Are we, as architectural designers, designing for ourselves and our clients, architecture buffs and critics, and tourists alone? Or, are we designing for the general public who will ultimately inhabit the buildings we design? If the former, then buildings are but just sculpture: art realized *through* technological innovation and often commercialized. Art cannot solve problems; it can merely confront them. If the latter, then buildings must be conceived of *as* technology, serving to solve societal problems and designed to meet the complex needs of all building end-users as well as the surrounding community. In this thesis, a building is re-conceptualized not as a functional artform, but as a technology for effecting positive social change.

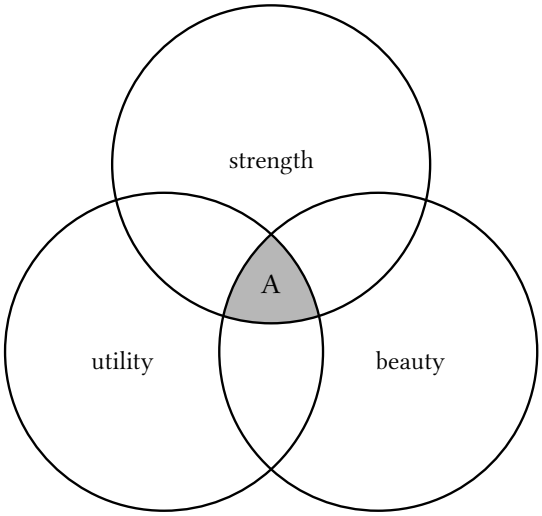
This re-conceptualization rests on the assumption that, in contemporary society, the Vitruvian triad must be expanded to include 'instrumentality' as a design principle in normative architectural practice. Vitruvius suggested that architectural designers must consider three design principles when developing the design of a 'good' building: *firmitas* (strength), *utilitas* (utility or functionality), and *venustas* (beauty) (Polión et al., 1960). I postulate that a structurally-sound, functional, and beautiful building—one which fulfills its

practical and safety requirements and improves the character and spatial quality of a neighbourhood—is not necessarily an instrument with a greater purpose; in other words, does not necessarily have 'instrumentality'. A building becomes an instrument, and has 'instrumentality', at the point when it is leveraged to effect change. At its best, a building should be the product of the balanced consideration of all four design principles, strength, utility, beauty, and instrumentality, which will result in not only a 'good' building, but a 'productive' building as well (see Figure 3.). As previously described, scientific research has explicitly established that the design of the built environment, which includes the design of buildings, can both directly and indirectly impact downstream public health outcomes—and often in more nuanced ways that one might anticipate. As such, a building can more specifically be used as an instrument to improve public health outcomes by contributing to the promotion of population health and health equity.

Instruments are, in effect, technologies. The conceptualizations of a building as a form of technology and design as a technological activity are not new. According to the Stanford Encyclopedia of Philosophy, Plato promoted the idea that technology imitates or is derived from nature; and, Democritus, another Ancient Greek philosopher, suggested that 'house-building' developed through the observation of birds constructing their nests and spiders, their webs (Franssen et al., 2018). Moreover, in reaction to more contemporary attempts to align design methods with the scientific method, Nigel Cross and colleagues (1981), prepared a paper for the '1980 Design Research Society Conference' justifying the idea of design as technological activity (and not as a pure science), which results in technological innovation. This implies that conceptualization of building as a technology itself—as opposed to a structure realized through technological innovation—is better suited to the philosophy of technology than the philosophy of architecture.

2.11 The Implications of a Building as Technology

What is technology? According to the Standard Encyclopedia of Philosophy, 'technology' is the application of scientific knowledge and practical expertise to address (fix) a problem (Franssen et al., 2018). Technology both informs and is informed by science. Furthermore, technology is without inherent value-systems; the designer of the technology imparts her own value-system during its design. This implies that technology can be leveraged for good, for evil, or for something in between. Consequently, it has been argued that the social impact of technology must also be considered throughout technological design decision-making—particularly in contemporary society wherein humans, for the first time in history, possess the power to destroy all of humanity as well as the environment (Franssen et al., 2018). Thus, when a building is viewed as technology, design decisions should be informed by scientific evidence, practical expertise, and analysis of social impact.



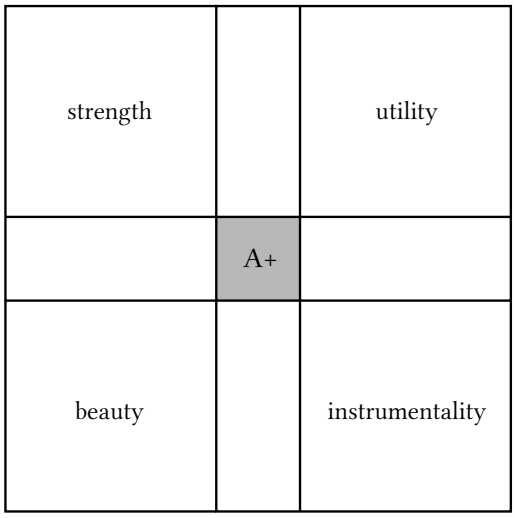


Figure 3. Architectural Design Principles for Contemporary Society—this figure illustrates the thesis' proposal to expand Vitruvian architectural design principles (strength, utility, and beauty) for contemporary society, and to include 'instrumentality' as a new design principle. Given that science has explicitly described the associations between health and the design of the built environment, buildings in contemporary society, in my opinion, should be used to effect positive change; more specifically, to positively impact population health and health equity outcomes. (source: figure by author)

2.12 The Fundamentals of General Decision-Making

Ronald A. Howard and Ali E. Abbas (2016) have identified six decision elements involved in 'decision-making'. The quality of each of these elements will determine the quality of the decision outcome. The quality of a decision outcome can be described as the likelihood that the decision-maker will identify the *optimal* (best) solution in the face of uncertainty (incomplete information). Thus, a high-quality decision outcome implies that it is very likely that the final decision is, in fact, the optimal solution (or as close as possible to). These decision elements include:

- **the decision-maker(s)**—the individual or group who is or are ultimately responsible for taking action.
- **the frame**—the lens through which the decision-maker will view the decision problem.
- **alternatives**—the potential actions to be taken. The alternatives available are influenced by the frame of the decision problem. For example, when purchasing a car, Howard and Abbas (2016) explain, "... the frame may be deciding which car to buy from a certain category of cars. The frame could also be whether to buy or lease a car, whether to own a car in the first place or to use public transportation, or even whether to commute to a job or work at home" (p. 37). Each frame of this decision problem presents the decision-maker with a different set of alternatives.
- **preferences**—the wants of the decision-maker. If the decision-maker did not have preferences, she would be content in allowing the future to unfold as it may.
- **information**—refers to the known facts or details about the decision problem that establish what courses of action *can*, realistically, be taken.
- **logic**—the process by which alternatives are analyzed to arrive at a solution to the decision problem.

Howard and Abbas (2016) conceptualize the connections between decision quality elements with the 'Decision Quality Stool' (see Figure 4.),

> One leg is what you can do: Your alternatives. The second leg is what you know: The knowledge that relates your alternatives to possible consequences. The third leg is what you want: Your preferences on the consequences. The three legs constitute the decision basis: The complete description of the decision problem you face. A seat, the logic that will determine your best action for this decision basis, holds the legs together (p. 38-9)

High-quality, 'good' decisions are dependent upon the frame of the decision problem (i.e. whether or not the 'right' problem has been identified) and quality and appropriateness of the inputs (i.e. what you know, what can be done, and what you want) (see Figure 5.). Tools are used to assist the decision-maker in applying the logic (Howard & Abbas, 2016). Table 3. outlines the decision quality elements and tools typical of normative architectural practice. Each of these decision quality elements will be expanded upon in turn in order to describe limitations of existing design decision-making models and tools in normative

architectural practice to: **(1)** address complex, societal problems in general and to address complex, public health issues in particular, and **(2)** ensure the likelihood of achieving high-quality architectural design outcomes in the face of uncertainty.

Note: Please refer to page 38 in the original source 'Foundations of Decision Analysis' by Ronald Howard and Ali Abbas.

Figure 4. Decision Quality Stool—this figure illustrates the elements involved in decision-making. If, for example, the logic used in decision-making is weak, then so too will be the decision quality stool. (source: Howard & Abbas, 2016).

Note: Please refer to page 39 in the original source 'Foundations of Decision Analysis' by Ronald Howard and Ali Abbas.

Figure 5. Decision Quality Chain—this figure illustrates the importance of identifying the 'right' decision quality elements. These are necessary to arrive at a 'good' decision outcome. (source: Howard & Abbas, 2016).

Decision Quality Elements	Normative Architectural Design Practice
Decision-Makers the main actors involved in an architectural project, and their respective roles	• **client or property owner:** a private developer, government entity, or corporation • **(legally- and publicly-mandated) regulatory bodies**: ○ Authorities Having Jurisdiction *(e.g. local planning or development authority)* ○ appellate body, if necessary (*e.g. Local Planning Appeal Tribunal*) • **architectural designers:** who act as the prime consultant, directing the work of sub-consultants, such as engineers, interior designers, landscape architects, and any experts pertinent to the clients or regulatory body requirements in order to realize an architectural solution
Frame the lens through which the design decision problem is viewed	• **client or property owner:** response to a particular 'demand'—often the building is viewed as an economic good, designed to maximize profits • **regulatory bodies**: adherence to regulatory requirements and restrictions • **architectural designers:** predominantly preoccupied with site analysis and development of siting options, programmatic function as required by the client and in response to the requirements of the relevant regulatory bodies, and finally the form, composition, and representation (i.e. beauty)
What You Can Do possible alternative interventions	**primary work within the professional architectural domain**: • all stages of building design, including the shell, interiors, immediate surroundings, and arrangement of building programming **other possible tasks within the architectural domain or supervised by the Architect**: • industrial design • installation design • public space design • landscape design • master plan design *(i.e. neighbourhood/district design)* • feasibility studies • functional programming • site analysis and selection • building surveys, audits, and measured drawings • re-zoning applications

What You Know information used to inform the development 'pro forma' and the subsequent architectural design work	**information consistently used in <u>design</u> decision-making by the client or property owner, the regulatory bodies, and the architectural designers:** • client or property owner design brief and/or functional and building program, if provided by the client or property owner; • site information from surveys and regulatory mapping information; • understanding of the ultimate building end-user, which is sometimes established through a consultation process if required by the client or the regulatory body; • design and construction resources (e.g. time, budget, staff, materials, capacity, etc.); • regulatory restrictions and allowances (e.g. zoning by-laws, building code, Architect's Act); • physical constraints and limitations (e.g. gravity, material, etc.); • specialized architectural expertise; • specialist engineering and other consultant expertise; and, • information learned through iterative design processes. **additional information frequently used throughout design decision-making processes:** • support or opposition from the public (i.e. neighbourhood stakeholders and local residents); • spatial principles from architectural theory (e.g. form, scale, pattern, balance, etc.); • architectural design precedents, propositions, or speculations from the architectural literature; • historical or natural heritage context; and, • varying qualities of scientific research findings, etc.

What You Want
decision-maker preferences and/or requirements regarding the final consequences of a built project
	• **client or property owner**:
	  ○ ensure profitability; and,
	  ○ ensure competitive advantage.
	• **regulatory body**:
	  ○ uphold regulatory requirements and restrictions in an ongoing planning approval process;
	  ○ align approval discourse with overall urban-planning and political agendas for the broader community; and,
	  ○ serve the public interest in achieving publicly outlined goals from all levels of public policy.
	• **architectural designers**:
	  ○ develop possible functional solution to the building program;
	  ○ integrate heuristic regulatory solutions implied in the regulatory guidelines and laws;
	  ○ develop technical solutions suitable to the building program and spatial goals;
	  ○ consider spatial quality beyond program, such as access to natural light and the proportions of the individual rooms;
	  ○ aspire to self-expression and artistic satisfaction (if possible);
	  ○ innovate at all levels from functional to technical;
	  ○ ensure client satisfaction and repeat business;
	  ○ ensure profitability for the practice to maintain its business integrity; and,
	  ○ receive positive reception from the architectural community, the public, and the private development sector.

Logic
the method of decision-analysis
	• **client or property owner:**
	development of a built project to achieve a strong speculative financial profit (with greater potential than the stock market) in the private case, or to promote the built presence of public institutions
	• **regulatory bodies:**
	project's adherence to the regulatory requirements and restrictions (i.e. comparison between design and regulations)
	• **architectural designers:**
	  ○ solutions-focused decision-making model (wherein synthesis is prioritized over analysis)
	  ○ non-standardized, unsystematic, but heuristically- and iteratively-cyclical method of problem-solving (analyzing and synthesizing):
	  ○ heuristics developed over a sequence of previous projects (i.e. rules of thumb)
	  ○ broader exploratory (divergent) and evaluative (convergent) thinking, guided by previous experience and best heuristic practices

Tools aids to assist the decision-maker in applying the logic	**design decision-support tools typically used by architectural designers, but more generally available to the client or property owner and the regulatory bodies throughout the development of an architectural design project:** • creative and/or Geographic Information Systems mapping resources • digital architectural drawings (*e.g. plan, section, elevation, diagram, axonometric, etc.*) • three-dimensional prototyping (*e.g. physical model-making, Building Information Modelling, etc.*) • architectural precedents, including those implemented in practice and those used in the development of urban-development policy (e.g. Toronto's Tall Building Guidelines) • phased project-delivery framework (*i.e. pre-design, schematic design, design development, construction documentation, bidding and negotiation, and contract administration*) • widely-used standards texts, such as Neufert, Architects' Data (*i.e. spatial dimension and configuration standards*) • land-use zoning • setback-based, building envelope, and Floor-Area-Ratio or Floor-Space-Index type of building zoning • building code standards established by the regulatory bodies to protect the public • industry innovations in building technologies or building sustainability standards (*e.g. LEED Building Certification Standards and WELL Building Standards*) • production tools for professional architecture practice: (*e.g. schedules, specifications, etc.*)

Table 3. Decision Quality Elements and Tools in Normative Architecture Practice—this table describes and outlines the decision quality elements and inputs in design decision-making processes, in normative architectural practice. (source: table by author; information sourced from Brown et al., 2009; Martin 2009; Martin, 2014; Plowright, 2014)

2.13 The Primary Decision-Makers in Normative Architectural Practice

According to the Canadian Handbook of Practice, there are typically three primary decision-makers involved in design decision-making processes throughout the development of a building's design (Brown et al., 2009). These actors include the client or property owner, the regulatory body or bodies who govern the design and construction of built structures, and the architectural designers. A client or property owner—who is most often a private developer, a government, or Non-Governmental Organization (NGO)—will commission the services of an architectural designer (or an architectural design firm) to design and coordinate the construction of a building. The regulatory bodies will oversee a building's conception, design development, construction, and sometimes its operation. The regulatory body will permit the client and architectural designers to progress through the project—provided building and development regulations are followed. The architectural designers are responsible for developing and implementing the design—usually from a project's conception until a year following its construction. They will typically act as 'Prime Consultant'—a managerial role under which specialist engineers and consultants operate, inform design decision-making, and execute the instructions of the architectural designers. Thus, while architectural designers are a key participant in design decision-making processes, they ultimately do not have final say in the development of a building's design. Further, the decision-makers involved in normative architectural practice are generally from the same urban development sector and, as such, buildings are often designed while working in a silo. This can be problematic when addressing complex, societal problems in general and complex, public health issues in particular because their upstream, underlying causes are often intersectoral.

2.14 The Frame of the Decision Problem in Normative Architectural Practice

An architectural design 'decision problem' is framed differently by each of the decision-makers involved in design decision-making processes:

- **client or property owner**—the focus of the decision problem is to respond to a particular demand (Brown et al., 2009). When a project is initiated by a private developer, the building is often viewed as an economic good, designed to maximize profits in a speculative venture in the marketplace. Whereas, when initiated by a government or NGO, the goal is most often to develop an institutional, public good.
- **regulatory body**—the focus of the decision problem is on adherence to regulatory requirements and restrictions of government or other relevant bodies or institutions (Brown et al., 2009).
- **architectural designer(s)**—for the architectural designers, the focus of the decision problem is on solving the stated or the desired building function, its

architectural form, and plan or three-dimensional composition representing varied ambition from efficiency of a functional distribution to beauty. The decision problem is typically framed according to the priorities of the individual architectural designer or the architectural design firm. Thus, there is a diversity in approaches to architectural 'problem-solving'; some architectural designers remain satisfied with a functional or technical solution that directly answers the client's design brief. Others have the broader ambition to achieve beautiful work, which is usually driven by the personal motivations of the individual designer.

Prior to initiation of construction documentation, the client or property owner and regulatory body will approve or reject a preliminary design proposal developed by the architectural designers according to the individual aims of the designers, the project aims defined by the client, and the regulatory requirements and restrictions. Despite the best of intentions of architectural designers, their clients, and the regulatory bodies that govern the design and construction of buildings, buildings are fundamentally erected to fulfill a particular demand whether initiated by a private or public entity. As a consequence, in normative architectural practice, buildings are generally designed such that they do not bring harm to building end-users or the surrounding community. However, buildings are not necessarily designed to *help* the end-users or the surrounding community thrive. This approach is likely be problematic when addressing complex, societal problems in general. As well, this approach is counter to fundamental objectives of health promotion, which seeks to empower populations to achieve positive health—not simply to reduce incidence of ill-health or to protect the public from harm.

2.15 The Alternatives in Normative Architectural Practice

Architectural designers provide architectural services to clients or property owners with the primary objective of modifying or manipulating the physical environment. As described in the Canadian Handbook of Practice and the Architects Act, building design (of a certain height and area, and for a particular end-user) is relegated to the *profession* of architecture (Brown et al., 2009; Architects Act, 1990). That said, the *practice* of architecture can be much broader than building design alone (Brown et al., 2009). Within what is considered to be 'basic' (typical) architectural services, architectural designers may also provide design services at a variety of scales. Other possible services within the architectural domain or supervised by architectural designers include: industrial, installation, public space, landscape, or master plan design; conducting feasibility studies, functional programming, site analysis and selection; conducting building services, audits, and developing measured drawings; and, re-zoning applications. These additional services depend on the client's financial support or the demands of a regulatory body. Thus, there is generally one strategy employed to address an architectural design decision problem, and that is through design alone (and/or services conducted in the pursuit of design). As the upstream, underlying causes

of complex, societal problems are often intersectoral, a comprehensive approach—one which utilizes multiple strategies to address an architectural design decision problem—is likely to be more productive when addressing complex, societal problems in general. Public health practitioners employ a combination of complementary intervention strategies in order to improve population health and health equity outcomes.

2.16 The Information Used to Inform Design Decision-Making in Normative Architectural Practice

A variety of information, or 'evidence', is used to inform the development 'pro forma' and the subsequent architectural design work. The information that is consistently used throughout design decision-making processes in normative architectural practice include the:

- client or property owner design brief and/or functional and building program, if provided by the client or property owner;
- site information from surveys and regulatory mapping information;
- understanding of the ultimate building end-user, which is sometimes established through a consultation process if required by the client or the regulatory body;
- design and construction resources (e.g. time, budget, staff, materials, capacity, etc.);
- regulatory restrictions, requirements, and allowances (e.g. zoning by-laws, building code, Architect's Act);
- physical constraints and limitations (e.g. gravity, material, etc.);
- specialized architectural expertise;
- specialist engineering and other consultant expertise; and,
- information learned through iterative design processes.

Additional information frequently used throughout design decision-making processes includes:

- support or opposition from the public (i.e. neighbourhood stakeholders and local residents);
- spatial principles from architectural theory (e.g. form, scale, pattern, balance, etc.);
- architectural design precedents, propositions, or speculations from the architectural literature;
- historical or natural heritage context;
- varying qualities of scientific research[4] findings, etc.

[4] Plowright (2014) and Martin (2014) both suggest that architectural designers do not, in fact, know what 'research' is according to the academic definition of research—an activity wherein new knowledge is developed based on existing knowledge. Architectural designers consider research instead to be what academics might refer to as 'information gathering'.

Beyond the information provided from the client or property owner and the regulatory body, additional information that architectural designers will consider throughout design decision-making processes is generally limited to that which is within the boundary of, or influential to, the architectural domain (see Figure 6.). Plowright (2014) suggests that, "… information needed to make decisions in architectural design is based on human interpretation of spatial qualities, elusive qualitative aspects, or effects that are not absolutely repeatable" (p. 65). Unless asked or independently motivated to do so, architectural designers typically do not consider 'scientific' research. If scientific research findings are used, the research findings are generally not appraised for quality and are often used arbitrarily. Thus, the additional information used to inform design decision-making can be very diverse between architectural design projects.

Further, based on my own professional experiences in the architecture, engineering, and construction industry, architectural designers generally do not rigorously consider the social impact of their design decisions. Such impact analyses, if conducted, are typically limited to the assessment of a building's environmental impact. For example, architectural designers will conduct 'shadow' studies, which are usually a regulatory requirement, to better understand the level of sunlight obstructed by a building on its immediate surroundings. Specialist engineers and/or consultants who work to support the development of a building's design, may conduct their own analyses that, as well, focus primarily on environmental factors, such as a building or site design's impacts to wind, noise, or vehicular traffic. Thus, impact analyses are sometimes used to inform architectural design decision-making, but they are generally limited to the analysis of environmental factors and do not capture the broad extents of the wider determinants of health.

In summary, the information used to inform design decision-making in normative architectural practice is determined by:

- the information provided from the client or property owner;
- the regulatory framework, which has primarily been established to protect rather than promote the public's health, and which also has a greater emphasis on environmental health as opposed to social health or health equity;
- the specialist, but practical, expertise of the architectural designer, learned through experience;
- the individual design-objectives of the architectural designer or architectural design firm, which are generally heavily focused on creating sensory experiences established through the spatial quality of the design; and,
- limited analysis of environmental impact (as opposed to social).

Thus, the type or quality of information necessary to support the proposition of a building as technology, or more specifically: a public health technology, is generally not used to inform design decision-making in normative architectural practice.

Note: Please refer to page 19 in the original source 'Revealing Architectural Design: Methods, Frameworks and Tools' by Philip D. Plowright.

Figure 6. Boundaries, Syntax, and Influences of the Architectural Discipline— this figure illustrates that which is within boundary of and influential to the architectural domain. These factors, in essence, determine the types of information considered in design decision-making in normative architectural practice. (source: Plowright, 2015).

2.17 The Preferences (or Decision-Maker Requirements) in Normative Architectural Practice

As previously described, each of the primary decision-makers involved in an architectural project will frame the design decision problem according their own priorities, and as such, each decision-maker has different preferences and/or requirements regarding the final consequences of a built project. Each decision-maker aspires to:

- client or property owner:
  - ensure profitability; and,
  - ensure competitive advantage.
- regulatory body:
  - uphold regulatory requirements and restrictions in an ongoing planning approval process;
  - align approval discourse with overall urban-planning and political agendas for the broader community; and,
  - serve the public interest in achieving publicly outlined goals from all levels of public policy.
- architectural designers:
  - develop a possible functional solution to the building program;
  - integrate heuristic regulatory solutions implied in the regulatory guidelines and laws;
  - develop technical solutions suitable to the building program and spatial goals;
  - consider spatial quality beyond building program, such as access to natural light and the proportions of the individual rooms;
  - aspire to self-expression and artistic satisfaction (if possible);
  - innovate at all levels from functional to technical;
  - ensure client satisfaction and repeat business;
  - ensure profitability for the firm to maintain its business integrity; and,
  - receive positive reception from the architectural community, the public, and the private development sector.

With such diversity in objectives and priorities across decision-makers and across architectural projects, each building designed will inevitably lead to the construction of object buildings. Object buildings are not designed as one interconnected system, but instead they act as their own, introverted ecosystem, which is likely to be problematic when aspiring to address complex, societal problems in general. As well, a patch-work approach to architectural design will likely prove to be ineffective in population health and health equity promotion; healthy cities theorists postulate that buildings should be designed as components of a larger, community-based ecosystem (Sarkar et al., 2006).

2.18 The Logic Used in Normative Architectural Practice

2.18.1 Decision-Analysis for Complex Decision-Making in General

Howard and Abbas (2016) explain that decision-analysis enables the decision-maker to achieve clarity of thought when faced with making a decision. They define a decision as, "a choice between two or more alternatives that involves an irrevocable allocation of resources" (p. 30). Decision-making can be difficult for a number of reasons. Uncertainty of the future can amplify the difficulty of a decision. Due to the nature of uncertainty, a good decision may not necessarily result in good outcome. For example, after becoming intoxicated at a party, you decide it best to stay the night at your friend's house with the intent of driving home, sober, in the morning. However, en route home the following morning, you are involved in a car accident. In this case, a 'good' decision resulted in bad outcome. Similarly, a 'bad' decision can result in a good outcome. If you instead decide to drive home intoxicated, you might arrive home safely by sheer lucky circumstance. Moreover, decisions can involve multiple individuals; as such, compromises need to be made between stakeholders. Particularly as decisions become increasingly complex, decision-analysis can assist the decision-maker in identifying the best course of action to take in the face of uncertainty.

According to Howard and Abbas (2016) different types of decisions demand different levels of analysis, or 'rigour' (see Figure 7.). Rigour refers to, "the judicious selection and application of methods in order to maximize the probability of producing trustworthy answers to the [decision-problem] under the constraints imposed by its context" (as cited in Lipshitz, 2010). Everyday decisions, such as determining what to eat for breakfast in the morning, are generally simple enough such that the decision-maker can rely on common sense, personal history or habit, or a rule of thumb to determine an appropriate solution. An architectural 'rule of thumb' could be to orient sustainable buildings such that the glazing is maximized along the south façade in order to increase solar gains. More important decisions, such as determining the correct car to buy, require more conscious thought. By referring to a car-buying checklist, for instance, the decision-maker can avoid frequently cited decision-making errors. Complex decisions, however, are those that are of great importance and require trade-offs to be made between multiple stakeholders (Howard & Abbas, 2016). They require the application of a formal process in order to arrive at high-quality decisions (Howard & Abbas, 2016). In summary, the more complex the decision-problem, the more rigorous the decision-making process must be. Thus, in order for architectural designers to address complex, societal problems in general, then they require rigorous methods of decision-analysis. The complexity of addressing public health in architectural design decision-making, and the existing decision-analysis methods used in normative architectural practice today are described below.

Note: Please refer to page 28 in the original source 'Foundations of Decision Analysis' by Ronald Howard and Ali Abbas.

Figure 7. Hierarchy of Decisions—this figure describes the methods of decision-analysis (or logic) necessary for decisions of varying levels of complexity. The more complex the decision problem, the more rigorous the methods of decision-analysis should be. (source: Howard & Abbas, 2016)

2.18.2 The Complexity of Promoting Population Health and Health Equity in Design Decision-Making in Normative Architectural Practice

Determining an optimal (or as close as possible to) architectural design solution that promotes population health and health equity, if prioritized in an architectural project, would arguably be very complex given the:

- intricacy of the pathways between wider determinants of health, population health, and health equity outcomes;
- magnitude of potential deleterious, public health impacts related to the design of the built environment;
- potential friction between the proactive nature of public health interventions and other, more well-established competing interests involved in the architectural design process; and,
- finite resources available in an architectural project.

In keeping with the foundations of decision-analysis, in order to address a new complex, societal issue, such as population health and health equity, in normative architectural practice, architectural designers would need to employ rigorous methods of decision-analysis and be equipped with tools capable of applying this logic.

2.18.3 Existing Decision-Analysis Methods in Normative Architectural Practice

There are two primary stages involved in problem-solving: analysis and synthesis. The Merriam-Webster dictionary defines analysis as, "a detailed examination of anything complex in order to understand its nature or to determine its essential features: a thorough study" (Merriam-Webster, n.d. a). Whereas, the dictionary defines synthesis as, "the combining of often diverse conceptions into a coherent whole" (Merriam-Webster, n.d. b). According to the Canadian Handbook of Practice, there are no standard approaches to design problem-solving in normative architectural practice (Brown et al., 2009). In other words, there are no prescribed approaches to 'analysis' and 'synthesis'. Fundamentally though, in normative architectural practice, architectural designers primarily rely on heuristics throughout the 'analysis' stage of problem-solving, and an iterative process of cyclical exploratory (divergent) and evaluative (convergent) 'design thinking' throughout the 'synthesis' stage.

This implies that architectural designers put greater emphasis on developing solutions as opposed to analyzing the decision-problem or its context in detail. Heuristics in design have been purported to be the key to shaping the complexity of the design process and its often countervailing and contradictory requirements. They are learned through practical experience dealing with common decision-problems, and are then applied to uncommon, new, design-problem challenges. In keeping with the foundations of decision-analysis theory, without thorough assessment of the impact of heuristics in design, these shortcuts can be considered

to be approximations, do not necessarily produce trustworthy outcomes, and cannot ensure the likelihood of achieving high-quality architectural design outcomes in the face of uncertainty. Exploratory and evaluative thinking processes enable architectural designers to generate and eliminate potential design solutions to answer the criteria set by the client or property owner, regulatory body, and their own personal design style or ambitions. These processes are without defined rules; rather they are framed by the designer's developing 'intuition' through iterative exploration and evaluation, as well as her personal preferences for spatial quality and self expression (as cited in Martin, 2014; Plowright, 2014). Without the necessary rigour to analyze the decision problem, and with the potential for such diversity between architectural designers and/or architectural firms in synthesizing what is known, architectural designers cannot guarantee optimal (or close as possible to) architectural design solutions. There exists greater potential to produce disconnected, object buildings, which are likely incapable of adequately addressing population health and health equity.

Italian architect Giancarlo de Carlo similarly identified a number of issues in the architectural discipline's approach to addressing the rampant societal problems of his time, which included extreme poverty among urban dwellers and widespread slum developments. In 1969, de Carlo presented a politically-driven lecture at an architectural conference, ostensibly reprimanding the discipline and empathizing with a younger generation of socially-conscious designers who felt betrayed by the Modernist movement. In 2005, contemporary architects, academics, and theorists, Peter Blundell-Jones, Doina Petrescu, and Jeremy Till, included de Carlo's lecture in a published compilation of essays on the topic of participatory design in architectural practice. In defending its inclusion, the editors expressed:

> Its strongly political tone recalls a time when the impact of global capitalism was beginning to be felt, and the political implications of the aesthetic were being exposed. Thirty-four years on, much remains relevant, and many of the problems are still with us … (Blundell-Jones et al., 2005, p. 3).

Since de Carlo's lecture was published again in 2005, I argue that capitalism has only led to the further deterioration of global and local ecosystems. De Carlo explains that architectural designers, whose livelihoods are dependent upon commissions, are too closely aligned with the elite; and as such, fail to adequately respond to the true needs and preferences of future building end-users (de Carlo, 2005). The resultant architecture becomes rigid and unable to adapt to end-users over time. A participatory approach, he claims, would instead enable the consideration of end-user needs and preferences throughout the design decision-making process; the resultant architecture would become dynamic and adapt to end-users over time. De Carlo (2005) argues that the leading designers of the Modernist movement too quickly jumped to find formal solutions to complex, societal problems without first understanding the mechanisms through which these problems were borne. With an in-depth understanding of 'why', he suggests using other words, that architectural designers would be better able to critically frame the design problem and to develop more appropriate design solutions (de Carlo, 2005).

Referencing a study of design behaviour, Nigel Cross (1982) describes the differences between how a scientist approaches problem-solving with the approach of an architectural designer:

> Lawson's studies of design behaviour, in particular, have compared the problem-solving strategies of designers with those of scientists. He devised problems which required the arrangement of 3D coloured blocks so as to satisfy certain rules (some of which were not initially disclosed), and set the same problems to both postgraduate architectural students and postgraduate science students. The two groups showed dissimilar problem-solving strategies, according to Lawson. The scientists generally adopted a strategy of systematically exploring the possible combinations of blocks, in order to discover the fundamental rule which would allow a permissible combination. The architects were more inclined to propose a series of solutions, and to have these solutions eliminated, until they found an acceptable one. Lawson has commented: "the essential difference between these two strategies is that while the scientists focused their attention on discovering the rule, the architects were obsessed with achieving the desired result. The scientists adopted a generally problem-focused strategy and the architects a solutions-focused strategy. Although it would be quite possible using the architect's approach to achieve the best solution possible without actually discovering the complete range of acceptable solutions, in fact most architects discovered something about the rule governing the allowed combination of blocks. In other words, they learn about the nature of the problem largely as a result of trying out solutions, whereas the scientists set out to specifically to study the problem". These experiments suggest that scientists problem-solve by analysis, where as designers problem-solve by synthesis (p. 223).

The aim of this thesis is not to turn architects into scientists, but rather to facilitate more in-depth analysis of the design decision-problem to complement existing solutions-focused processes in normative architectural practice. One could, perhaps, argue that this currently does not happen as a result of a lack of financial support from clients or property owners, or condensed project timelines. However, as Cross (1982) goes onto explain:

> Lawson repeated his experiments with younger students and found that first-year students and sixth-form [(grade 5)] school students could not be distinguished as 'architects' and 'non-architects' by their problem-solving strategies: there were no consistent differences. This suggests that architects learn to adopt their solution-focused strategy during and presumably as a result of, their education. Presumably, they learn, are taught, or discover, that this is the more effective way of tackling the problems they are set (p. 223).

Despite not knowing exactly how existing design decision-making processes in normative architectural practice came to be, the problem remains clear: in order for architectural designers to address complex, societal problems—including, but not limited to, population health and health equity—through architectural design, methods of decision-analysis in normative architectural practice must become more rigorous to ensure the likelihood of achieving high-quality architectural design solutions in the face of uncertainty.

Attempts have been made to improve the rigour of design decision-making in normative architectural practice—one such example is 'Evidence-Based Design'. Kirk Hamilton, academic and architect, defines Evidence-Based Design as, "a process for the conscientious, explicit, and judicious use of current best evidence

from research and practice in making critical decisions, together with an informed client, about the design of each individual and unique project" (Stichler and Hamilton, 2008, p. 3). The steps prescribed by the Evidence-Based Design process, and promoted by the Centre for Health Design, are outlined below. Depending on the particulars of the project in question, these steps may be combined, repeated, or carried out in a different order.

1. **Together with the client, such as a healthcare organization, establish project goals and objectives. Consider how the design of the building can promote these aims. Develop research questions informed by the project goals and objectives.** *For example, on a healthcare-related project, a project goal may be to reduce the rate of medical errors.*
2. **Gather existing scientific and contextual evidence related to the research questions.** *For example, on a healthcare-related project, activities may include, but are not limited to: conducting a literature review, visiting other facilities, or reviewing internal data from the healthcare organization.*
3. **Evaluate the strength and reliability of each source of evidence. For example, when reviewing a research study, consider if the research methods selected align with the author's stated research questions.**
4. **Distill the evidence gathered into a series of design guidelines. Based on the established design guidelines, begin to develop preliminary design strategies.** *For example, on a healthcare-related project, a design guideline may indicate that patient rooms should be arranged in the same way no matter their orientation.*
5. **Develop hypotheses predicting the potential outcomes of proposed design strategies.** *For example, on a healthcare-related project, by standardizing the layout of patient rooms, the rate of medical errors may be reduced.*
6. **Identify what factors should be measured, before and after the implementation of a design strategy, in order to prove or disprove the hypotheses. Collect the necessary data in order to establish the baseline measurements for the factors identified earlier.** *For example, on a healthcare-related project, by comparing the number of errors reported by medical staff, before and after, will indicate whether or not there has been a reduction in medical errors as a result of the standardizing the layout of patient rooms.*
7. **Monitor the implementation of the design strategies and construction processes, and ensure that the original design intent is not compromised by any changes made.**
8. **Following occupancy of the building, measure the factors previously identified in Step 6. Compare measurements from before and after in order to prove or disprove the hypotheses. Report and publish the results** (The Center for Health Design, 2015).

According to Martin (2009)—who has referenced E.M. Roger's 'diffusion of innovation' theory, which seeks to describe the level or rate of implementation of a particular innovation—evidence-based design in normative architectural practice is, at best, at the very early stages of adoption. Martin (2009) explains that in more specialized architectural practice, such as in healthcare design,

adoption of evidence-based design is further along. While it has the potential to improve the rigour with which design decisions are made in normative architectural practice, current evidence-based design practices do not facilitate the consideration of population health or health equity, unless it is requested by a client, property owner, or regulatory body, or unless the architectural designer or architectural design firm chooses to prioritize public health in design decision-making. So, while evidence-based design might prove more effective in ensuring higher-quality architectural design outcomes when addressing complex, societal problems in general, in keeping with the foundations of decisions analysis: the 'right' decision-makers must be involved, the 'right' decision problem must be identified, the 'right' strategies must be used, the 'right' information must be considered, and the decision-makers must share the 'right' preferences or requirements as well.

2.18.4 Stressing the Importance of Rigorous Decision-Analysis Methods in Public Health Decision-Making

It is critical that decisions concerning public health be assessed using rigorous, analytical decision-making models. Flawed decision-making in the interest of the public's health has led to dire consequences in the past. The consequences can be especially terrible when the system fails completely. In 1956, for example, a German pharmaceutical company developed a new drug called Thalidomide (Thalidomide Victims Association of Canada [TVAC], n.d. a). The drug was primarily intended to improve nausea symptoms in pregnant women (TVAC, n.d. b). In 1959, Health Canada approved the use of the Thalidomide, and Canadian physicians began to prescribe it to their patients (TVAC, n.d. a). However, the Food and Drug Administration—the agency responsible for drug approvals in the United States—did not approve the use of Thalidomide, and instead demanded further evidence of the effects of the drug in pregnant women[5] (TVAC, n.d. a). By 1960, reports from physicians of unintended side effects attributable to Thalidomide began to emerge (TVAC, n.d. a). Pregnant mothers were experiencing mild to severe neurological issues, and babies were being born with devastating abnormalities, including extreme congenital deformities, paralysis, and total vision or hearing loss (see Figure 8.) (TVAC, n.d. b). In some instances, Thalidomide-use even resulted in the baby's death (TVAC, n.d. b).

Thalidomide was eventually taken off the Canadian market, but many lives remain impacted by its negative side-effects. The initial testing of the drug—on which Health Canada based their approval—was conducted by the pharmaceutical company that developed it, without independent review (TVAC, n.d. a). In other words, there was an inherent conflict of interest on the part of the pharmaceutical company when evaluating the efficacy of the drug. As well, the pharmaceutical company's safety claims were found to be unreliable (TVAC,

[5] Ironically, it was a Canadian pharmacist who, while working for the FDA, would not approve the use of Thalidomide in the United States (TVAC, n.d. a).

n.d. b). Had Health Canada's methods of analysis been more rigorous, use of the drug would likely never have been approved. Following the tragedy of the Thalidomide approvals process, reforms were instituted in Canada to improve the rigour in the control of new drugs (TVAC, n.d. a).

The traditional heuristic-based decision-analysis methods used in normative architectural practice today are arguably not rigorous enough to facilitate the consideration of public health in design decision-making. Given what is known about the evident and more nuanced, deleterious health impacts associated with the design of the built environment, there exists potential to inflict great harm on society. This is especially concerning when, as explained by Giancarlo de Carlo, ideas promoted in the architectural discipline are at least 50 years old (de Carlo, 2005); many architectural and urban-planning models for living—such as Modernist architect Le Corbusier's 'Towers in the Park' model wherein activities of daily life are dramatically separated, spatially—have resulted in 'urban sprawl'. Urban sprawl has scientifically been shown to have significant influence on sedentary lifestyles, which ultimately lead to increased incidence of overweight and obesity. Despite the scientific findings, these design models continue to be implemented globally. Buildings impact too many lives on a daily basis and, as such, their potential health impacts should be rigorously considered throughout design decision-making processes—the magnitude of potential negative impact is far too great not to be.

Figure 8. A Baby with Severe Birth Defects as a Result of the Mother's Thalidomide-use During Pregnancy—this figure intends to demonstrate and emphasize the seriousness with which health-related decisions should be made. When less than rigorous methods of decision-analysis are used in decision-making in the interest of the public's health, there can be severe consequences. One such example in Canadian history was when Health Canada approved a drug called Thalidomide without rigorously evaluating its potential to inflict harm. This error in judgement negatively impacted the health of many Canadians. It even resulted in death. (source: TVCA, n.d. b)

2.19 The Tools Used in Normative Architectural Practice

As explained by Howard and Abbas (2016), tools used in decision-making assist the decision-maker in applying the logic (the method of decision-analysis). In normative architectural practice, the tools used help to facilitate solutions-focused problem-solving. As Plowright (2014) describes:

> Architectural outcomes are always physically based on the arrangement of form and of a particular scale, regardless of the starting position. The formal composition involves a complex relationship to the human body, social content, technical position, and cultural representation. The language used, the syntax, is based on negotiating these relationships with formal arrangements in space. All the tools that have developed to access architectural ideas are based on this premise. These include very traditional tools of plan, section, elevation, axonometric, isometric, and model, but also newer tools such as digital visualization, algorithms, and environment simulations. Production tools involved in project delivery, such as specification and schedules, are also focused on formal arrangement and physical manifestation. They are used to create coherence between intention and results. Even the diagram, as it is used in architecture, is a representation of forces which, ultimately, become physically located and define in space. The tools have a tendency to be based in the visual field or to be visually biased, prioritizing sight over the other senses. However, olfactory (smell) and auditory (sound) knowledge can also be considered as critical components in the discipline of architecture, especially contributing to the interpretation of a place. While our tools tend not to engage this information directly, it can be notated by them graphically and is part of the interpretation of the quality of a space. Taste, as a sense, is outside of the domain of architecture. Tools used in considering architectural solutions can access information based on its syntax directly. For example, we can use plan-based drawing to address circulation, sequence, rhythm, hierarchy, and field; or elevation to represent texture, surface, rhythm, massing, and materiality (p. 16-17).

Thus, there exist few tools in architectural practice that are capable of analyzing the design decision problem in any level of depth necessary to address complex, societal problems, especially the issue of population health and health equity.

2.20 The Limitations of Existing Design Decision-Making Models and Tools Used in Normative Architectural Practice

The limitations of existing design decision-making models and tools used in normative architectural practice to address complex, societal problems, especially the issue of population health and health equity are summarized below:

- the decision-makers—architectural designers do not have final decision-making power, and the primary decision-makers involved in an architectural project are typically from within the same sector.
- the frame—design decision problem varies between architectural design projects, and generally it does prioritize complex, societal problems, especially population health and health equity issues.

- **alternatives**—architectural designers are currently limited in their strategies to address complex, societal problems, especially population health and health equity, through design alone.
- **preferences (or requirements)**—there is great diversity in the preferences on the final consequences of a built project between the decision-makers involved in an architectural project; the personal preferences of the decision-makers do not necessarily reflect complex, societal priorities, including public health priorities.
- **information**—the information considered in design decision-making is limited to the information provided from the client or property owner, the regulatory framework, which is established to protect health and does not yet reflect a comprehensive definition of health, and that which is within the architectural domain, which generally reflects the priorities of the architectural designer and/or architectural design firm; this information is typically not integrated in a systematic way. Scientific evidence is rarely considered, and when it is, it is generally not assessed for quality and is often used arbitrarily; and, social impact is generally not thoroughly considered, if it is at all. Information used to inform design decision-making can be very diverse between architectural projects.
- **logic**—the methods of decision-analysis used are not rigorous enough to consider the complexity of societal problems, including issues of population health or health equity; there is greater emphasis on the 'synthesis' stage of problem-solving than the 'analysis' stage. In turn, existing tools in normative architectural practice do not support rigorous analysis of the design decision problem.

Thus, if architectural designers are to contribute more effectively to improving the public's health and well-being by promoting population health and health equity through architectural design, then the design decision-making models and tools used in normative architectural practice must be reinvented, and the discourse of the architectural discipline, widened.

2.21 The Transformation of Public Health Practice

Public health practitioners are, as well, problem-solvers who are faced with similar constraints and power-dynamics as architectural designers. Public health practitioners are focused on identifying pragmatic solutions, and are generally pressed for resources, such as time, money, staff, and capacity. Public health practitioners are also dependent upon a higher authority (the Canadian government across all levels) who has shifting political ideologies, varying levels of appreciation for public health, and ultimately has the final decision-making power by choosing to withhold or disburse public health funding. Public health practitioners are also dependent upon the cooperation of actors across sectors and disciplines, as well as the public itself. Moreover, as doctor, public health practitioner, and academic Bernard J. Turnock (1997) explains, public health was founded in colonialism. According to an historical review conducted by the

Canadian Public Health Association, public health in Canada was initiated in the 1600s when European immigration introduced infectious diseases in Indigenous populations native to North America, resulting in increased mortality rates (Rutty and Sullivan, 2010). Despite their challenges and history, the public health discipline has seemingly united to transform their practices accordingly in order to support health promotion.

Instead of assuming an apolitical stance, and aligning themselves with the elite—as what architect Giancarlo de Carlo has suggested architectural designers have done—the public health discipline has, in essence, armoured themselves with the practices and tools necessary to compete with a higher authority, on whom they are dependent, but who may not necessarily agree with public health objectives and values. By developing explicit and coherent disciplinary approaches to decision-making, which include basing decisions on high-quality, scientific and contextual evidence, they are more capable of withstanding the subjective criticism from those who may yield more power. While their efforts may not always change minds (as evidenced by U.S. President Trump's complete disregard for science and the recommendations of his public health advisors throughout the present-day, COVID-19 pandemic), in my opinion, the public health discipline as a whole continues to put up a good fight by not only strengthening the validity of their claims, but by also working to inform health policy itself.

The entire world is now witnessing firsthand what can happen to the public's health when some groups choose to take a more personalized or subjective, narrative approach and denigrate or disregard scientific evidence and its projections. If there is one good thing that can come from today's global public health crisis, I hope that this experience has awakened the architectural community, in particular, to the connections between public health and the design out the built environment. Should COVID-19 persist despite a possible vaccine, the architectural implications are profound. The architecture discipline can learn from the successes and failures of public health practice in order to contribute more effectively to improving the public's health and well-being by promoting population health and health equity through architectural design.

2.22 Evidence-Informed Decision-Making Models Typical of Public Health Practice

In contrast to the more adhoc design decision-making practices in normative architectural practice described above, public health practitioners utilize a standardized and structured decision-making model to identify effective public health interventions in support of population health (see Table 4.). Public health interventions are focused on improving the health of populations and reducing or eliminating disaparities in health across populations (Health Canada, 2001). As such, all decision problems are viewed through a 'population health' lens (which includes considerations for health equity). To address population health, preferences have been stipulated and are reflected in public health practices. Preferences include: increase in upstream investements, public involvement,

intersectoral collaboration, employment of multiple strategies, accountability for outcomes, as well as the appropriate allocation of health resources (Health Canada, 2001). At a minimum, public health practitioners consider the following information in their decision-making practices:

- a combination of relevant quantitative, qualitative, or mixed high-quality scientific research findings (i.e. evidence resulting from rigorous research methods);
- the prioritization of community health issues and contextual information (i.e. status of community health, inequities, and determinants of health);
- community and political preferences and actions (i.e. needs and interests of local residents, political capital (support or opposition from officials), political climate, and organizational or corporate climate); and,
- avalablility of public health and community resources (e.g. time, funding, staff, materials, capacity, etc.) (National Collaborating Centre for Methods and Tools [NCCMT], 2018).

To identify the most appropriate strategy or strategies, a step-wise (i.e. systematic) evidence-informed method of decision-analysis is used (see Figure 9.). The steps involved include:

- **Define**—**(1)** define the decision problem or question; **(2)** develop quantitative search strategies by identifying the: target population(s), intervention to be used or exposure (e.g. tobacco smoke) to be addressed, alternatives to be compared, and desired decision outcome; and, **(3)** develop qualitative search strategies by identifying the: target population(s) and conditions, circumstances, or experiences of the phenomemon or situation under study.
- S**earch—(1)** develop an effective search strategy—one that will produce high-quality and relevant evidence; and, **(2)** gather relevant evidence.
- A**ppraise**—assess the quality and relevance of the information gathered.
- S**ynthesize**—synthesize the information learned and develop general, actionable recommendations.
- **Adapt**—adapt the recommendations to address the local context.
- **Implement—**develop and implement an appropriate plan of action.
- **Evaluate—(1)** identify outcomes to be evaluated; **(2)** identify indicators to be measured; **(3)** collect the data necessary for evaluation; and, **(4)** conduct the evaluation, and identify changes to be made or lessons to be learned. (NCCMT, 2018)

Public health expertise is necessary to conduct each of these processes, and lessons learned from practice are generally embedded in the scientific evidence used to inform decision-making. Tools have been developed to support practitioners carry out each step of evidence-informed decision-making. For example, 'Developing an Efficient Search Strategy Using PICO tool' guides public health practitioners through the steps necessary to develop effective research questions and strategies. As well, critical appraisal tools outline the steps required to assess the quality of research evidence. Arguably, this model of decision-

making in public health practice better balances between the two problem-solving stages, analysis and synthesis, which can improve the likelihood of achieving high-quality public health outcomes. The HIA tool reflects decision-making models typical of public health practice, and has potential to help facilitate reform in design decision-making in normative architectural practice.

Figure 9. 'Evidence-Informed' Decision-Making Model Used in Typical Public Health Practice—this figure illustrates the prescribed, 'evidence-informed' process utilized to inform decision-making in typical public health practice. As well, it identifies many of the decision inputs that are considered throughout decision-making processes. Decision-making in typical public health practice appears to have more equal emphasis on the 'analysis' and 'synthesis' stages of problem-solving. Whereas, architectural designers generally put greater emphasis on and effort into the 'synthesis' stage of design decision-making. With improved decision-analysis, architectural designers are more likely to achieve higher-quality architectural design outcomes. (source: NCCMT, 2018)

Decision Quality Elements	Typical Public Health Practice

Decision-Makers
the main actors involved in public health decision-making
	Primary actors:
	• **Government of Canada, provincial or territorial governments, local (regional or municipal) governments**
	• **public health practitioners at federal, provincial or territorial, and/or local levels, which consists of:**
	  ○ **federal**: Health Canada, Public Health Agency of Canada
	  ○ **provincial or territorial**: Ontario Ministry of Health and Long-Term Care, Public Health Ontario (each province and territory has their own authorities)
	  ○ **local**: local health units, including local public health practitioners (e.g. public health nurses)
	
	Decision-Support actors:
	• **federal organizations** (e.g. Canadian National Collaborating Centres for Public Health: Aboriginal Health, Determinants of Health, Environmental Health, Infectious Diseases, Health Public Policy, and Methods and Tools)
	• **non-governmental organizations, authorities, or associations** (e.g. World Health Organization, Canadian Public Health Association)
	• **academic institutions**
	• **key stakeholders**

Frame the lens through which the public health decision problem is viewed	• **population health and/or health equity**—objectives are to improve the health of populations and to reduce or eliminate health disparities across populations
What You Can Do possible alternative interventions	**interventions within the public health domain**: • policy interventions (e.g. passive smoking policies in buildings) • programs (e.g. Healthy Babies, Health Children—early childhood development program) • services (e.g. oral health clinics) • intersectoral support and collaboration (e.g. with academic institutions, local community partners, or local stakeholders)

What You Know
information used to inform public health decision-making
	information <u>required</u> in public health decision-making:
	• high-quality research findings:
	  ○ best and current
	  ○ quantitative, qualitative, and/or mixed-methods
	  ○ intersectoral
	• prioritized community health issues and local context (i.e. status of community health, inequities, and determinants of health):
	  ○ surveillance data
	  ○ reports
	• community (i.e. stakeholders and affected populations) and political preferences and actions:
	  ○ needs and interests of local residents
	  ○ political capital (support or opposition from officials)
	  ○ political climate
	  ○ organizational/corporate climate
	• public health resources (e.g. time, funding, staff, materials, capacity, etc.)
	• public health expertise
	
	additional information, e.g.:
	• stakeholder expertise
	• specialist expertise (e.g. epidemiologic, statistical, etc.)

What You Want decision-maker preferences and/or requirements regarding the final consequences of public health intervention	• increase in upstream investments • public involvement • intersectoral collaboration • employment of multiple strategies • accountability for outcomes • appropriate allocation of health resources
Logic the method of decision-analysis	An 'analytical' decision-making model; standardized and systematic 'evidence-informed' method of decision-analysis: • **Define**—clearly define decision problem or question. • **Search**—develop effective search strategies and methods, and gather evidence. • **Appraise—**critically appraise the quality of the evidence gathered. • **Synthesize**—interpret and synthesize findings, and develop general, actionable recommendations. • **Adapt—**modify recommendations to suit the local context. • **Implement—**develop implementation plan, and implement intervention. • **Evaluate**—evaluate intervention outcomes, and make any necessary changes.

Tools aids to assist the decision-maker in applying the logic	**decision-support tools used by public health practitioners, e.g.:** • population health template • Evidence-Informed Decision-Making checklist • Developing an Efficient Search Strategy Using PICO tool • Levels and Sources of Public Health Evidence tool • Keeping Track of Search Results: A Flowchart tool • Levels & Sources of Public Health Evidence tool • PhotoVoice exercises • critical appraisal tools • Improving Future Decisions: Optimizing the Decision Process from Lessons Learned tool • Decisions, Rationale, and Key Findings Summary tool • Early Development Instrument • public health standards • databases (e.g. Statistics Canada)

Table 4. Decision Quality Elements and Tools in Typical Public Health Practice—this table describes and outlines the decision quality elements and inputs in decision-making processes, in typical public health practice. (source: table by author; information sourced from Health Canada 2001; NCCMT, 2018)

2.23 The Potential Implications of Employing Public Health Approaches in Normative Architectural Practice

If the HIA tool can enable architectural designers to employ the population health, health equity, and evidence-informed approaches typical of public health practice in normative architectural practice, then it is more likely that architectural designers will be better able to contribute to promoting population health and health equity through architectural design.

More specifically:

- If architectural designers were to similarly employ a **population health approach** to design in normative architectural practice, then it is more likely that architectural design will be better able to contribute to enabling a healthier population to thrive.
- If architectural designers were to similarly employ a **health equity approach** to design in normative architectural practice, then it is more likely that architectural design will be better able to contribute to reducing or eliminating health disparities, and to improving the overall health of the whole population by targeting sub-populations proportionate to their levels of need and disadvantage.
- If architectural designers were to similarly employ a scientific and contextual **evidence-informed public health approach** to design in normative architectural practice, then the likelihood of achieving higher-quality architectural design outcomes will increase as a result of the improved rigour, balance between analysis and synthesis problem-solving stages, and focus on public health. As well, an evidence-informed approach in general is more likely to complement existing heuristically- and iteratively-informed approaches than a purely evidence-based approach to design. However, an evidence-informed approach to design is also likely to necessitate improvements to the level of rigour and transparency with which practical knowledge is both derived and applied in normative architectural practice today.

CHAPTER 3

Potential Solution: The Health Impact Assessment

3.1 Proven Potential, Versatility, and Diverse Applicability of the HIA as a Health Promotion Tool

Given the pragmatic nature of the HIA, a characteristic of the tool that is inherently tied to its development, there is strong potential for the HIA to be an effective tool in normative architectural practice to improve the public health impacts of design decision-making, in an industry where the marketplace often dictates the objectives of an architectural project. In 1996, a group of researchers at the Institute of Health Promotion Research (IHPR) at the University of British Columbia submitted a report to Health Canada, documenting and reflecting on their rigorous assessment of the HIA as a population health promotion tool. According to the researchers, around this time in Canadian health history, government debts and budgetary deficits were becoming 'intractable' (Frankish et al., 1996). Further, there was a growing emphasis within the public health sector on the influence of health determinants beyond medical care and genetics, and recognition of the public health sector's limited ability to impact a broad range of health determinants. As well, there was an increasing commitment from public officials to engage communities in health-related decision-making. As a result, public health practices were, at the time, in the process of being reformed in order to:

- ensure greater accountability for public policies and programs—to ensure that policies and programs achieved their stated goals without unintended, adverse effects;
- facilitate the consideration of the social and environmental determinants of health;
- facilitate intersectoral collaboration; and,
- facilitate public participation and broad community consultation in health-related decision-making (Frankish et al., 1996).

Ultimately, the researchers concluded that the HIA operationalizes these practice goals by providing a framework through which policy-makers and practitioners can assess the intended and unintended health impact(s) of their proposals on the health outcomes of all Canadians (Frankish et al, 1996). Through rigorous assessment, including through the work of researchers at the Institute of Health Promotion Research, the HIA has been shown to be a valuable tool to provide its users with a framework to advance public health objectives despite the political and economic constraints often imposed on public health interventions. Thus, the HIA has embodied potential to advance public health agendas in architectural design and practice despite an architectural project's political or economic context.

The HIA has also been shown to be a versatile tool to implement improvements to the health impact especially of place-based projects, including larger-scale urban- and transportation-planning projects. In 2006, Dannenberg and colleagues, who are all public health and/or HIA experts, collectively contributed to a paper to identify the tool's development, successes, and potential issues preventing its advancement. The authors explain that despite the increasing recognition of the impact of the built environment on public health outcomes, public health practitioners are not skilled in its design, and urban-planning professionals, in particular, do not share the health-related expertise necessary to effectively address public health in policies intended to regulate the design of the built environment (Dannenberg et al., 2006). They assert, however, that, "there is substantial potential [in the HIA] to improve public health by bringing decision-makers' attention to the health consequences of their actions; city councilpersons, zoning commissioners, and other decision-makers typically have little background in health" (Dannenberg et al., 2006, p. 268). In support of their claim, the authors noted the repeated, demonstrable influence of HIA on decision-makers to implement changes to their respective proposals in order to improve a proposal's impacts on public health outcomes. They describe one such example in which, "an HIA of a proposed airport [master plan] in England focused on noise, air, pollution, traffic congestion and local employment, and led to health-promoting changes in the developer's plans" (Dannenberg et al., 2006, p. 262). As well, Dannenberg and colleagues (2006) note the versatility and diverse applicability of the tool to assess a variety of proposal-types, including place-based projects (as previously described) and higher-level policy proposals; and, to assess a variety of public health concerns, including the impact of a proposal on biomedical health outcomes (e.g. cardiorespiratory disease), the wider determinants of health, and/or health equity. Given the HIA's the versatility and diverse applicability, in addition to its proven impact on decision-making in a related field: urban-planning, there is strong potential that the HIA tool could be effective in normative architectural practice to promote population health and health equity in architectural design decision-making.

3.2 HIA Origins

According Harris-Roxas and Harris (2011), throughout the development of HIA, differences in public health concerns have resulted in three distinct approaches to HIA practice (see Figure 10.). These approaches include:

environmental health approach—which considers the impact of individual characteristics and behaviours as well as the physical environment on population health outcomes. HIAs with concerns for environmental health have typically been incorporated into environmental impact assessments (EIA), rather than conducted as stand-alone evaluations. The development and regulation of EIAs have been prompted by environmental disasters, and their impacts on human health.

social health approach—which considers the impact of the social, economic, and physical environment on population health outcomes. HIAs with concerns for social health have primarily been conducted on proposals outside of the health sector. Recognition of the impact of social factors on human health has been increasing over the last half century.

health equity approach—which considers the *differential* impact of the social, economic, and physical environment on health outcomes across populations. HIAs with concerns for health equity are more deliberate in their approach to addressing inequities; it is, after all, possible to conduct an HIA without considering the particular needs of vulnerable populations. Concern for health equity within the public health practice was initiated in the late 1980s (Harris-Roxas & Harris, 2011).

Each approach is underpinned by a particular epistemological stance, impacting the methods used and the information and evidence considered throughout the decision-making process (see Table 5.). Today, these three approaches to HIA practice have generally converged (Harris-Roxas & Harris 2011), and best practices have been recommended to guide decision-makers across a diverse-range of sectors (North American HIA Project Standards Working Group [NAHPSWG], 2009).

Environmental Health Approach	Social Health Approach	Health Equity Approach
• based on a narrow definition of health; • considers the impact of individual characteristics and behaviours and the physical environment on population health outcomes; • based on scientific evidence and predictive methods; • implicit/explicit values do not play a role in decision-making; and, • **Positivist** in approach.	• based on a broader definition of health; • considers the impact of the social, economic, and physical environment on population health outcomes; • broad definition of what constitutes evidence; • implicit values influence decision-making; and, • **Social Constructionist** in approach.	• based on a definition of health that recognises that health outcomes can be inconsistent within and across populations, and that the differences are often preventable, avoidable, unjust and unfair; • considers the differential impact of the social, economic, and physical environment on health outcomes across populations. • community participation is often considered to be valuable evidence; • more explicit values influence decision-making; and, • **Social Constructionist** or **Structuralist** in approach.

Table 5. Approaches to HIA Practice and Their Implications—this table describes the three distinct approaches in HIA practice throughout the tool's development, and outlines each the implications of each different approach. (source: table by author; information sourced from Harris-Roxas & Harris, 2011)

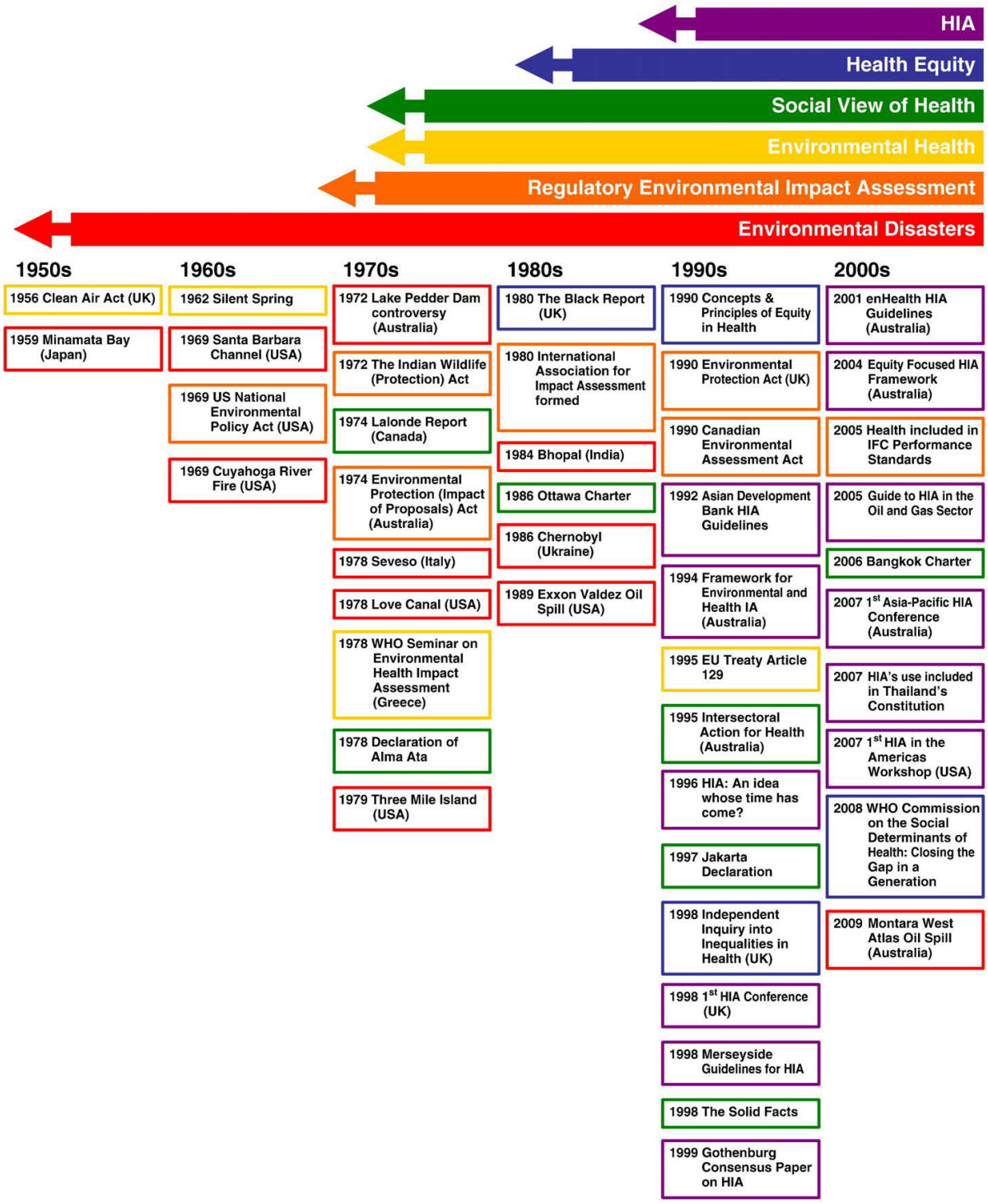


Figure 10. Selected Timeline of HIA Development—this figure illustrates the timeline of the HIA tool's development. Differences in public health concerns have resulted in three distinct approaches to HIA practice throughout the tool's development. Today, these three approaches to HIA practice have generally converged. (source: Harris-Roxas & Harris, 2011). Reprinted with permission from the publisher.

3.3 HIA Use in Canada

Implementation of an HIA-based assessment process has been legislated and regulated for various applications throughout the world, including within Canada (Harris-Roxas & Harris, 2011). At various points in time, use of HIAs has been mandated in British Columbia and Quebec, requiring government ministries to ensure that proposed legislation does not negatively impact human health (St-Pierre & Mendell, 2012). In 2019, the Canadian federal government passed the Impact Assessment Act, which requires the consideration of broad human health criteria and the employment of HIA best practices in all federally mandated impact assessment processes[1] (Freeman, 2019). In addition, impact assessments must be conducted by qualified individuals (Freeman, 2019). The Canadian National Collaborating Centre for Environmental Health (NCCEH)—a federally-supported organization established to assess, report, and take action on environmental health—recently conducted a nation-wide scan to understand current HIA practices and capacity within Canadian public health organizations. The NCCEH identified that, among the individuals questioned, public health practitioners provided intersectoral HIA support across 12 different fields and at all levels of government (i.e. federal, provincial or territorial, and local) (Freeman, 2019). Fields that have utilized public health support to conduct HIAs include: oil and gas, mining, hydroelectricity, forestry, transportation, landfill, alternative energy, contaminated site remediation, zoning and permitting, health equity, traditional foods, and built environment (Freeman, 2019). HIA practice, particularly as it relates to urban development, is increasingly gaining support within Canada. According to the Canadian Handbook of Practice, the 'Canadian Environmental Assessment Act' has jurisdiction over normative architectural practice, and requires the, "assessment and auditing of crown land and federal property based on a wide-range of environmental factors" (Brown et al., 2009, p. CH-13, 1). As such, it is likely that architectural designers will be directed to engage in HIA work in the near future in some form or another; it would be prudent of architectural designers to familiarize themselves with HIA practice in anticipation of legislation that would require them to do so.

[1] There are primarily four types of impact assessments employed in Canada (National Collaborating Centre for Healthy Public Policy [NCCHPP], 2010). These include: Health Impact Assessments, Environmental Impact Assessments, Strategic Environmental Assessments, and Risk Assessments (NCCHPP, 2010).

3.4 Foundational Principles in HIA Practice

Five principles underpin the HIA, and include:

1. **democracy**—the aspiration to enable a community's right to self-determination.
2. **equity**—the aspiration to reduce or eliminate health disparities across populations that are avoidable, unfair, and unjust.
3. **sustainable development**—the aspiration to ensure that the needs of the present generation can be addressed without impacting future generations.
4. **ethical use of evidence**—the aspiration to conduct a rigorous evaluation of the impact of a proposal on health outcomes; to value a variety of evidence types (e.g. high-quality research evidence as well as public opinion); and, to ensure that decisions are evidence-informed (i.e. not based on theory alone).
5. **comprehensive approach to health**—the aspiration to consider the impact of broad range of health determinants on health outcomes (Quigley et al., 2006).

These principles are reflected in eight key characteristics of HIA practice.

3.5 Key Characteristics of HIA Practice

The HIA can be defined as:

1. **rigorous**—refers to the step-wise (i.e. systematic), mixed-methods process that considers high-quality evidence to analyze the impact of proposal decisions on population health outcomes.
2. **participatory**—refers to the consensus-based approach to decision-making employed to reduce bias and tailor recommendations to address local community need.
3. **proactive**—refers to the prospective nature of the assessment and the set objectives to improve the impact of the wider determinants of health on both general and vulnerable population health outcomes.
4. **adaptable**—refers to the ability of the HIA to be modified in order to suit a wide-range of proposals and align with the resources available (e.g. time, funding, staff, capacity, etc.).
5. **transparent**—refers to the provision of: justification for decisions made, description of assumptions and inferences, opportunity for public review, and dissemination of findings to all those involved in or impacted by the assessment.
6. **action-oriented**—refers to the development of actionable (i.e. pragmatic) recommendations, grounded in scientific research, to improve a proposal's impact on population health and health equity outcomes.
7. **accountable**—refers to the comparison of actual outcomes related to a proposal against the anticipated outcomes.
8. **economically-viable**—refers to the process of assessing the potential value and feasibility of conducting an HIA, prior to deciding to proceed with a full assessment.

These characteristics will each be expanded upon in turn.

3.5.1 Rigorous

The HIA employs a systematic, mixed-methods approach to evaluate a proposal's impact on the health of a community. Despite differences in terminology, it is generally accepted that there are six phases (*Screening*, *Scoping*, *Assessment*, *Recommendations*, *Reporting*, and *Evaluation and Monitoring*) in the HIA process, each with a distinct purpose and defined activities (see Table 6.). Appraisers utilize a combination of qualitative and quantitative evidence, such as a review of the scientific literature, a community-wide survey, and structured interviews, to validate findings between sources (Harris et al., 2007). Further, Scoping and Assessment Phases are often conducted iteratively: as new information is learned, research questions and/or methods may be revised to reflect new findings (Bhatia, 2011). The methodological rigour inherent to the HIA process results in appraisers having a more comprehensive and reliable understanding of a proposal's impact, strengthening the development of and support for their recommendations (Harris et al., 2007). Questions have been raised, however, concerning whether the HIA is, in fact, rigorous enough.

Concern for HIA rigour appears to fixate on the notion that 'hypotheses' in HIA practice are generally based on connections to health that are not yet fully understood (Thomson, 2008). As well, critics suggest that there is an over-reliance in HIA practice on grey literature and public participation without validating this evidence with higher-quality, scientific research (Thomson, 2008). Hilary Thomson (2008), public health academic and researcher, who is seemingly skeptical of the rigour with which HIA practice is conducted, admits, "nevertheless, acknowledgement of uncertainty in HIA must be preferable to wrong and uninformed assumptions" (p. 437). Moreover, in reaction to the concern for rigour in HIA practice, HIA expert, researcher, and public health academic John Kemm (2008) explains:

> One can readily agree that evidence derived from research studies and synthesized in systematic reviews are needed for HIA and that HIA will get better as more of these become available. It is unrealistic, however, to think that research could ever provide a library of health consequences of changes or a 'list of interventions that work', since there will always be questions as to whether they are relevant to a particular context (p. 438)

Given the pragmatic nature of HIA practice, like that of normative architectural practice, it is unlikely to ever truly conform to a definition of rigour more often associated with purely scientific pursuits. That said, despite the concerns for rigour in HIA practice, the HIA offers a far more rigorous approach to decision-making than existing approaches in normative architectural practice. Thus, the HIA could still improve the quality of architectural design outcomes in normative architectural practice. Any assumptions, uncertainties, or limitations in HIAs must be acknowledged by those involved and relayed to those affected by a proposal.

HIA Phase	Purpose of Phase	Activities Involved
Screening	• clearly describe assessment objectives; and, • systematically evaluate the value and feasibility of conducting an HIA.	• collect, organize, and review pertinent background information; • develop screening criteria, or select and adapt an existing screening tool; • assess the feasibility and value of conducting an HIA; • establish whether or not to proceed with a full HIA; and, • notify those involved in or impacted by the proposal of the final decision.
Scoping [a]	• define the limits of the assessment; • develop hypotheses concerning the connections between the proposal and health; • identify health impacts to be assessed; and, • outline how each phase will be conducted.	• establish the Project Team and the Steering Committee; • establish values to inform execution of the assessment; • develop work plans for each phase; • develop a preliminary causal model to illustrate plausible connections between the proposal and health; • choose the health impact(s) [b] to be assessed; and, • develop 'Terms of Reference'.
Assessment [a]	• validate, characterize, and prioritize health impacts.	• evaluate causal relationships; • develop a community health and environmental profile to describe the existing, baseline conditions; • quantitatively forecast future impact on those affected by the proposal; • characterize the health impact(s) associated with the proposal in terms of nature, likelihood, distribution of impact, etc.; and, • prioritize the health impact(s) according to their health characterizations and the objectives of the HIA.
Recommendations	• develop pragmatic, scientific and contextual evidence-informed recommendations to mitigate negative or maximize positive health impacts.	• draft action-oriented recommendations; • engage external expertise in the development process as necessary; and, • review and refine recommendations alongside the Steering Committee.
Reporting	• disseminate HIA methods, findings, and recommendations to those involved in or impacted by the proposal.	• develop a draft report; • enable opportunity for public review; and, • disseminate the final HIA report to those involved in or impacted by the proposal.
Evaluation and Monitoring	• compare actual outcomes against anticipated outcomes.	To plan the evaluation component: • identify evaluation tasks to be undertaken; • identify individuals to be included in the evaluation process; • articulate evaluation criteria; and, • collect necessary data—depending on the method of evaluation selected. To plan the monitoring component: • identify health outcomes and indicators to be monitored, • identify implementation tasks to be monitored; • identify individuals responsible for monitoring activities; and, • develop monitoring plan(s).

[a] Note: Scoping and Assessment Phases can be conducted iteratively: as new information is learned through the validation process, the scope of the assessment, as well as the hypotheses made, can be re-worked.

Table 6. The Six Phases of the HIA—this table describes the purpose of each phase of the HIA process as well as the activities involved throughout. (source: table by author; information sourced from Bhatia, 2011; Birley, 2011; EcoPlan (n.d.); Harris et al. 2007; NAHPSWG, 2009; NCCHPP, 2019; Quigley et al., 2006).

3.5.2 Participatory

The HIA relies on a participatory process in order to reduce the likelihood of introducing bias in decision-making and to develop recommendations tailored to a community's present and future needs. A Project Team (i.e. a group of appraisers) is primarily responsible for managing and executing the assessment activities with oversight from a multi-disciplinary, multi-sectoral Steering Committee. As well, input is often collected from decision-makers, proposal proponent (if not the decision-maker), experts, key informants, key stakeholders, and affected populations. Consideration for a variety of perspectives is fundamental to sustaining a democratic assessment process and to ensuring a community's right to self-determination.

3.5.3 Proactive

The HIA prospectively assesses both the short- and long-term impacts of a proposal on future population health and health equity outcomes (Bhatia, 2011; National Collaborating Centre for Healthy Public Policy [NCCHPP], 2019; Quigley et al., 2006). Recommendations are proposed to mitigate any negative or maximize any positive health impacts resulting from a proposal (Bhatia, 2011; NCCHPP, 2019). Further, the HIA considers the distribution of a proposal's health impacts across populations. Recommendations are proposed to target the particular needs of vulnerable sub-populations. By examining the health impacts related to a proposal on the surrounding population, appraisers can identify potential differences that may exist between communities and develop pragmatic recommendations, tailored to a community's particular needs (both present and future).

3.5.4 Adaptable

By modifying the scope and level of inquiry, the HIA can be adapted to suit the objectives of a wide-range of proposals and align with the resources available (e.g. time, funding, staff, capacity, etc.) Appraisers can control the scope of the assessment parameters in terms of:

- **temporal scope**—timescale of impact or stage of project;
- **spatial scope**—physical area or scale of project; and,
- **demographic scope**—key stakeholders and affected populations to be included in data collection and analysis (Birley, 2011; Harris et al. 2007)

As well, HIAs can be executed according to varying levels of depth. For one person, working full-time:

- **desk-based HIAs**—typically require two to six weeks;
- **rapid HIAs**—typically require six to 12 weeks;
- **intermediate HIAs**—typically require 12 weeks to six months; and,

- **comprehensive HIAs**—typically require six to 12 months (Harris et al. 2007).

Generally, the broader the assessment parameters and more in-depth the inquiry, the greater the number of health impacts will be assessed (Harris et al. 2007).

3.5.5 Transparent

It is critical that the HIA process remain transparent in order to uphold the fundamental values of the HIA: democracy, equity, and ethical use of evidence, in particular. Those involved in the HIA are expected to:

- provide justification for its execution;
- provide rationale for the inclusion or exclusion of certain methods and evidence sources;
- identify any gaps in the existing literature, the strength or quality of evidence used, and describe any assumptions or inferences made;
- provide support for each recommendation proposed;
- describe any lessons learned;
- summarize and distribute results of the HIA to all those involved in or impacted by the proposal;
- provide opportunity for public review of a draft report; and,
- provide formal, written responses to criticisms made and/or revise the report as necessary following the public review period (Bhatia, 2011; Harris et al. 2007; NAHPSWG, 2007; NCCHPP, 2019).

A transparent process can help to ensure that decision-making remains impartial throughout.

3.5.6 Action-Oriented

Actionable recommendations, grounded in scientific research, are developed to improve a proposal's impact on health. Generally, there are two types of recommendations:

1. those that seek to mitigate negative health outcomes; and,
2. those that seek to maximize positive health outcomes (Birley, 2011).

Strategies to mitigate negative health impacts include (see Table 7.):

- **elimination**—refers to fundamental modifications to a proposal such that features causing negative impact(s) are removed or changed directly at the source (this mitigation strategy is of highest priority);
- **minimization**—refers to measures added on- or off-site to a proposal in order to reduce negative impact(s);
- **restoration**—refers measures taken to repair or restore negative impact(s) when they are unable to be eliminated or minimized; and,

- **offset**—refers to offsets that balance any negative impact(s) associated with a proposal (this mitigation strategy is of lowest priority) (Birley, 2011).

Strategies to maximize positive health impacts include (see Table 8.):

- **whole population benefit**—refers to fundamental modifications to a proposal such that its features positively impact the whole population, both general and vulnerable (this maximization strategy is of highest priority);
- **targeted vulnerable population benefit**—refers to targeted strategies to address the specific health needs of one or more disadvantaged groups;
- **influence health behaviours**—refers to measures added to a proposal in order to ensure that healthy choices can readily be made by the individuals impacted; and,
- **educate**—refers to programs, presentations, etc. developed to educate individuals, so that they can make informed decisions about their health (this maximization strategy is of lowest priority) (Birley, 2011).

Recommendations focus on health impacts of high-importance and high-modifiability (Harris et al., 2007; NCHHPP, 2019). By developing justifiable recommendations, appraisers can influence the decision-making process to ensure that the final iteration of a proposal is most favourable to health (Birley, 2011; NCHHPP, 2019)

3.5.7 Accountable

Integral to the HIA, is the evaluation of the actual outcomes related to a proposal against the anticipated outcomes. There are typically three different methods of evaluation in HIA (see Table 9.):

- **process evaluations**—appraise the quality of the assessment conducted (Harris et al., 2007).
- **impact evaluations**—appraise the influence of the HIA on the proposal, society, and decision-making processes (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019).
- **outcome evaluations**—appraise the long-term health outcomes associated with the implementation of a proposal (Harris et al., 2007).

The appraisers, proposal proponent, decision-makers, community partners, stakeholders, and/or public monitor the health impact(s) of a proposal or track the implementation of recommendations over a defined period of time to collect the information necessary to support evaluation (Harris et al., 2007). Through the evaluation of outcomes HIA theory and practice can be advanced (Harris et al., 2007); HIA effectiveness as a health promotional tool can be improved (NCCHPP, 2019); and, modifications can be made, as necessary, following the implementation of recommendations (Bhatia, 2011; NCHHPP, 2019).

Priority-level	Strategy	Recommendation-type	Description	Example
5 (highest)	Elimination	Eliminate or minimize impact directly at the source	Fundamental modifications to a proposal, such that the features causing negative impact(s) are removed or changed.	Re-locating a proposal away from a contaminated site.
4	Minimization (on-site)	Minimize impact on-site	Measures added on-site to a proposal in order to reduce negative impact(s).	Installing noise-barriers between a highway proposal and the neighbouring residences.
3	Minimization (off-site)	Minimize impact off-site	Measures added off-site to a proposal in order to reduce negative impact(s).	Installing double-glazed windows in the residences nearby a highway proposal.
2	Restoration	Restore or repair impacts	Measures taken to repair or restore impact(s) when they are unable to be eliminated or minimized.	Repairing soil erosion caused by the proposal.
1 (lowest)	Offset	Offset impacts	As a final alternative, initiatives, or 'offsets', can be suggested to balance any negative impact(s) associated with a proposal.	Contributions (e.g. financial) made by the proposal proponent to local community organizations.

Table 7. Mitigation Recommendation Hierarchy—this table outlines potential strategies, in priority order, to mitigate negative health outcomes. (source: adapted from Birley, 2011).

Priority-level	Strategy	Recommendation-type	Description	Example
4 (highest)	Whole Population Benefit	Benefit all populations impacted, and are integral to the proposal.	Fundamental modifications to a proposal, such that its features positively impact the whole population (general and vulnerable).	Access to green space, or well-ventilated work environments.
3	Targeted Vulnerable Population Benefit	Benefit vulnerable populations impacted.	Targeted strategies to address the specific health needs of one or more disadvantaged groups, in order to ensure they experience the most benefit from the proposal.	Establishing clauses within construction contracts specifying the employment of local residents, or establishing community profit-sharing agreements.
2	Influence Health Behaviours	Promote positive health behaviours in individuals.	Measures added to a proposal in order to ensure that healthy choices can readily be made by the individuals impacted by the proposal.	Easy access to bike-parking and shower facilities in work environments.
1 (lowest)	Educate	Proactively educate and inform individuals.	Programs, presentations, etc. developed to educate individuals, so that they can make informed decisions about their health.	Presentations concerning nutrition or active transportation.

Table 8. Health Maximization Recommendation Hierarchy—this table outlines potential strategies, in priority order, to maximize positive health outcomes. (source: adapted from Birley, 2011).

	Process	Impact	Outcome
Description	Appraise the quality of the assessment.	Appraise the influence of the assessment.	Appraise the health outcomes of the assessment.
Timing	Immediately following the assessment.	12 – 18 months following acceptance of the report by the proponent or decision-makers.	Following implementation of the proposal.
Purpose	Advance HIA practice and theory.	Improve effectiveness of HIA.	Enable modifications to be made following implementation, as necessary.

Table 9. Methods of Evaluation in HIA—this table describes the three types of evaluation typically used in HIA practice: process, impact, and outcome. (source: table by author; information sourced from Harris et al., 2007)

3.5.8 Economically-Viable

An HIA may not suit all policies, plans, or projects, and may not be warranted when:

- a proposal's connections to public health are limited, weak, or unclear;
- existing regulations are in place to protect health;
- health is already being considered as part of another assessment; or,
- the decision-making timeline does not allow for changes to be made to a proposal (Bhatia, 2011; Harris et al., 2007).

However, an HIA may be warranted when:

- there is significant scientific evidence, but a lack of support from the public, stakeholders, or decision-makers—an HIA can illustrate the health impacts of a proposal;
- health impacts are unequally distributed across populations, avoidable, or unjust—an HIA can improve a proposal by better balancing health disparities; or,
- the health impact of a proposal is uncertain or is politically controversial (Bhatia, 2011).

Early on in the HIA process, appraisers use screening criteria to assess the potential value and feasibility of conducting an assessment, which can ensure that often limited resources are appropriately allocated (Harris et al., 2007).

3.6 The Potential Influences of HIA Integration in Normative Architectural Practice

Rajiv Bhatia, doctor, public health practitioner, and HIA expert, has identified potential impacts of conducting an HIA (see Table 10.). These changes include, "changes to design, adoption, or implementation of the project/policy... changes to societal understanding of the causes of good or poor health ... changes to the way health is considered in institutional decision-making practices" (Bhatia, 2011, p. 4). Thus, integration of the HIA in normative architectural practice could encourage similar changes to occur (see Table 11.). Assessing the potential of integrating the tool in the HIA in normative architectural practice in order to promote population health and health equity in architectural design decision-making is the primary objective of this thesis.

Changes to design, adoption, or implementation of the project/policy
• inclusion of design changes or mitigations to protect or promote health • adoption of an alternative decision option • delay of a decision in order to assess health impacts
Changes to societal understanding of the causes of good or poor health
• greater societal understanding of relationships among the decisions, environmental conditions, and health • identification of new priority public health problems • advocacy for healthy policy interests
Changes to the way health is considered in institutional decision-making practices
• coordination and cooperation among public health and other institutional sectors • public or institutional support and/or resources for HIA • adoption of health objectives, indicators, and standards for policy and decision-making

Table 10. Potential Influences of the HIA in All Applications—this table describes the potential impacts of conducting an HIA, in general. (source: Bhatia, 2011) Reproduced with permission from the publisher.

Changes to design, adoption, or implementation of the architectural design project
• inclusion of architectural design changes or mitigations to protect or promote health • adoption of an alternative architectural design option • delay of a decision in order to assess health impacts
Changes to societal understanding of the causes of good or poor health
• greater societal understanding of relationships between architectural design decisions and health, and facilitation of public participation in architectural design decision-making processes • identification of new priority public health problems • advocacy for healthy policy interests as part of the politics of land-development and architectural design
Changes to the way health is considered in architectural design decision-making practices
• coordination and cooperation between architecture, public health, and other institutional sectors • public or institutional support and/or resources for HIA • adoption of health objectives, indicators, and standards for policy and design decision-making

Table 11. Potential Influences of the HIA Process in Architectural Design Applications—this table describes the potential impacts of integrating the HIA in design decision-making in normative architectural practice. (source: adapted from Bhatia, 2011)

CHAPTER 4

Thesis Methodology

4.1 Overview of the Thesis Methodology

The primary objectives of this thesis are to assess:

- the ways in which integration of the HIA could plausibly improve the quality of decision-making in normative architectural practice to address complex, societal problems—in general;
- the ways in which improved decision-making quality realized by integrating the HIA in normative architectural practice could plausibly promote population health and health equity in architectural practice and design; and,
- the applicability and transferability, including potential limitations, of the HIA in normative architectural practice.

In this thesis, leading HIA guidance was reviewed first to identify what *should* happen when conducting an HIA. A 'scoping' review, of completed HIAs focused on modifying the built environment, was then conducted to assess the potential of promoting population health and health equity in architectural design through the integration of the HIA in normative architectural practice. Finally, to illustrate the envisioned potential of the integrating the HIA in normative architectural practice, a fictional project was described to demonstrate the steps that architectural designers might take when implementing an HIA in such an architectural project. The scoping review-type and the justification for its use within this thesis are described herein.

4.2 Scoping Review Description

There are many types of reviews, each requiring different levels of rigour. Reviews are conducted to gather and synthesize existing knowledge related to a particular topic or research question in order to appreciate what has been established to date and to identify where there are gaps in understanding. The 'systematic' review is the most rigorous of review-type and, as such, considered the public health gold standard (Harris et al., 2007). Systematic reviews methodically collect, critically appraise, and synthesize findings from the existing literature published in peer-reviewed journals. Systematic reviews generally focus on findings from quantitative studies and they can take months up to years to complete. Like the systematic review, the scoping review is structured in its approach. However, the information included in a scoping review is typically not appraised for methodological quality (Peters et al., 2015). This review-type was developed to address broader research questions; and, to rigorously synthesize evidence from a wider variety and/or a combination of sources (e.g. qualitative and quantitative, peer-reviewed and grey literature, etc.) (Peters et al., 2015).

Scoping reviews are often conducted when little is known about a topic or research question and/or to evaluate whether it is necessary to undertake a full systematic review (Peters et al., 2015). They can, for example, "be used to map the key concepts underpinning a research area as well as to clarify working definitions, and/or conceptual boundaries of a topic" (Peters et al., 2015, p. 6). Scoping review findings are typically summarized in tabular-form.

4.3 Scoping Review Justification and Thesis HIA Case Studies

The scoping review is utilized in this thesis for a number of reasons. To begin with, the research questions pursued demanded that an exploratory approach be taken to appropriately respond to them. Moreover, while procedural steps have been defined for a typical HIA, due to the diversity in its application, little is known about how these steps have been applied in practice (NAHPSWG, 2009). Professional HIA summary reports (i.e. grey literature) offer unique insight into the assessment process in situ that peer-reviewed case studies alone cannot. Furthermore, by systematically identifying case studies for review, the likelihood that I will impart my own biases in the selection process is reduced. In the end, seven-case study HIA summary study reports were reviewed in order to understand how the tool has been used in practice to improve population health and health equity outcomes related to urban development decisions; and, to evaluate the applicability and transferability of the HIA in normative architectural practice. It should be noted that though conclusions will be drawn based on the findings from this scoping review, further research will be required to validate the impact and effectiveness of the HIA in normative architectural practice.

CHAPTER 5

HIA Case Study Scoping Review

5.1 Introduction

The summary study reports of seven HIAs, focused on modifying the built environment, were studied to better understand:

- the breadth of design interventions assessed;
- the ways in which integration of the HIA could plausibly improve the quality of decision-making in normative architectural practice;
- the ways in which improved decision-making quality realized by integrating the HIA in normative architectural practice could plausibly promote population health and health equity in architectural practice and design; and,
- the applicability and transferability, including potential limitations, of the HIA in normative architectural practice.

The HIAs examined were completed in 2016 and located throughout the United States, in communities experiencing an assortment of health concerns and diverse environmental conditions. Assessments focused on proposals for design-related policies or plans, or discrete design projects. Described herein are the:

- particularities of the methods employed within this scoping review, including methodological limitations;
- overview of general findings, including the apparent value-added from the HIA process;
- summary and overarching conclusions drawn from these findings; and,
- detailed discussion of these conclusions.

Note: refer to Appendix B in-depth description of the characteristics of each assessment, the resources required (e.g. funding, time, staff, expertise, etc.), and the methods undertaken by appraisers.

5.2 HIA Case Study Scoping Review Methods

HIA summary study reports were gathered from the Health Impact Project's (HIP) online database of assessments conducted throughout the United States—HIP itself is a collaboration between The Pew Charitable Trusts and the Robert Wood Johnson Foundation. Relevant HIA summary reports were identified using the steps prescribed by the Preferred Reporting of Items for Systematic Reviews and Meta-Analyses (PRISMA) method (see Figure 11.). The PRISMA method enables researchers to critically and systematically appraise the eligibility of articles to be included in a review (Moher et al., 2009). Inclusion and exclusion criteria were developed to narrow the HIA selection (see Table 12.). Nine reports from HIP were initially identified and their abstracts or executive summaries, screened. Reports were excluded if the proposal did not focus on assessing the health impact of one or more local design interventions. For the purposes of this thesis scoping review, a 'design intervention' was defined as a modification to the built environment, altering its physical development. This definition includes, but is not limited to, design decisions involved in master planning, urban design, building design, and functional programming. This definition does not include high-level policy or visioning statements, such as comprehensive regional plans. Following the initial abstract screening, one report was excluded leaving eight, and a full-text review of the eight reports was then completed. One additional report was further excluded because it was incomplete (the report was still in a draft stage). The final HIA selection from HIP then included seven reports. Report authors were contacted when supporting documents were not available in the HIP database. The characteristics of each assessment, the resources required, and the methods undertaken by appraisers were abstracted from each of the summary reports, collated, and summarized. Based on these findings, the potential of architectural design interventions to plausibly affect improved population health and health equity outcomes, as well as the transferability and limitations of integrating the HIA in normative architectural practice, were evaluated and summarized in tables (see Tables 24. and 25.).

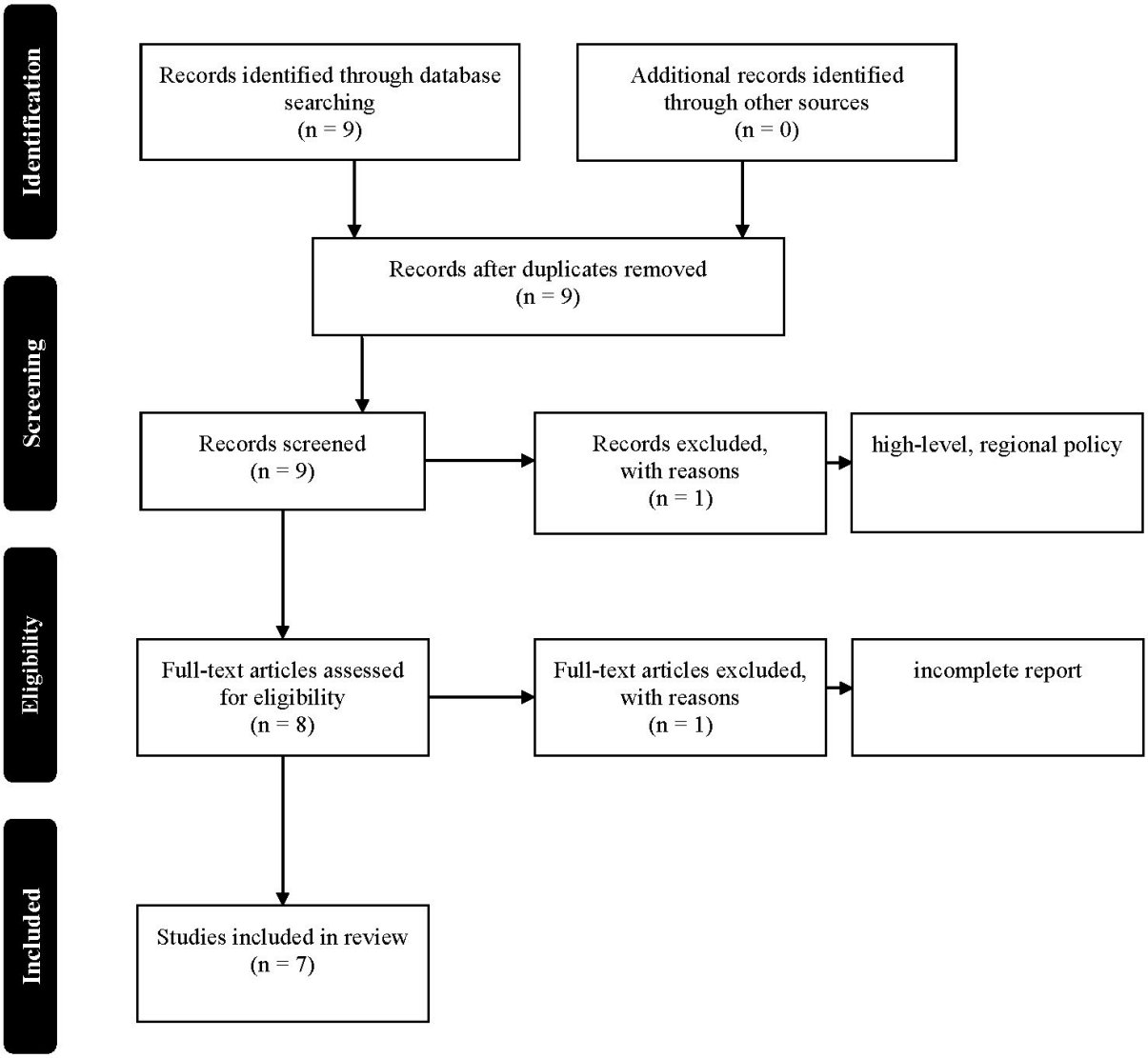


Figure 11. PRISMA Flow Diagram—this figure describes the systematic process by which HIA case studies were identified and appraised for their eligibility in this scoping review. (source: figure by author)

Criterion	Included	Excluded
Sector (as indexed by HIP)	Built Environment	all other sectors
Language	English-language reports	all other languages
Geographic Region	United States	outside of the United States
Time period	2016	outside of 2016
Proposal	design intervention (or related)	not a design intervention

Table 12. Scoping Review Inclusion and Exclusion Criteria—this table describes the criteria used to determine the eligibility of HIA case studies in this scoping review. (source: table by author)

5.3 HIA Case Study Scoping Review Methodological Limitations

There were a number of limitations in this case study scoping review; these factors should be taken into consideration when interpreting general findings and summary conclusions. While systematic in approach, this review only included grey literature. As well, reports were not appraised for quality as HIA reporting practices have not been standardized. Additionally, the review was limited to HIAs found on HIP's database. This may have had an impact on the selection available, biasing results (e.g. the database is limited to HIAs conducted in the United States). To narrow the scope of the review, reports were limited to those completed in 2016. At the time of this review, the HIP database only included reports from HIAs completed up until 2017; in 2017, there was only one HIA report indexed under built environment sector. Finally, the review was conducted by myself alone. According to scoping review best practices, ideally, at least two investigators would have been involved in assessing the reports in order to limit bias and to improve the validity and reliability of the conclusions drawn. Finally, only two of the case study HIAs reviewed assessed design interventions at the building-scale of most architectural practice; one of which assessed the proposed building program.[1] Building program development is typically a very preliminary activity undertaken in normative architectural practice, and generally is not considered to be part of basic architectural services. Largely, the case study HIAs reviewed assessed the health impacts of design interventions at the neighbourhood- or city-scales. Further research should try to address these limitations

5.4 HIA Case Study Scoping Review Findings Tables

The following tables summarize the information extracted or abstracted from the HIA case study summary reports reviewed. Conclusions drawn in response to the research questions pursued in this thesis were developed based on this information (see Tables 13 – 23).

[1] The physical environment can be manipulated across a number of spatial scales. This review focuses on human-, building-, neighbourhood-, and city-scales: **Human-scale design**—refers to the manipulation of the physical environment in direct proportion to the human body, e.g. a curb, set of stairs, or park bench; design decisions are perceived, in their entirety, by an individual through her senses. **Building-scale design**—refers to the manipulation of the physical environment in proportion to a building, e.g. building program or massing (composition). **Neighbourhood-scale design**—refers to the manipulation of the physical environment in proportion to a block or a series of blocks (district), e.g. the master plan of a new development or massing of a collection of buildings. **City-scale design**—refers to the manipulation of the physical environment in proportion to a city, e.g. street networks or land-use designations.

HIA Name; Location; Designation; Built Condition; Citation.	Objective of Assessment	Design Intervention	Primary Spatial Scale(s) Addressed
Omaha Street Connections and Development Review Processes; Omaha, Douglas County, Nebraska; City; Suburban; (Douglas County Health Department, 2016).	The City of Omaha's master plan encouraged increased street connectivity. However, the construction of new street connections was often met with resistance by residents. This HIA sought to: • identify and assess the health impacts of increased street connections; and to, • determine how best to engage residents in the development review process.	• street elements • street network	• neighbourhood • city
Hoboken Stormwater Management; Hoboken, Hudson County, New Jersey; City; Urban; (Carnegie et al., 2016).	The City of Hoboken was looking to address chronic flooding through the adoption of a city-wide stormwater management plan. This HIA sought to: • identify and assess the health impacts of chronic flooding, including combined sewer system backup issues; and to, • identify and assess the health impacts of the proposed green infrastructure design interventions.	• green infrastructures • green infrastructure network	• neighbourhood • city
Colorado School-Based Health Centres; Colorado Springs, El Paso County, Colorado; City; Urban/Suburban mix; (Rothwell et al., 2016).	The Children's Hospital of Colorado (CHCO) proposed utilizing School-Based Health Centres (SBHCs) as a means of impacting child physical activity and mental health. This HIA sought to: • identify and assess the health impacts of SBHCs on physical activity and mental health outcomes in school-aged children; • assess existing SBHCs in order to inform future implementation strategies; and to, • inform how CHCO could implement a concept for School-Based Resource Centres based on their findings of SBHCs.	• building program	• building • city
Liberty Street Design; Liberty, Clay County, Missouri; City; Suburban; (Ilabaca-Somoza et al., 2016).	Current policy in the City of Liberty favours a street grid design over cul-de-sacs and favours sidewalks on two sides of a street. This HIA sought to: • identify and assess the impacts of street design on health outcomes—in particular, the impacts of grid versus cul-de-sac configurations, including on first responder response times; and to, • identify and assess the health impacts of sidewalk design on health outcomes; in particular, the impacts of sidewalks located on one versus two sides of a street.	• street elements • street network	• neighbourhood • city

Pasadena Infill Development; Pasadena, Harris County, Texas; City; Suburban; (Cummings et al., 2016b).	Within the City of Pasadena there is need for a shift from greenfield to infill development and for increased housing options. City officials proposed four updated residential ordinances to facilitate these needs. The ordinances outlined design standards and regulations of different types of residential development: townhouses, patio-home subdivisions, and multi-family. This HIA sought to: • identify and assess the short- and long-term health impacts of the proposed ordinances on health outcomes of residents.	• housing types • land-use mix, infill development	• building • city
Carpentersville Intersection Design: Carpentersville, Kane County, Illinois; Village; Suburban; (Wade et al., 2016).	During peak hours, congestion at a well-trafficked intersection within the Village of Carpentersville was problematic. The Carpentersville Old Town Plan recommended that improvements to the intersection be made to address the health and safety of all users. This HIA sought to: • identify and assess the health impacts of two design options (a signalized intersection versus a single-lane roundabout) on the health outcomes of drivers, pedestrians, cyclists and nearby residents.	• street elements	• neighbourhood
East Aldine Town Centre Design; East Aldine, Harris County, Texas; Management District; Suburban; (Cummings et al., 2016a).	East Aldine Management District had developed a master plan for a new town centre, which included a variety of social and community services as well as retail spaces. The initial proposal was developed without consideration for the health. This HIA sought to: • identify and assess the health impacts of the proposed town centre on health outcomes; and to, • forecast revenues generated by the proposal, which could support public services.	• district master plan	• neighbourhood

Table 13. Findings Table: Overview of HIA Case Studies (repeated)—this table identified each of the HIA case studies reviewed in this thesis. As well, it describes the particulars of each of the HIAs, including their locations, objectives, design intervention-types under assessment, and the primary spatial scales addressed through each assessment. HIA case studies were located throughout the United States. The HIAs were used to assess the health impacts of design interventions across many design scales. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

	Existing Health Conditions	Existing Environmental Conditions	Impact Area	General Population Addressed	Vulnerable Population Addressed
Omaha Street Connections and Development Review Processes	• physical inactivity • overweight • pedestrian injuries and fatalities • stress, as a result of the current development review process	• suburban (west Omaha): single-family homes, curvilinear streets • new development • arterial roads have higher: volume of traffic, speed rates, and rates of accidents	city-wide—focus on new neighbourhoods	• local residents	• children • older adults • persons with disabilities • persons who cannot drive
Hoboken Stormwater Management	• racial and income disparities • flooding negatively impacting individual behaviours and health.	• urban: mid- to high-rise buildings and street grids • adjacent to Hudson River • varied topography; artificial land, with some areas lying below sea level • increasing precipitation, tide levels.	city-wide—focus on low-lying areas impacted by flooding events	• local residents	• low-income individuals, families • persons with physical, mental, or emotional disabilities • older adults
Colorado School-Based Health Centres	• child physical inactivity, mental health concerns • child obesity, overweight • limited child mental health resources • high population of uninsured or under-insured	• suburban/urban mix; and, • few school-based healthcare resources available for children.	K – 12 Schools in Colorado Springs	*none*	• school-aged children and their families, sub-populations of uninsured or underinsured • those without adequate access to healthcare
Liberty Street Design	• physical inactivity • overweight • high rate of vehicular accidents	• suburban: single-family homes, cul-de-sacs • disconnected subdivisions • large commuter population	city-wide	• local residents	• low-income individuals, families • older adults • children • youth
Pasadena Infill Development	• increasing population growth • high poverty rate • poor self-reported health • overweight	• suburban: limited housing options • segregated land-uses • no public transportation • superfund (polluted) site-adjacent • outward growth has reached city limits	city-wide	• local residents	• low- and middle-income households, including renters • aging individuals on fixed-incomes • young adults and families

Carpentersville Intersection Design	• physical inactivity
	• overweight
	• high incidence of asthma—particularly in low-income groups
		• the intersection:
		  ○ has a two-way stop
		  ○ is heavily trafficked
		  ○ is located near to a walking/cycling trail, schools, businesses, and residential areas
			¼- and ½-mile radii from the intersection, or project site	• pedestrians and cyclists
				• drivers
				• local residents living within ½ mile radius of the intersection
					• visually-impaired pedestrians

East Aldine Town Centre Design	• physical inactivity • overweight • pedestrian injuries and fatalities • primarily populated by minority groups • lower level of educational attainment	• unincorporated state management district, completely enveloped by the City of Houston; • suburban: single-family homes • limited access to healthcare resources and healthy food options	1-mile radius from the town centre, or project site.	• local residents	• those without a car • school-aged children • youth • older adults

Table 14. Findings Table: Particulars of Each HIA—this table describes the existing health and environmental conditions of the local communities in which proposals were situated; the impact area considered; and, the types of populations addressed in each assessment, including both general and vulnerable populations. Proposals were situated in communities experiencing an assortment of health concerns and with diverse environmental conditions. The HIAs reviewed considered the health needs of all populations within each assessment's defined Impact Area, and not simply those who may be directly impacted by each proposal. Assessments considered the differential impacts of each proposal on both vulnerable and general populations. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

	Omaha Street Connections and Development Review Processes	Hoboken Stormwater Management	Colorado School-Based Health Centres	Liberty Street Design	Pasadena Infill Development	Carpentersville Intersection Design	East Aldine Town Centre Design
Individual Health							
mental well-being	X	X	X				
Behavioural Risk Factors							
diet		X					X
physical activity / inactivity	X	X	X	X	X	X	X
smoking		X					
alcohol consumption		X					
drug addiction		X					
leisure and recreational activities		X					X
Family and Community Structure							
civic engagement	X						
Employment and Livelihood							
employment and job security		X					
Housing							
housing safety and quality		X					
housing supply / type, affordability, and accessibility					X		
residential segregation					X		
Environmental Quality							
air quality	X	X			X	X	
water quality and safety		X					
food resources and safety		X					X
active transportation hazards (e.g. pedestrian / cyclist safety)	X			X	X	X	X
mixed land-uses					X		X
neighbourhood street infrastructure	X			X		X	X
access to greenspaces							X
Public Services							
educational access		X					X
healthcare access		X	X				X
waste systems and services		X					X
police, security, and emergency response				X			
recreational centres							X
public transportation					X		X
Private Services							
access to retail food services		X					

Table 15. Findings Table: Health Determinants Considered—this table identifies the broad range of health determinants considered during each of the HIA case studies. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

	Omaha Street Connections and Development Review Processes	Hoboken Stormwater Management	Colorado School-Based Health Centres	Liberty Street Design	Pasadena Infill Development	Carpentersville Intersection Design	East Aldine Town Centre Design
Proposal Type							
Policy or Plan	X	X	X	X	X		
Program							
Project						X	X
Form of HIA							
Mandated							
Decision-support	X		X	X	X	X	X
Advocacy		X					
Community-led							
Primary View of Health							
Environmental	X	X	X	X	X	X	X
Social	X	X	X	X	X	X	X
Health Equity	X	X	X	X	X	X	X
Stage of Decision-Making Process							
Planning			X		X	X	
Draft Proposal	X	X		X			X
Implementation (or Construction)							
Monitoring							
Evaluation							
Temporal Scope							
Design	X**	X	X	X	X	X	X
Construction		X					
Occupancy (or Operation)		X					
Demolition (or Renovation or Decommissioning)							
Causal Model Development							
Scoping Phase		X		X			
Assessment Phase	X				X	X	X
Method of Evaluation							
Process	X *						X *
Impact		X *				X *	X *
Outcome	X *	X *				X *	X *
Undetermined			X	X	X		
Monitoring Activities	X *	X *				X *	X *

* Note: indicates proposed; ** Note: including the impact of development review processes.

Table 16. Findings Table: Details of HIAs—this table identifies the proposal type, the form of HIA conducted, the primary view of health considered, the stage of the decision-making process when the HIA was conducted, the temporal scope of each HIA, the phase during which Project Teams developed causal models, the methods of evaluation proposed, and whether or not monitoring activities were proposed. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

HIA	Time Required to Complete Assessment * 0 – 6, 7 – 12, 13 – 18, or 19 – 24 months	Funding Source(s)
Omaha Street Connections and Development Review Processes	0 – 6 months	• Health Impact Project
Hoboken Stormwater Management	*undetermined*	• Health Impact Project
Colorado School-Based Health Centres	0 – 6 months	• Health Impact Project • Children's Hospital of Colorado • Colorado School of Public Health • University of Colorado—School of Medicine, Department of Pediatrics
Liberty Street Design	7 – 12 months	• National Association of County and City Health Offices
Pasadena Infill Development	13 – 18 months	• Health Impact Project • Episcopal Health Foundation
Carpentersville Intersection Design	0 – 6 months	• Chicago Metropolitan Agency for Planning's Local Technical Assistance program
East Aldine Town Centre Design	19 – 24 months	• Health Impact Project • Episcopal Health Foundation

* Note: as abstracted from the reports—it remains undetermined if these timeframes reflect full-time or part-time efforts.

Table 17. Findings Table: Time Required and Funding Sources—this table identifies the time required to complete each assessment, as well as their primary funding sources. The time required to complete each assessment ranged from 0 – 6 months to 19 – 24 months. HIAs were primarily funded through grant opportunities. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

	Initiator of HIA	Proponent	Assessment Managers	Project Team	Steering Committee (or similar)	Decision-Makers	Key Stakeholders	Key Informants	Others
Omaha Street Connections and Development Review Processes	• City of Omaha (CoO), Planning Department; • CoO Public Works Department	• CoO	• CoO Planning Department • CoO Public Works Department	• Douglas County Health Department staff • CoO Planning, Public Works staff	*none*	• Omaha City Council	• residents • CoO staff from Planning and Public Works Departments	• community leaders • City Councillors	• community partner organizations
Hoboken Stormwater Management	• Rutgers University, School of Planning and Public Policy (Rutgers)	• City of Hoboken (CoH)	• Rutgers	• Rutgers academics • Sustainability Institute at College of New Jersey researchers • New Jersey Future staff	• Advisory Committee: local, regional and federal officials, government staff, non-profit leaders, and residents	• Hoboken City Council • Hoboken Planning Board	• residents • CoH • local and regional health departments • North Hudson Sewerage Authority • impacted community partner organizations	• City officials • City consultant team responsible from the stormwater management plan	• HIA expert • methodological experts • academics from Rutgers University
Colorado School-Based Health Centres	• Children's Hospital of Colorado (CHoC)	• CHoC	• CHoC	• Colorado School of Public Health (CSPH) academics • Child Health Advocacy Institute at CHoC staff	• Strategic Advisory Group: CSPH, U of Colorado—School of Medicine, and CHoC reps	• CHoC	• residents • Stakeholder Group: reps from child-focused community service providers • CHoC	• Stakeholder Group; • child health service providers; • school district professionals • SBHC experts.	*none*
Liberty Street Design	• City of Liberty (CoL)	• CoL	• Clay County Public Health Centre (CCPHC)	• Liberty Community Health Action Team staff (LCHAT) • CCPHC staff • CoL Planning Department staff	*none*	• CoL Planning Commission	• residents • first responders • Stakeholder Group: reps from CCPHC and LCHAT • CoL	• first responders • Stakeholder Group	• CoL staff • CCPHC staff • HIA experts • Keystone Policy Centre staff • National Association of County & City Health Officials staff • Children's Mercy Hospital researchers • LCHAT stakeholders

	Initiator of HIA	Proponent	Assessment Managers	Project Team	Steering Committee (or similar)	Decision-Makers	Key Stakeholders	Key Informants	Others
Pasadena Infill Development	• Harris County Public Health and Environmental Services (HCPH)	• City of Pasadena (CoP) Planning Department (PD)	• HCPH	• HCPH staff	*none*	• CoP PD • Pasadena Planning Commission • Pasadena City Council	• residents • CoP	• community leaders • decision-makers • content experts • CoP PD and Community Development (CD) staff	• community partner organizations • CoP PD and CD staff • local and regional methodological experts
Carpentersville Intersection Design	• Kane County (KC) Planning Co-operative • Chicago Metropolitan Agency for Planning (CMAP)	• Village of Carpentersville (VoC)	• KC • CMAP	• VoC Assistant Village Manager • KC Health Department, Development and Community Services, and Division of Transportation staff	• Steering Committee: VoC, KC Planning Co- and CMAP reps	• Carpentersville Village Board	• residents • local businesses • drivers • schools • bus drivers • first responders	• school board reps • police department staff • content experts	*none*
East Aldine Town Centre Design	• Harris County Public Health and Environmental Services (HCPH)	• East Aldine Management District (EA)	• HCPH	• HCPH staff	*none*	• Harris County Infrastructure Department • EA Board of Directors	• residents • EA Board of Directors and staff	• EA staff • health and safety experts	• additional EA staff • community organization partners • local and regional methodological experts

Table 18. Findings Table: Roles and Actors Involved in Each HIA—this table identifies who was involved in each of the HIAs reviewed and their respective roles. The HIAs involved a variety of actors: decision-makers, proposal proponents, experts, key informants, stakeholders, and affected populations. Areas of expertise on Project Teams included: public health, urban-planning, public works, and/or community and policy development. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

Evidence Source	1 Omaha Street Connections and Development Review Processes	2 Hoboken Stormwater Management	3 Colorado School-Based Health Centres	4 Liberty Street Design	5 Pasadena Infill Development	6 Carpentersville Intersection Design	7 East Aldine Town Centre Design
Review of available information:	X	X	X	X	X	X	X
• Literature review *	X	X	X	X	X	X	X
• Review of existing reports and/or data **	X	X	X	X	X		X
• Review of completed HIAs					X	X	X
• Review of precedents (e.g. design interventions, site visits, etc.)			X				
Original Observational Studies							X
Environmental Modelling or Spatial Analysis	X	X		X	X		X
Quantitative Forecasting:			X		X	X	X
• Health impact							X
• Economic							X
• Other					X		
Expert Consultation			X			X	X
Key Informant Consultation:		X	X	X	X		X
• Key informant semi-structured or structured interview(s)		X	X		X		X
• Key informant survey(s)				X			
Stakeholder and Affected Population Outreach and Engagement:	X	X	X	X	X	X	X
• Interview(s)	X						
• Stakeholder or affected population meeting(s) or forum(s)	X	X	X	X			
• Focus group(s)		X					
• PhotoVoice exercise(s)							X
• Community-wide survey(s)		X		X			X
• Community workshop(s)					X	X	
• Town Hall meeting(s)						X	
Consultation with Decision-makers	X	X			X		X
Consultation with Steering Committee (or similar)		X	X			X	

* Literature review in this case refers to systematic and general literature reviews, not grey literature reviews; ** Review of existing reports and/or data in this case includes the review of grey literature.

Table 19. Findings Table: Evidence Sources—this table identifies the evidence sources used to evaluate and validate each proposal's health impact. All HIAs used a mixed-methods approach. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

Fundamental Design Modifications		
Strategy	Spatial Scale(s) of Modification(s)	Select Example(s)
Elimination	• human • building • neighbourhood	**Pasadena Infill Development** • utilize a Crime Prevention Through Environmental Design (CPTED) approach to create safe spaces. • Note: CPTED is a multi-scalar approach to design, which encourages consideration for: location and orientation of one or more buildings; delineation of public and private spaces; materiality; and, more.
Whole Population Benefit	• building	**East Aldine Town Centre Design** • maintain the proposed federal health centre (building program), Vecino Health • maintain proposed grocery store (building program)
	• human • neighbourhood	**Carpentersville Intersection Design** • convert existing, controlled intersection to a single-lane roundabout with splitter island to guide traffic
	• building • neighbourhood • city	**Pasadena Infill Development** • convert the majority of vacant lots to housing developments, incorporating multi-family housing types • convert select lots to other land-use types, including green spaces, commercial, or mixed-use developments
Targeted Vulnerable Population Benefit	• building	**Colorado School-Based Health Centres** • School-Based Health Centres (building program) to be incorporated in schools throughout Colorado Springs to target school-aged children and their families
Influence Health Behaviours	• neighbourhood • city	**Liberty Street Design** • continue to favour gridded streets over cul-de-sacs • promote mixed land-use development Note: gridded streets and mixed land-use development are associated with improved health behaviours

Table 20. Findings Table: Examples of Fundamental Design Modifications Recommended—this table provides examples of recommendations generated by Project Teams in the HIA case studies. These recommendations proposed that fundamental design modifications be made to proposals in order to improve their health impact. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

Secondary Design Measures		
Strategy	Spatial Scale(s) of Measure(s)	Select Example(s)
Minimization (on-site)	• human • neighbourhood	East Aldine Management District: • crash reduction counter measures (e.g. street trees) to be added to minimize incidence of pedestrian-vehicular collisions
Minimization (off-site)	• human • neighbourhood	East Aldine Management District: • sufficient lighting should be implemented on trails extending from the town centre to the nearby Keith Weiss Park • Note: safe environments are associated with increased active transportation
Targeted Vulnerable Population Benefit	• human	Carpentersville Intersection Design: • implement measures that comply with the Americans with Disabilities Act at the intersection to assist visually impaired persons
Influence Health Behaviours	• neighbourhood	Carpentersville Intersection Design: • incorporate wayfinding signage to direct pedestrians and cyclists • Note: wayfinding or signage is associated with increased active transportation

Table 21. Findings Table: Examples of Secondary Design Measures—this table provides examples of recommendations generated by Project Teams in the HIA case studies. These recommendations proposed that secondary design measures be added to proposals in order to improve in their health impact. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

Design-Support Recommendations	
Recommendation Domain	Select Example(s)
Proposal Implementation	

Policy Development	**East Aldine Town Centre Design**
	• specified mechanisms and identified strategies to promote health policy development:
	  ○ utilize a Request for Proposal process to select a grocer who will promote health by:
	  ▪ collaborating with EAMD and the new health centre, Vecino Health, on the programs (e.g. Fruits and Vegetable Prescription Program)
	  ▪ designing the space to encourage healthy behaviours (e.g. stocking shelves near the cash registers with healthy food options)

Creation of Advisory Committee (or similar)	**Hoboken Stormwater Management** • establish an advisory committee to oversee implementation of green infrastructures

Pilot Projects	**East Aldine Town Centre Design**
	• pilot Crash Reduction Countermeasures (CRCs) to:
	  ○ test potential impact of permanent changes with low-cost materials
	  ○ gain political support to encourage development of policy frameworks for the approval and implementation of CRCs

Further Research	**Pasadena Infill Development** • identify potential partners to assist in realizing projects for select lots (e.g. green spaces, commercial, or mixed-use developments)

Creation of Incentives	**Pasadena Infill Development**
	• specified incentives to encourage multi-family housing development:
	  ○ permit auxiliary dwellings and increase density requirements
	  ○ remove minimum parking requirements
	  ○ establish rebate programs

Funding Access Strategies	**East Aldine Town Centre Design** • specified project procurement method to fund implementation of proposal (e.g. utilize a public-private-partnership arrangement in order to procure a high-quality, affordable grocery store)
Development Partnerships	**Colorado School-Based Health Centres** • specified potential partners to facilitate the expansion of SBHCs and SBRCs in Colorado Springs (e.g. form a community task force made up of service providers, residents, and key stakeholders)
Proper Construction and/or Performance	

Policy Development	**Hoboken Stormwater Management**
	• specified issues to address within stormwater management policy:
	  ○ ensure proper construction and maintenance of green infrastructures by requiring public and private workers to be trained and certified
	  ○ incorporate monitoring programs within North Hudson Sewerage Authority Long-Term Control Plan

Creation of Advisory Committee (or similar)	**Hoboken Stormwater Management**
	• establish an advisory committee to:
	  ○ oversee implementation of green infrastructures
	  ○ identify indicators to track their performance over time

Guidelines	**East Aldine Town Centre** • specified design guidelines to incorporate: Crime Prevention Through Environmental Design
Further Research	**Omaha Street Connections and Development Review Processes** • monitor traffic volumes in order to establish more accurate thresholds, triggering the need for traffic calming measures to be implemented.

Maintenance Strategies	**Hoboken Stormwater Management**
	• specified methods and tools to analyze green infrastructure performance outcomes:
	  ○ establish a database for each green infrastructure intervention to track performance, ensure upkeep, and report performance findings
	  ○ conduct community-wide surveys to understand ongoing impact of flooding and stormwater management strategies.

Funding Access Strategies	**Liberty Street Design**: • specified mechanisms to fund the repair and continued maintenance of active transportation routes
Sustained Use and/or Behaviour Change	

Community Engagement or Outreach	**East Aldine Town Centre**
	• identified strategies to promote healthy behaviours:
	  ○ collaborate 911 Call Centre to encourage walking breaks for their employees
	  ○ establish walk-to-school programs
	  ○ collaborate with key residents of the neighbourhood to develop culturally sensitive healthy eating strategies for the community

Training or Education Programs	**East Aldine Town Centre** • specified strategies to promote attentive driving through development of educational programs

Maintenance Strategies	**East Aldine Town Centre**
	• specified strategies to improve neighbourhood walkability:
	  ○ increased enforcement of drinking- and crime-related offenses
	  ○ trash removal, finding uses for vacant lots, and front yard maintenance

Development of Partnerships	**East Aldine Town Centre** • specified partnerships to promote healthy behaviour (e.g. East Aldine Public Health & Neighbourhood Services Committee, the proposed health centre, the selected grocer, and the neighbouring City of Houston) • specified partnerships for new projects to ensure multi-modal transportation routes throughout East Aldine
Target Vulnerable Populations	

Training or Education Programs	**Hoboken Stormwater Management**
	• specified sub-groups to target education efforts on stormwater management practices that impact vulnerable populations
	  ○ public and private (outsourced) maintenance workers
	  ○ students
	  ○ low-income individuals and families
	  ○ seniors
	  ○ individuals with physical, mental, or emotional disabilities

Policy Development	**Hoboken Stormwater Management** • specified policy issues to be addressed: ○ strengthen the local economy to benefit low-income individuals and families by:

	• awarding green infrastructure construction and maintenance contracts to local companies or those who employ local residents • incorporating community benefit strategies within contracts. ○ select sites for green infrastructure projects that will improve neighbourhoods home to vulnerable populations
Guidelines or Standards	**Pasadena Infill Development** • established guidelines for the construction of new, multi-family housing developments (e.g. include amenities and services within walking distances of new developments, with attention to areas where households have limited access to transportation)
Development of Partnerships	**Pasadena Infill Development** • specified partnerships to address concerns related to concentrated poverty and implement crime prevention programs (e.g. Pasadena Planning and Police Department)

Table 22. Findings Tables: Examples of Design-Support Recommendations— this table provides examples of recommendations generated by Project Teams in the HIA case studies. Design-support recommendations were proposed in order to ensure a proposal's implementation, proper construction and/or performance, and sustained use by and/or behaviour change in end-users; and, to target the particular needs of vulnerable populations. Each Project Team recommended multiple strategies—both design and design-support—in order to improve a proposal's health impacts. (source: table by author; information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

	Omaha Street Connections and Development Review Processes	Hoboken Stormwater Management	Colorado School-Based Health Centres	Liberty Street Design	Pasadena Infill Development	Carpentersville Intersection Design	East Aldine Town Centre Design
Common Written Forms:							
Comprehensive HIA report		X	X	X	X	X	X
Executive Summary	X	X					
Press release/Press advisory							
Formal Decision-Making Process Forms:							
Testimony at public hearings							
Public comment and response processes *(in EIA, regulatory standard setting processes, permit approval, etc.)*							
Legislative briefings							
Other Media for a Broader Outreach/Dissemination:							
Op-ed and letters to the editor							
Meeting with editorial boards							
Organizational newsletters, emails, outreach materials							
Community workshops or panel discussions							
Distribution of materials door-to-door							
Distributed materials to local residents	X	X					
Distributed materials to other stakeholders	X	X					
Article in popular magazine							
Article in peer-reviewed journal							
Graphic/visual representations	X						
Radio, TV, interviews							
Websites/Blogs (distributed materials online)		X				X	
Presented report findings and recommendations to public		X					
Presented report findings and recommendations to decision-makers		X				X	
*additional methods not disclosed			X	X	X		X

Table 23. Findings Tables: Communication Methods—this table identifies the communication methods employed by Project Teams to report assessment methods, findings, and recommendations. A variety of methods were used between HIA case studies. (source: table by author (developed from a list of communication methods from Bhatia, 2011); information sourced from Carnegie et al., 2016; Cummings et al, 2016a; Cummings et al., 2016b; Douglas County Health Department, 2016; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016; Wade et al., 2016)

5.5 General HIA Case Study Scoping Review Findings Summarized

Overview of the Characteristics of the Case Study HIAs

- The seven-case study HIAs were used to assess:
  - the health impacts of design interventions across many design scales; proposals primarily addressed design at neighbourhood- and city-scales, but modifications were suggested at human-, building-, neighbourhood-, and city-scales.
  - short- and long-term health impacts of decisions made at many stages in the lifecycle of urban development projects; proposals assessed Design, Construction, and Operation Stage decisions.
  - differential health impact of design interventions across populations; proposals considered the needs and preferences of both general and vulnerable populations.
  - a broad range of health determinants to be acted upon upstream in order to improve population health outcomes downstream; health determinant domains considered included: Individual Health, Behavioural Risk Factors, Family and Community Structure, Employment and Livelihood, Housing, Environmental Quality, and, Public and Private Services.
- Assessments were prospective, and conducted either during proposal planning stages or following the development of a draft proposal.
- The time required to complete each assessment ranged from 0 – 6 months to 19 – 24 months.
- All of the HIAs conducted the six phases of the HIA and generally following best practices.
- The HIAs involved a variety of actors: decision-makers, proposal proponents, experts, key informants, stakeholders, and affected populations.
- Areas of expertise on Project Teams included: public health, urban-planning, public works, and/or community and policy development.
- Project Team members contributions often aligned with their respective disciplines.
- Four of seven HIAs examined established multi-sectoral, multi-disciplinary Steering Committees and/or formal Stakeholder Groups.
- Multiple sources were used by Project Teams to validate and strengthen findings, including:
  - review of available information;
  - original observational studies;
  - environmental modelling or spatial analysis;
  - quantitative forecasting;
  - expert consultation;
  - key informant consultation;
  - stakeholder and affected population outreach and engagement; and,
  - consultation with decision-makers and Steering Committees (or similar).
- Appraisers generated both design and design-support recommendations to improve a proposal's impact on health.

Value-Added from the HIA Process

The seven-case study HIAs enabled the respective appraisers to:

- pilot application of and build capacity for HIA;
- adapt the assessment process to align with the objectives of the proposal and resources available;
- systematically evaluate the proposal's impact on health within the context of larger urban and social systems;
- compare the impact of and consider the trade-offs between two or more design alternatives;
- engage non-traditional stakeholders and affected populations through a participatory, rather than didactic, process;
- consider the needs of all individuals within the defined Impact Area, and not simply those who may be directly impacted by the proposal;
- collaborate with other sectors to develop a coordinated approach to sustainable development;
- quantitively forecast myriad impacts associated with design decisions, including:
    - percent reduction on pedestrian-vehicular collisions associated with the implementation of proposed crash reduction countermeasures;[2]
    - economic impacts of the change in pedestrian-vehicular collisions predicted;
    - number of Disability-Adjusted Life Years (DALYs)[3] saved following implementation;
    - economic value of the yearly savings associated with DALYs saved;
    - economic impacts of the proposal on property values and retail sales; and,
    - cost-effectiveness of the financial outcomes of the proposal (physical activity benefits, increase in property values and retail sales, and costs associated with pedestrian-vehicular collisions) against the costs of construction; and,
    - units gained if planning policies were relaxed to allow for denser, multi-family units on smaller lots.
- generate pragmatic, scientific and contextual evidence-informed recommendations that account for the contextual circumstances (physical, political or corporate climate, etc.) surrounding the proposal while improving its health impact;
- improve health outcomes related to urban development;
- develop targeted strategies to address differential health impacts across populations (both general and vulnerable); and,
- plan evaluation and monitoring activities to assess:
    - commitment to HIA best practices;
    - considerations for health and health equity;
    - barriers to and facilitators for the implementation of recommendations;
    - resident experiences with and perceptions of design interventions;
    - changes to traffic volumes and speeds;
    - changes to pedestrian-vehicular crash rates; and,
    - changes to community health following implementation.

[2] crash reduction countermeasures are measures intended to reduce vehicular collisions, and may include: roundabouts, curvilinear streets, street trees, sidewalks, and/or designated pedestrian crossings.

[3] DALY is a time-based measure that indicates the number of years of life lost as a result of the premature death or healthy years of life lost as a result of disability.

5.6 HIA Case Study Scoping Review Conclusions for Normative Architectural Practice and Architectural Design

Despite the limitations of the seven-case study HIAs to directly corelate to building-scale design projects, some lessons for normative architectural practice have been articulated in the charts below. This is the primary contribution of this thesis (see Tables 24. and 25.). Architectural designers have historically had limited influence over the conception and direction of architectural projects. Nonetheless, the lessons drawn from this case study scoping review can be applied through a voluntary shift in practice. This shift in practice, however, must be enabled through the financial commitment of the client or property owner and especially by the existing regulatory bodies who, through normative regulatory processes, can expand the integration of the HIA within architectural practice with far more urgency.

Impact on Decision-Making Quality in Normative Architectural Practice to Address Complex, Societal Problems—in General	
Interpretation	Potential Impact of Integrating HIA in Normative Architectural Practice
Integration of the HIA in normative architectural practice could facilitate greater public participation in the architectural design process.	Greater public participation within the architectural design process could: • encourage community empowerment; • enable a shift from technocratic decision-making to democratic decision-making; and, • produce more dynamic architectural design interventions that will respond to end-user's health needs over time.
Integration of the HIA in normative architectural practice could enable greater accountability for decision-making and the impact of design outcomes on society.	Through the evaluation of decision-making and the impact of design outcomes on society in normative architectural practice: • the quality of decision-making could be improved; • architectural theory and practice could be advanced; and, • modifications could be made, as necessary, following the occupation of a building.
Integration of the HIA in normative architectural practice could enable use of a more science-based, analytical decision-making model to inform the best course of action to take to address complex, societal problems, such as population health and health equity.	Implementation of a standardized, systematic process in normative architectural could improve the rigour and transparency of decision-making, ensuring more trustworthy decision-outcomes in the face of uncertainty.
Promotion of Population Health and Health Equity in Normative Architectural Practice and Architectural Design	
Interpretation	Potential Impact of Integrating HIA in Normative Architectural Practice
Integration of the HIA in normative architectural practice could facilitate greater public participation in the architectural design process	Greater public participation driven by public health concerns within the architectural design process could: • encourage self-determined community change; and,

	• produce more responsive architectural design interventions that will respond to end-user's health needs over time; and in turn, • produce architectural design interventions with greater potential to positively influence population health and health equity outcomes.
Integration of the HIA in normative architectural practice could enable greater accountability for decision-making and the health impact of design outcomes on the public health of society	Through the evaluation of decision-making and the health impact of design outcomes on society in normative architectural practice: • HIA theory and practice in normative architectural practice could be advanced; • the impact and effectiveness of the HIA as a health promotional tool could be improved; and, • modifications could be made as necessary to improve health outcomes, following the occupation of a building. Architectural design interventions, as a result, would have greater potential to positively influence population health and health equity outcomes.
Integration of the HIA in normative architectural practice could enable use of a more science-based, analytical decision-making model to inform the best course of action to take to address population health and health disparities.	Evidence-informed architectural design interventions, developed through a standardized and systematic process, are more likely to positively influence population health and health equity outcomes.
Integration of the HIA in normative architectural practice could facilitate the consideration of the impact of architectural design on the wider determinants of health.	Design decisions that consider the impact of architectural design interventions on social, economic, and physical (or environmental) determinants of health have greater potential to positively influence population health and health equity outcomes.
Integration of HIA in normative architectural practice could facilitate the consideration of the health of both those directly and indirectly impacted by an architectural design project.	Applying an ecological approach to architectural decision-making, by considering the health of both those directly and indirectly impacted by an architectural design project, could result in architectural design interventions that have greater potential to positively influence population health and health equity outcomes.
Integration of the HIA in normative architectural practice could facilitate the consideration of the particular needs and preferences of vulnerable end-users.	Architectural design interventions that target the particular needs of vulnerable end-users have greater potential to reduce or eliminate health disparities that are avoidable, unfair, and unjust. Further, by specifically targeting vulnerable populations, the overall health of the population can be elevated.
Integration of the HIA in normative architectural practice could facilitate the development of multiple intervention strategies to address the impact of architectural design on population health and health equity outcomes.	Architectural design interventions have greater potential to positively influence population health and health equity outcomes when coupled with design-support interventions.
Integration of the HIA in normative architectural practice could enable architectural designers to account for health impacts associated with a building throughout its lifecycle—from design through construction, operation, and renovation or demolition.	Architectural designers could leverage their involvement in the design and construction process to improve not only health impacts associated with decisions made during the Design Stage, but also those throughout the lifecycle of an architectural design intervention by broadening the Temporal Scope of decision-making in normative architectural practice. The proactive consideration of health impacts throughout the lifecycle of architectural design intervention has greater potential to positively influence population health and health equity outcomes

	than the consideration of the health impacts of the Design Stage alone.
Transferability of the HIA in Normative Architectural Practice	
Interpretation	Potential Impact of Integrating HIA in Normative Architectural Practice
Integration of the HIA in normative architectural practice is plausible given that the HIA has been used to assess the health impacts of design interventions across many design scales.	Therefore, the HIA has strong potential to not only be used to assess the impact of buildings, but also the impact of other design interventions that are often manipulated by architectural designers in normative architectural practice, but that are not regulated by the 'profession of architecture'.
Integration of the HIA in normative architectural practice is plausible given the comprehensive, problem-solving skillset required to conduct the assessment and the intersectoral approach that the assessment demands. Architectural designers, as generalists, professionals, and interdisciplinary project managers, are uniquely positioned to acquire the expertise necessary to facilitate and conduct HIAs.	Thus, the HIA has strong potential to be an effective tool in normative architectural practice to improve decision-making and, in turn, to develop architectural design interventions capable of promoting population health and health equity. Legislation governing the profession of architecture could be leveraged to ensure that both candidates and members of the profession develop capacity for HIA practice and increase their awareness of the connections between the wider determinants of health and the design of the built environment.
Integration of the HIA in normative architectural practice is plausible given: the prospective nature of the assessment process. Moreover, the optimal timing of the assessment process aligns well the existing phased project-delivery framework in normative architectural practice.	As such, the HIA has strong potential to have influence over decision-making in normative architectural practice, and in turn, to promote population health and health equity, if integrated during: • *Pre-design*—to assess a proposed project plan or to compare alternatives; or, • *Schematic Design*—to assess a proposed preliminary design or to compare alternatives, prior to design approval.
There were a number of limitations abstracted from the reports or explicitly noted by appraisers concerning the assessment process; integration of the HIA in normative architectural practice would likely face similar challenges.	However, many of these limitations could be overcome by committing, for example, to: • up-skilling (e.g. understanding of the scientific method, critical appraisal, connections between health and the built environment, community engagement, etc.); • rigorously and transparently documenting design decision-making processes, and disseminating results to the design community; • developing intersectoral partnerships; • developing partnerships with academic institutions; • educating clients and public alike about the impacts of architectural design interventions on health; and, • identifying barriers to or facilitators for implementation of the HIA process in normative architectural practice (i.e. individual-, organizational-, and systems-level barriers/facilitators).

Table 24. Case Study Scoping Review Table: Summary Conclusions—this table describes the primary conclusions drawn in this scoping review in response to the research questions pursued within this thesis. (source: table by author)

Overarching Conclusion	
Interpretation	Potential Impact of Integrating HIA in Normative Architectural Practice
Integration of the HIA in normative architectural practice could facilitate a paradigm shift in normative architectural practice: challenging previous approaches and assumptions in architectural decision-making with a fundamental shift in thinking from that of market justice to social justice.	While many architectural designers may individually support social justice issues, integration of the HIA in normative architectural practice could enable architectural designers to become more effective champions of public health-related social justice issues, and to contribute to improving population health and health equity through architectural design. As well, findings from this review indicate that the HIA has strong potential to be an effective tool in normative architectural practice. This suggests that aspiring for architectural design in support of social justice is not a misplaced dream, but can, in fact, become a reality through a commitment to changing the practice of architecture.

Table 25. Case Study Scoping Review Table: Overarching Conclusion—this table describes the overarching conclusion drawn in this scoping review in response to assessment of the potential of HIA integration in normative architectural practice. (source: table by author)

5.7 Discussion of Findings

> Integration of the HIA in normative architectural practice could facilitate greater public participation in the architectural design process

A fundamental principle of health promotion is that a community is entitled to self-determination (World Health Organization [WHO], n.d.). The World Health Organization (n.d.) describes health promotion as, "the process of enabling people to increase control over, and to improve, their health". As such, public participation was integral to all of the HIAs reviewed. Each HIA conducted outreach and engagement activities with key stakeholders and affected populations and consulted key informants.[4] To involve key stakeholders and affected populations, Project Teams conducted community-wide resident surveys, interviews, focus groups, forums and/or meetings, PhotoVoice exercises, town hall meetings, and formal committee meetings open to the public. The intent of these outreach and engagement activities was to:

- understand local perceptions of the built environment, and to, together, define qualities and components of a 'healthy community';
- understand local perspectives for and against design alternatives;
- identify local, priority health concerns to inform future decision-making (e.g. trade-offs);
- supplement and/or validate findings from existing data or literature;
- collect more precise and/or up-to-date information;
- investigate factors influential to current resident health behaviours (i.e. to evaluate causal relationships), including barriers and facilitators;
- understand the particular needs and experiences of vulnerable populations;
- identify assets and challenges within the community;
- discuss findings, generate recommendations, and/or solicit feedback; and,
- build or strengthen local networks.

Key informants were consulted through a variety of means, such as online surveys, and structured and semi-structed interviews—either via telephone or in-person to:

- gather local and relevant health-related information;
- solicit input concerning potential health impact(s) associated with each proposal;
- gain insight into existing or potential implementation barriers and/or facilitators;
- assist in identifying potential stakeholders and affected populations;

[4] Key stakeholders included: local residents and businesses; local and/or regional governments, including essential services; schools; drivers; and, impacted authorities and community service providers and partner organizations. Affected populations considered were generally local residents, situated within each HIA's defined Impact Area. Key informants included local and/or regional governments, including essential services; governmental consultants; and, local community service providers and leaders.

- assist in recruitment efforts for and facilitation of outreach and engagement activities; and,
- compare lessons learned from informants' professional experiences with findings from the literature.

While community engagement is often mandated in construction projects, normative architectural practice typically fails to critically understand or accurately map end-user needs and preferences (Blundell-Jones et al., 2005). Rather, community engagement is viewed as a milestone that has the potential to complicate a project with a multitude of ideas beyond those of the client (Blundell-Jones et al., 2005). As a result, architects have a tendency to approach community engagement with trepidation (Blundell-Jones et al., 2005). As Italian architect Giancarlo de Carlo explained in the late 1960s—showing how this has been already on the radar of architectural designers for a while—when the public is effectively excluded from the design process, design decision-making disregards reality, and buildings become inanimate—reflecting only the institutions they were borne out of; flexibility is often inhibited and end-users are forced to adapt to the architecture itself (de Carlo, 2005). In contrast, when communities are included in the design process, design decision-making can respond to the local context, and buildings become living organisms—capable of adapting to the needs of end-users over time; flexibility is instead encouraged by the architecture (de Carlo, 2005). Greater public participation within the architectural design process could: encourage community empowerment; encourage self-determined community change; enable a shift from technocratic decision-making to democratic decision-making; produce more responsive architectural design interventions that will respond to end-users' needs over time; and in turn, produce architectural design interventions with greater potential to positively influence population health and health equity outcomes.

> Integration of the HIA in normative architectural practice could enable greater accountability for decision-making and the impact of design outcomes on society

Four of seven HIAs described their intentions with regard to evaluation and monitoring activities. Between the four HIAs, three types of evaluation methods were proposed: process, impact, and outcome. To conduct a process evaluation, for example, East Aldine Centre Design HIA developed evaluation questions and identified indicators to be assessed that focused on: (1) commitment to HIA best practices; (2) consideration for health and health equity; and, (3) barriers to and facilitators for implementation of recommendations. To conduct an impact evaluation, Hoboken Stormwater Management HIA suggested that resident experiences with and perceptions of green infrastructures be studied. To conduct an outcome evaluation, Omaha Street Connections and Development Review Processes HIA recommended evaluation of changes to traffic volumes and speeds, pedestrian-vehicular crash rates, and community health following the construction of new street connections. Monitoring activities were proposed to collect information necessary for conducting evaluations. Tasks included: conducting biannual community-wide

surveys, as well as interviews with affected populations; and, ongoing data collection of indicators.

In normative architectural practice today, there is little accountability for decision-making or the impact of architectural design outcomes on society. Standard evaluation activities (e.g. contract administration, commissioning, or warranty reviews) are typically focused on construction deficiencies, client satisfaction (i.e. whether the resultant building design aligns with the initial design brief or functional program), and building performance (e.g. thermal, or mechanical and electrical systems, etc.) (Brown et al., 2009). Further, Post-Occupancy Evaluations (POE), which often evaluate outcomes including end-user comfort or internal environmental quality, are rarely conducted (Hay et al., 2018). In fact, despite their conception in the 1960s, presently only 3% of British architecture firms routinely conduct POEs (Hay et al., 2018). As Hay and colleagues (2018) explain, "[there exists a] 'terrible psychology of short-termism' that is seen to beset an industry driven by quickly realized profits, and efficiency savings in the construction process, rather than long-term benefits to clients or wider society". However, if the quality of decision-making in normative architectural practice is to improve and healthy communities are to be realized, it is necessary to evaluate the impact of architectural design on end-users, local communities, and society at-large following implementation. Through the evaluation of decision-making and the impact of design outcomes on society in normative architectural practice: (1) the quality of decision-making could be improved; (2) architectural theory and practice could be advanced; (3) HIA theory and practice in normative architectural practice could be advanced; (4) the impact and effectiveness of the HIA as a health promotional tool could be improved; and, (5) modifications could be made, as necessary, following the occupation of a building. Architectural design interventions, as a result, would have greater potential to positively influence population health and health equity outcomes.

> Integration of the HIA in normative architectural practice could enable use of a more science-based, analytical decision-making model to inform the best course of action

All seven of the HIAs reviewed conducted the six phases of the HIA and generally following best practices. Appraisers applied consensus-based, systematic approaches to:

- judge the value and feasibility of conducting an HIA;
- clearly define the decision-problem;
- develop plausible hypotheses concerning the connections between each proposal and health;
- identify health impacts to be assessed;
- develop rational plans for each phase of the assessment;

- evaluate causal relationships by collecting primary and secondary data;[5]
- develop community health and environmental profiles by collecting primary and secondary data;
- quantitively forecast myriad impacts associated with design decisions;
- characterize health impacts, taking into consideration factors such as: direction, likelihood, magnitude, duration, and distribution of impact; as well as the strength of evidence supporting the anticipated impacts between proposals and health;
- generate pragmatic, scientific and contextual evidence-informed recommendations that account for the contextual circumstances (needs and interests of local residents, political and corporate climate, etc.) surrounding the proposal while improving its health impact; and,
- document and report findings and recommendations to all those involved in or affected by the proposal.

At the time of documentation, no HIA had yet completed any evaluation or monitoring activities.

In normative architectural practice, there are no standard defined design decision-making processes to determine the best course of action. In each project, such initiatives are driven by either the developer's needs, the requirements of regulatory processes, or the political pressures on the project by affected community actors. All standardized, systematic processes in normative architectural practice focus, typically, on project-delivery to ensure that, "services are delivered on time, accurately, and within budget" (Brown et al., 2009, Ch 2.8.1. p. 3). Each stage of an architectural design project, for example, from conception to occupancy, is organized according to a phased project-delivery framework. There is a general reluctance in normative architectural practice to implement standardized, systematic design decision-making processes in practice, for fear of a loss of control or creativity (Martin, 2014). However, while recommendations in HIA are developed through a prescribed process, the HIA does not necessarily provide appraisers with exact intervention solutions. Rather, expertise and creativity are required to adapt the HIA findings to the local context. Simply put: standardized, systematic processes improve the likelihood of high-quality decision outcomes universally. Implementation of a standardized, systematic process in normative architectural practice could improve the rigour and transparency of decision-making, ensuring more trustworthy decision-outcomes in the face of uncertainty. Evidence-informed architectural design interventions, developed through a standardized and systematic process, are more likely to positively influence population health and health equity outcomes.

[5] All HIAs applied mixed-methods approaches when sourcing the evidence necessary to support assessment activities. Multiple sources were used by Project Teams to validate and strengthen findings, including review of available information; original observational studies; environmental modelling or spatial analysis; quantitative forecasting; expert consultation; key informant consultation; stakeholder and affected population outreach and engagement; and, consultation with decision-makers and Steering Committees (or similar).

Integration of the HIA in normative architectural practice could facilitate the consideration of the impact of architectural design on the wider determinants of health

Combined, the HIAs reviewed assessed the impact of their proposals on a broad range of health determinants. Health determinant domains evaluated included:

- **Individual Health**—mental well-being.
- **Behavioural Risk Factors**—diet; physical activity/inactivity; smoking; alcohol consumption; drug addiction; and, leisure and recreational activities.
- **Family and Community Structure**—civic engagement.
- **Employment and Livelihood**—employment and job security.
- **Housing**—housing safety and quality; housing supply/type, affordability, and accessibility; and, residential segregation.
- **Environmental Quality**—air quality; water quality and safety; food resources and safety; active transportation hazards e.g. pedestrian/cyclist safety; mixed land-uses; neighbourhood street infrastructure; and, access to green spaces.
- **Public Services**—educational access; healthcare access; waste systems and services; policy, security, and emergency response; recreational centres; and, public transportation.
- **Private Services**—access to retail food services.

In normative architectural practice, consideration for health is primarily limited to the influence of design on environmental factors, such as natural light, air and water quality, or thermal comfort. Further, building regulations establish the minimum standards to reduce or eliminate health risks and harmful exposures (Brown et al., 2009); designing above these requirements is done voluntarily. However, design decisions that consider the impact of architectural design on social, economic, and physical (or environmental) determinants of health have greater potential to positively influence population health and health equity outcomes.

Integration of the HIA in normative architectural practice could facilitate the consideration of the impact of the health of both those directly and indirectly impacted by an architectural design project

The HIAs reviewed considered the health needs of all populations within each assessment's defined *Impact Area*,[6] and not simply those who may be directly impacted by the proposal. For example, Carpentersville Intersection Design

[6] The *Impact Area* demarcates the physical space in which health impact(s) connected to a proposal will be assessed.

HIA—which assessed two design options: a signalized intersection versus a single-lane roundabout—considered the impact of each design alternative on direct end-users, including pedestrians, cyclists, and drivers, as well as local residents living within a ½-mile radius of the intersection. In current normative architectural practice, buildings are, more often than not, designed as isolated objects, concerned with only the, "impact of a building or buildings on the character of a community" (Brown et al., Ch 1.1.2 p. 3).[7] Instead, the contextual scope of consideration in an architectural design project is generally limited to the building site and/or factors beyond that may have direct impact on the site itself. As notable architect Moshe Safdie explains:

> I think the most avant-garde in our profession today is preoccupied with fundamentally, the object building … The object building cannot make a city … they are introvert. They do not connect one to the other … they create a world, and another world, and another universe, each upon itself. Not as a connective city … (as cited in Fairs, 2014).

Some may argue that it is the responsibility of urban planners to account for the needs of the community, and not that of architectural designers. However, urban-planning policies have historically prioritized the needs of the individual over those of the community (Lavin et al., 2006). This approach has resulted in a fragmented urban framework, generally separated by the activities of daily life: live, work, and play (Lavin et al., 2006; Oldenburg, 1999). We, as a society, are now coming to realize the impact of these policies on human health.[8] For example, there has been significant increase in the incidence of obesity and overweight as a result of the sedentary lifestyles that traditional urban-planning policies have encouraged. Subsequently, urban-planning practices are beginning to be transformed in order to rigorously address these failings and to better support population health and health equity. That said, theorists and practitioners postulate that if healthy communities are to be realized, a coordinated, ecological approach must be taken (Public Health Agency of Canada, 2017; Health Resources in Action, 2013; Metcalf et al., 2009; Barton, 2006) where buildings are designed as components of a larger system (Sarkar et al., 2014). Applying an ecological approach to design decision-making, by considering the health of both those directly and indirectly impacted by an architectural project, could result in

[7] Architectural designers can be tasked with developing a 'functional program' prior to the design phase of a building project. A functional program, "describes the requirements which a building must satisfy in order to support and enhance human activities … [among other considerations,] the architect must understand the impacts of a building's occupants and processes on the built environment; the social impacts of its program on the community …" (Brown et al., 2009). However, functional programming is not considered to be part of basic architectural services, and it is understood that this service requires a specialized skillset (Brown et al., 2009). In other words, the existing methods and tools in normative architectural practice are limited in their ability to develop a thoughtful functional program.

[8] For further insight into the connections between urban-planning and health refer to 'Urban Sprawl and Public Health: Designing, Planning, and Building for Healthy Communities' by H. Frumkin, L. Frank, and R. Jackson.

architectural design interventions that have greater potential to positively influence population health and health equity outcomes.

> Integration of the HIA in normative architectural practice could facilitate the consideration of the particular needs and preferences of vulnerable end-users

All of the HIAs reviewed considered the needs and preferences of vulnerable sub-populations, including children, young adults, young families, older adults, low- and middle-income individuals and families, persons with physical, mental, or emotional disabilities, and persons who could not drive or were without access to a car. These groups were identified through multi-disciplinary, intersectoral Steering Committees,[9] formal Stakeholder Groups, and/or through direct engagement of the public. Further, Project Teams conducted spatial analyses to reveal existing relationships between a population's health and place, including spatial inequities. For example, through mapping, Hoboken Stormwater Management HIA—which assessed the potential of green infrastructure interventions to address the City's chronic flooding issues—established that the areas continually affected by flooding were home to the majority of the City's impoverished and low-income residents and minorities and residents with physical, emotional, and/or mental disabilities (Carnegie et al., 2016). It was determined that the vulnerable sub-populations identified would benefit most from improved flood mitigation strategies. As such, these groups became a focus for the Hoboken Stormwater Management HIA; the Project Team conducted focus groups with representatives from these sub-populations, in addition to other engagement efforts targeting the general population. Not all HIAs examined described the methods used to characterize health impacts following evidence gathering and analysis. Of those that did, however, the distribution of impact across populations was included among the factors considered, and recommendations were developed based on these characterizations.

In normative architectural practice, according to the Canadian Handbook of Practice, building end-users, "have no direct involvement with the design and implementation of a building project" (Brown et al., 2009, Ch 1.2.2. p. 1). However, the needs and preferences of vulnerable end-users may be incompatible with those of the decision-makers—particularly if the client is fixated on

[9] Steering Committees were composed of: local, regional, and federal officials or government (including government agency) staff; academics and researchers; non-profit organization leaders; and/or, local residents. Throughout the assessment process, Steering Committees worked alongside Project Teams to: judge the feasibility and value of the HIA; provide specialized input concerning the circumstances surrounding a proposal; develop goals, objectives, and research questions; define the assessment scope, including spatial, temporal, and demographic scopes, as well as selected health impacts and related determinants to be assessed; strategize research methods, including recruitment opportunities or approaches for stakeholder and affected population engagement activities; discuss and interpret assessment findings; and/or, develop and finalize recommendations.

profitability; architectural designers, on client satisfaction, self-expression, spatial quality, or innovation; and regulatory bodies, on upholding the regulatory requirements and restrictions. Architectural clients, who have enough capital to commission an architectural project, architectural designers, who are highly-educated professionals, and regulatory bodies, who may have political influence, all possess inherent biases; their perceptions of the world, as understood through their lived experiences, can differ dramatically from more vulnerable or marginalized groups. In other words, there is an inherent risk of bias and/or of a conflict of interest—especially when the building end-users affected by an architectural project are not participatory members of the design decision-making process. To enable vulnerable end-users to thrive, architectural designers must consider their unique needs and preferences through a collaborative design process (de Carlo, 2005). Architectural design interventions that target the particular needs of vulnerable end-users have greater potential to reduce or eliminate health disparities that are avoidable, unfair, and unjust. Further, by specifically targeting vulnerable populations, the overall health of the population can be elevated.

> Integration of the HIA in normative architectural practice could facilitate the development of multiple intervention strategies to address the impact of architectural design on population health and health equity outcomes

Public health organizations employ a combination of complementary strategies to improve population health outcomes (Health Canada, 2001). In doing so, public health practitioners are able to: (1) develop an incremental and synergistic approach; (2) address the distinctive characteristics and health needs of vulnerable populations separately from those of the general population; (3) take comprehensive action along the health continuum: from promotion to prevention to protection; (4) implement strategies across a variety of settings (e.g. home, school, workplace, or community); and, (5) consider and leverage the dynamic nature of the interplay between macro-, meso-, and micro-level health determinants in order to improve health outcomes (Health Canada, 2001). According to Health Canada (2001), evidence suggests that, "a mix of strategies … potentially yields the greatest positive impact on population health outcomes" (p. 21).

In all of the HIAs reviewed, a combination of design and design-support recommendations were developed in order to improve population health and health equity outcomes. **Fundamental design modifications** were proposed to ensure the proposal features causing negative health impact(s) were eliminated (or severely reduced) and features producing positive health impact(s) benefit the whole population or target the particular needs of vulnerable sub-populations. Fundamental design modifications were also proposed to influence positive

health behaviours in end-users. Fundamental design modifications included, for example, the conversion of an existing, controlled intersection to a single-lane roundabout or specification of certain building program. **Secondary design measures** were suggested to be added, either on- or off-site, to: minimize negative health impact(s) associated with the design; target the particular needs of vulnerable populations; and/or influence positive health behaviours in end-users. Design measures, for example, included the addition of wayfinding signage or lighting on trails to mitigate the risk of injury to pedestrians and cyclists and/or promote active transport. **Design-support recommendations** were proposed to ensure: actual implementation of proposal features; proper construction and/or performance of the proposal's features; sustained use by end-users; healthy behaviour changes by end-users; and/or, that the proposal targeted the particular needs of vulnerable populations (see to Tables 21 – 23 for specific examples of design and design-support recommendations). Design-support recommendations spanned several domains: community engagement and outreach; training or education programs; policy development; creation of advisory committees (or similar); guidelines or standards; pilot projects; further research; maintenance strategies; creation of incentives; funding access strategies; and, development of partnerships.

In normative architectural practice, the intervention alternatives are limited to those related to, "the design, construction, enlargement, conservation, restoration or alteration of a building or group of buildings" (Brown et al., Ch 1.1.2. p. 5). Architectural services in normative architectural practice, such as feasibility studies, may not always result in the design of a building, however, all services offered are conducted in preparation for design of a building—whether one is ultimately realized or not. In other words, intervention strategies in normative architectural practice are limited primarily to the manipulation of the built environment (i.e. a meso-level determinant). Health Canada (2001) explains, "interventions [that] focus solely on one determinant of health are likely to be less effective unless complementary action is taken to influence a linked factor." (p. 21). Thus, architectural design interventions have greater potential to positively influence population health and health equity outcomes when coupled with design-support interventions.

> Integration of the HIA in normative architectural practice could enable architectural designers to account for health impacts associated with a building throughout its lifecycle—from design through construction, operation, and renovation or demolition

The *Temporal Scope* of an HIA can be limited to one or more stages of a proposal's lifecycle; the health impacts assessed will differ depending on the stage(s) of focus (Birley, 2011). Not only can the health impacts of a proposal's design be scrutinized, but so too can the design process itself. The *Design Stage*

can last many years and leave local residents in a state of uncertainty, unsure how the proposal will impact their future lives (Birley, 2011). The *Construction Stage* poses many health risks, such as exposure to cancer-causing construction materials, which can be particularly harmful to the health of the construction workers, those nearby, and the environment (U.S. National Library of Medicine [USNLM], 2019). As well, the interruption of a sidewalk or street network by construction has been linked to decreased levels of physical activity, and, in turn, increased incidence of overweight and obesity. When a new housing development, for example, has reached the *Operation Stage* there will likely be an influx of people, concentrated in a particular area, which can have many effects on the health of residents, both old and new. For example, if additional resources, such as access to healthcare or healthy food options, have not been allocated in advance to meet increased demand, existing resources can become strained and residents' health, negatively impacted. Further, when a building or infrastructure project is demolished, decommissioned, or renovated, the *Demolition Stage* can release toxins embodied in older materials, such as asbestos or formaldehyde, into the environment (USNLM, 2019). Similarly, the health impacts associated with an architectural design intervention will vary throughout its lifecycle, and the HIA could be an effective tool to evaluate and respond to the impacts of these distinct stages.

In the HIAs reviewed, appraisers focused primarily the short- and long-term impacts of Design Stage decisions. However, during the Hoboken Stormwater Management HIA, appraisers identified that decisions affecting the construction and operation of their proposal could influence population health outcomes, and so broadened the Temporal Scope of the assessment to include the Construction and Operation stages. In normative architectural practice, architectural designers have limited involvement in the Operation Stage of an architectural design project. Their focus is predominantly on the Design Stage, acting as design decision-makers, and the Construction Stage, acting as administrators (see Table 26.). Though architectural designers' direct involvement in the decision-making process is generally restricted to the Design Stage of an intervention, recommendations could still be proposed to influence health impacts associated with the other stages of a building's lifecycle. That is, architectural designers could leverage their involvement in the design and construction process to improve not only health impacts associated with decisions made during the Design Stage, but also those throughout the lifecycle of an architectural design intervention by broadening the Temporal Scope of decision-making in normative architectural practice. The proactive consideration of health impacts throughout the lifecycle of architectural design intervention has greater potential to positively influence population health and health equity outcomes than the consideration of the health impacts of the Design Stage alone.

Intervention Lifecycle Stage	Architectural Services Provided [a]	General Role of Architectural Designer(s)
DESIGN	• **Pre-Design—**project planning: site, zoning, and code analysis, confirmation of project goals, scope, budget, etc. • **Schematic Design—**development of preliminary design and estimation of construction costs • **Design Development—**refinement and coordination of design and construction costs • **Construction Documentation—**production and coordination of construction drawings and bid package) • **Bidding and Negotiation—** construction procurement and value-analysis of alternative proposed bid prices	• design decision-makers (reporting to the client)
CONSTRUCTION	• **Construction-Contract Administration—** project coordination: issuance of construction documentation, evaluation of construction, preparation of certificates of payment, etc.	• administrators
OPERATION	• **Post-Construction—**evaluation of building deficiencies and performance, preparation of certificates of payment, etc. **Note**: *involvement is generally limited to the time period immediately following construction and at the end of the first year of building occupancy.*	• administrators
DEMOLITION (or RENOVATION or DECOMMISSIONING)	• potential services provided, if renovations require demolition—refer to services listed in 'Design Stage'	• potential design decision-makers (reporting to the client)

[a] Information sourced from the Brown et al., 2009.

Table 26. Architectural Services Provided and Role of Architectural Designers—this table describes the role of architectural designers, and the services they provide, throughout the lifecycle of an architectural project. Though architectural designers' direct involvement in the decision-making process is generally restricted to the Design Stage of an intervention, recommendations could still be proposed to influence health impacts associated with the other stages of a building's lifecycle. (source: table by author)

Integration of the HIA in normative architectural practice is plausible given that the HIA has been used to assess health impacts of design interventions across many design scales

In the HIAs reviewed, proposals primarily addressed design at the neighbourhood- and city-scales. Design interventions evaluated included the design of street elements and networks; the design of green infrastructures and networks; the design of district master plans; the propagation of housing types (townhouses, patio homes, and multi-family developments), including considerations for land-use mix and infill development; and, the curation of building program. In normative architectural practice, the profession of architecture is governed through legislation, which intends to regulate the profession and protect the interests of the public. In the province of Ontario, for example, the Architects Act governs the profession of architecture (Ontario Association of Architects, n.d. a). As stipulated by the Architects Act, only licensed architectural designers ('Architects') are entitled to engage in the design for the construction, enlargement, or alteration of buildings: intended for human occupancy (e.g. industrial uses excluded), over three storeys tall, and greater than 600 square metres in gross area (Architects Act, 1990).

Though legislation limits the design of buildings of a certain scale and type to the 'profession of architecture', the 'practice of architecture' is often much wider in scope than what is currently regulated (Brown et al., 2009). As explained in Canadian Handbook of Practice, "architecture is environmental design; in fact, any manipulation of the physical environment is of potential interest to architects." (Brown et al., 2009; Ch 1.1.2 p. 3) Consequently, the transferability of the HIA to normative architectural practice should not be rejected on the grounds that the design interventions assessed in the HIAs reviewed are of too large a design-scale. Furthermore, in the HIAs reviewed, design modifications were recommended at human- and building-scales—both of which the 'profession of architecture' does directly engage. Therefore, the HIA has strong potential to not only be used to assess the impact of buildings, but also the impact of other design interventions that are often manipulated by architectural designers in normative architectural practice, but that are not regulated by the 'profession of architecture'.

Integration of the HIA in normative architectural practice is plausible given the comprehensive, problem-solving skillset required to conduct the assessment and the intersectoral approach that the assessment demands. Architectural designers, as generalists, professionals, and interdisciplinary project managers, are uniquely positioned to acquire the expertise necessary to facilitate and conduct HIAs

In the HIAs reviewed, areas of expertise on Project Teams included: public health, planning, public works, and/or community and policy development. As generalists, architectural designers are inherently capable of broadening their understanding of the built environment and its impact on society:

> Today, an architect is a professional with a general knowledge of the many disciplines involved in the design, construction, maintenance, and alteration of buildings. … professionals are required to be proficient, adept, skilled, and expert. While in practice, professionals continue their personal scholarship, their quest for knowledge, and their growth by experience. In addition, they should be teachers and mentors to those in training for the profession. (Brown et al., 2009, Ch. 1.1.2 p. 1-2).

Moreover, provincial or territorial legislation mandates that individuals admitted to the profession of architecture must share certain academic qualifications (Brown et al., 2009). In Canada, the Canadian Architectural Certification Board is tasked with, "[certifying] the academic qualifications of candidates; [and, accrediting] programs offered by Canadian university schools of architecture" on behalf of each province or territory (Brown et al., 2009, Ch 1.1.4 p. 1). Further, licensure requirements in Ontario, for example, require all license architectural designers to engage in continuing education—70 hours in total, every 24 months (Ontario Association of Architects, n.d. b). Architectural designers are continually challenged to advance their skills and expand their knowledge. These legislative requirements could, in turn, be leveraged to ensure that both candidates and members of the profession develop capacity for HIA practice and increase their awareness of the connections between health and the built environment. Though, arguably, architectural designers will never become health experts (which is not the intent of this thesis). In the HIAs reviewed, Project Team members contributions often aligned with their respective disciplines. As such, an advanced understanding of health and its determinants was not necessary to effectively participate in HIA practice. Moreover, when Project Team members did not possess the expertise or technical skills required, external experts or community partner organizations were engaged. Architectural designers can, therefore, outsource HIA activities as needed; as designers build capacity for integrating and conducting HIAs, they will rely less on external assistance.

In all the HIAs reviewed, appraisers 'problem-solved' in order to improve each proposal's impact on health. Problem-solving ultimately necessitates the identification of a decision-problem, gathering of relevant information, analysis and interpretation of the evidence, and, and the development of an appropriate solution that is capable of addressing the established criteria, accounting for the contextual circumstances, and responding to the inferences made from the information gathered. As professionals, architectural designers possess the comprehensive skillset and practical experience necessary to excel at architectural 'problem-solving':

> Professionals possess a comprehensive body of knowledge, skills, and theory developed through education and experience. The process of professional education, experience, and examination is structured to assure the public that professionals engaged to perform professional services have acquired the expertise to perform them to acceptable standards (Brown et al., 2009, Ch 1.1.2., p. 1).

While existing decision-making models in normative architectural practice are currently limited in their ability to promote population health and health equity, they need only to be refined and executed more rigorously—expertise that can easily be learned. As interdisciplinary project managers (architectural designers often act as the client's 'Prime Consultant'), architectural designers are inclined to intersectoral collaboration, "one of the architect's important roles is to manage and coordinate the work of consultants, whether they are retained directly by the architect or separately by the client" (Brown et al., 2009, Ch 1.2.3 p. 2). Architectural designers typically collaborate and coordinate a host of specialist consultants, including engineers (e.g. acoustical, civil, mechanical, electrical, geotechnical, seismic, traffic, and environmental remediation), urban planners, landscape architects, marketing professionals, interior designers, specification writers, etc. (Brown et al., 2009). Thus, the HIA has strong potential to be an effective tool in normative architectural practice to improve decision-making and, in turn, to develop architectural design interventions capable of promoting population health and health equity.

> Integration of the HIA in normative architectural practice is plausible given the prospective nature of the assessment process. Moreover, the optimal timing of the assessment process aligns well with the existing phased project-delivery framework in normative architectural practice

All of the HIAs examined were conducted either during the proposal planning stages or following the development of a draft proposal. In the Colorado School-Based Health Centres HIA, for example, the Children's Hospital of Colorado (CHCO) proposed utilizing School-Based Health Centres (SBHCs) as a means of impacting child physical activity and mental health. This HIA was conducted during the proposal planning stage—at a point when community health needs had

been established and prioritized, and a potential design intervention had been identified. Those involved sought to: (1) identify and assess the potential health impacts of SBHCs on physical activity and mental health outcomes in school-aged children; (2) assess existing SBHCs in order to inform future implementation strategies; and (3) inform how CHCO could implement a new concept for School-Based Resource Centres based on their findings of SBHCs. As well, in the East Aldine Town Centre Design HIA, the East Aldine Management District had developed a master plan for a new town centre, which included a variety of social and community services as well as retail spaces; however, the initial proposal was developed without consideration for health. This HIA was conducted following the development of a draft proposal order to: (1) identify and assess the health impacts of the proposed town centre on health outcomes; (2) forecast revenues generated by the proposal, which could support public services; and, (3) ensure that health was a priority in the final iteration of the town centre design.

In normative architectural practice, architectural services are generally divided among a phased project-delivery framework. The phases of this framework typically include: *Pre-design*, *Schematic Design*, *Design Development*, *Construction Documentation*, *Bidding and Negotiation*, *Construction-Contract Administration*, and *Post-Construction* (see Figure 12.). Fundamental design decisions are made during the Pre-design (e.g. programmatic decisions, spatial relationships, etc.) and Schematic Design (e.g. design approach or concept, formal design characteristics, etc.) phases. At the culmination of Schematic Design, prior to the initiation of Design Development, a preliminary design must first be approved by the client; this a natural break in the phased project-delivery framework when architectural designers shift from design ideation to design refinement. The approved design will then be refined and realized throughout subsequent phases of the project-delivery framework. Implementing design changes becomes progressively more costly and less effective the further along a project is in this phased project-delivery framework (see Figure 13.). Edith Cherry and John Petronis, both practicing architects explain, "the most cost-effective time to make changes is during programming [(Pre-Design)]. This phase of a project is the best time for interested parties to influence the outcome of a project" (Cherry & Petronis, 2016a). As well, the assessment of social impact is considered to be optimal during the design stage of technology, "during the design [stage], technologies, and their social consequences, are still malleable whereas during the 'use' [stage], technologies are more or less given and negative social consequences may be harder to avoid or positive effects harder to achieve" (Franssen et al., 2018). As such, the HIA has strong potential to have influence over decision-making in normative architectural practice, and in turn, to promote population health and health equity, if integrated during Pre-design to assess a proposed project plan or to compare alternatives or, Schematic Design to assess a proposed preliminary design or to compare alternatives, prior to design approval.

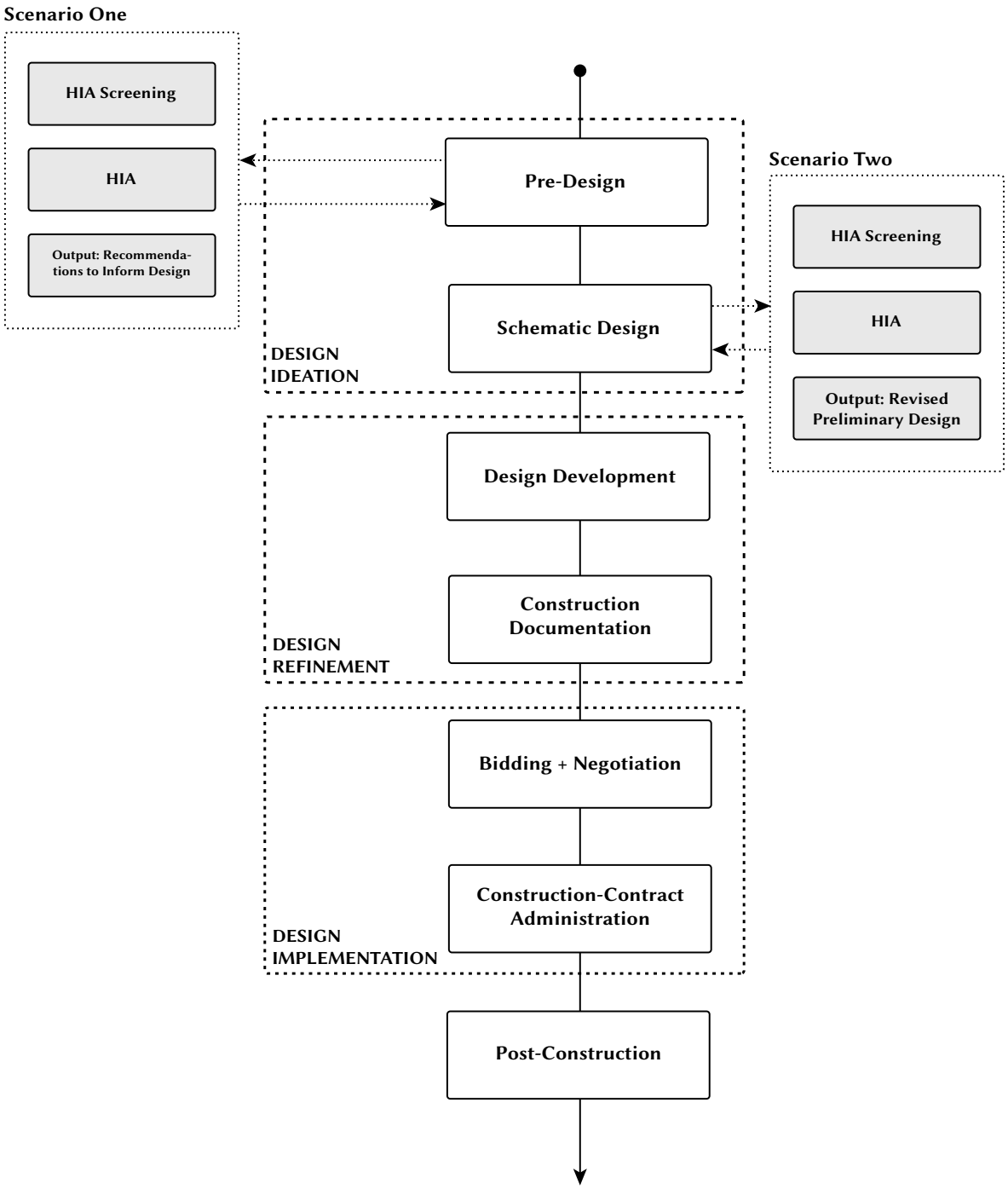


Figure 12. Potential Integration of the HIA in Normative Architectural Practice—this figure illustrates the point at which HIA could be integrated in normative architectural practice in order to have the greatest impact on design decision-making. The HIA has strong potential to have influence over decision-making in normative architectural practice, and in turn, to promote population health and health equity, if integrated during: Pre-design—to assess a proposed project plan or to compare alternatives; or, Schematic Design—to assess a proposed preliminary design or to compare alternatives, prior to design approval. (source: table by author; information sourced from Brown et al., 2009)

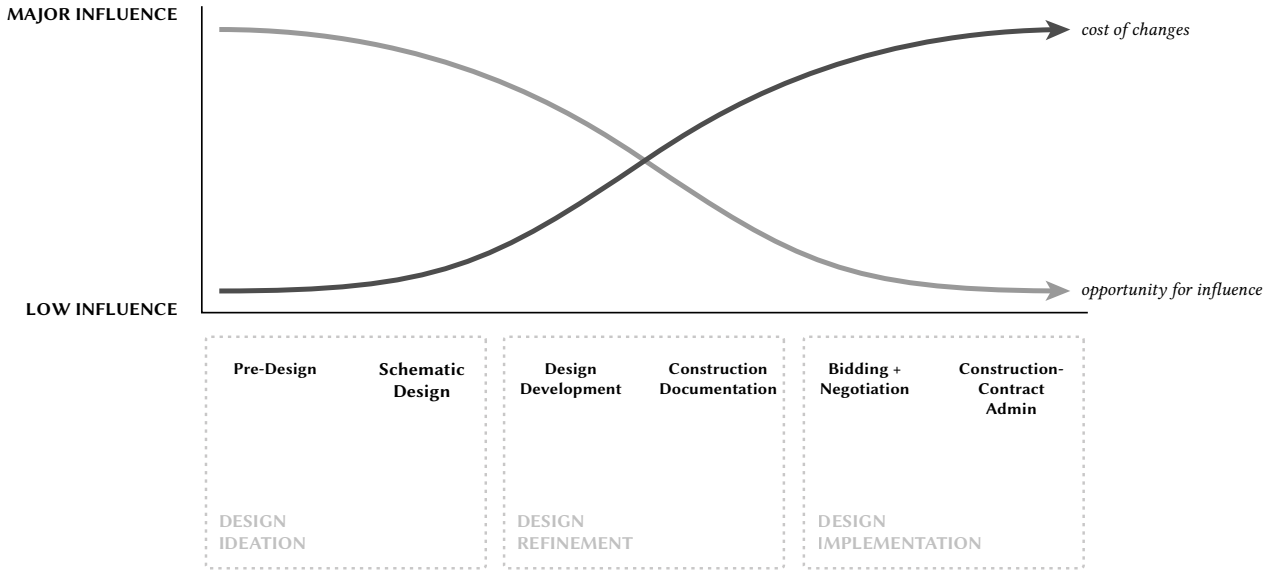


Figure 13. The Cost and Effectiveness Implications of Implementing Design Changes at Various Points Within the Phased Project-Delivery Framework— this figure illustrates impact to cost and effectiveness of implementing design changes throughout an architectural project. Implementing design changes becomes progressively more costly and less effective the further along a project is in this phased project-delivery framework. As such, integration of the HIA in normative architectural practice should come before a preliminary design is approved by a client or property owner. (source: adapted from Cherry & Petronis, 2016b).

There were a number of limitations abstracted from the reports or explicitly noted by appraisers concerning the assessment process; integration of the HIA in normative architectural practice would likely face similar challenges

In the HIAs reviewed:

- appraisers sometimes expressed difficulty establishing direct, causal relationships between the built environment and health.[10]
- recommendations primarily focused on improving a proposal's impact through local changes, limited to each defined Impact Area. However, certain health impacts were also dependent upon factors outside of a proposal's jurisdiction. In cases such as this, appraisers extended the reach of select recommendations.
- the HIA process was resource-intensive, and required commitment from many actors across sectors.
- the HIAs were primarily conducted voluntarily and funded through grant opportunities.
- those involved had to have some knowledge of the connections between health determinants, health equity, and the built environment. This required many actors to broaden their understanding and develop new skills.
- Project Team members did not always possess the expertise or technical skills required.
- official data, in some cases, was:
    - not at the spatial scale or level of detail required;
    - not in a workable format to conduct statistical or spatial analyses (e.g. data had been aggregated); or,
    - based on sample sizes that were too small to provide true representation of community health status.
- in some instances, scientific literature was not readily available to appraisers (e.g. appraisers did not have access to peer-reviewed journals).
- many Project Teams conducted original research, which presented challenges.
- complexity was introduced when engaging stakeholders and affected populations—and required a particular skillset.
- the direct connections between health impacts and the recommendations proposed were not always clear.

[10] Features of the built environment are multivariable and complex, making it hard to identify causation (Carnegie et al., 2016). In addition, studies of the built environmental are typically observational in their design, and as such, not as reliable as other study-types (e.g. randomized controlled trials) when examining cause-effect relationships (Carnegie et al., 2016).

- ongoing monitoring activities were to be supported by local governmental staff, academic partners, community partner organizations, regional authorities, or private property owners.

However, many of these limitations could be overcome in normative architectural practice by committing, for example, to:

- up-skilling (e.g. understanding of the scientific method, critical appraisal, connections between health and the built environment, community engagement, etc.);
- rigorously and transparently documenting decision-making processes, and disseminating results to the design community;
- developing intersectoral partnerships;
- developing partnerships with academic institutions;
- educating clients and the public alike about the impacts of architectural design interventions on health;[11] and,
- identifying barriers to or facilitators for the implementation of the HIA in normative architectural practice (i.e. individual-, organizational-, and systems-level barriers/facilitators).

> Integration of the HIA in normative architectural practice could facilitate a paradigm shift in architectural practice: challenging previous approaches and assumptions in architectural decision-making with a fundamental shift in thinking from that of market justice to social justice

Public health practice is rooted in the concept of *social justice* (Lee & Zarowsky, 2015; Turnock, 1997). A social justice approach asserts that, "significant factors within society impede the fair distribution of benefits and burdens. Examples of such impediments include social class distinctions, heredity, racism, and [ethnicism]. Collective action … is necessary to neutralize or overcome those impediments" (Turnock, 1997, p. 15). The foundational principles of the HIA—democracy, equity, sustainable development, ethical use of evidence, and comprehensive approach to health—reflect the values of social justice in public health and necessitate certain actions and inputs throughout decision-making processes in order to develop appropriate recommendations:

- **actions**, including:
    - consensus-based decision-making;

[11] According to the Canadian Handbook of Practice, it must be assumed that client is not knowledgeable about architecture or architectural services (Brown et al., 2009). As a professional, the architect is obligated to educate her client (Brown et al., 2009).

    - consideration for a proposal's impact on wider determinants of health, including the differential impact across population groups (both general and vulnerable);
    - community engagement;
    - analytical decision-making;
    - standardized and systematic methods of decision-making model;
    - transparent documentation and dissemination of findings; and,
    - development of evidence-informed and action-oriented recommendations that address the needs of both the general population and vulnerable population(s) and intervene across determinant-levels (macro-, meso-, micro).
- **inputs**, including:
    - baseline community health and environmental data;
    - information concerning the contextual circumstances (e.g. political or corporate climate).
    - stakeholder and affected population(s) needs and preferences; and,
    - high-quality, scientific evidence, for a variety of sources—both qualitative and quantitative, etc.

As all HIAs conducted the six phases of the HIA, and generally followed best practices, it can be claimed that appraisers assumed a social justice approach when developing their design interventions.

In normative architectural practice decision-making is arguably motivated by the concept of *market justice,* as is much of the business activity in Western societies. In contrast to social justice, which aims to address inequities through collective action and is typically seen as an add-on to business activity, market justice argues that, while every person is entitled to equality, the impetus is on the individual to fulfill her own needs (Turnock, 1997). As it relates to health, a market justice approach instead:

> emphasizes personal responsibility as the basis for distributing burdens and benefits. Other than respecting the basic rights of others, individuals are responsible primarily for their own actions and are free from collective obligations. Individual rights are highly valued, whereas collective responsibilities are minimized. In terms of health, individuals assume primary responsibility for their own health. There is little expectation that society should act to protect or promote the health of its members beyond addressing risks that cannot by controlled through individual action (Turnock, 1997, p. 15).

As previously discussed, a market justice value-system is reflected in the actions and inputs in architectural decision-making in normative architectural practice today:

- **actions**, including:
    - technocratic decision-making;
    - consideration of the health impact of architectural design limited to environmental determinants (generally) with inattention to the differential impact across population groups (both general and vulnerable);

    - ineffective community engagement—or a lack thereof;
    - solutions-focused decision-making;
    - non-standardized and unsystematic methods of decision-making model;
    - lack of transparency in decision-making processes; and,
    - development of architectural design interventions (i.e. a meso-level intervention) that ultimately respond to the particular demands identified by the client.
- **inputs**, including:
    - project-specific information and evidence of varying qualities;
    - personal preferences of the client (e.g. profitability, competitive advantage, etc.)
    - personal preferences of the architectural designer(s) (e.g. spatial quality, self-expression, innovation, client satisfaction, profitability, etc.); and,
    - land-use zoning, building zoning, and building code requirements, which outline the minimum protections to reduce or eliminate health risks and harmful exposures; designing above these requirements is done voluntarily.

Though the pursuit of social justice through architectural design may seem idealistic at best and at worst naïve, public health interventions intend to be pragmatic; public health practitioners resolve to identify evidence-informed solutions that account for the contextual circumstances surrounding a proposal. Further, HIA best practices suggests that recommendations should focus on health impacts of high importance and high modifiability (Harris et al., 2007; National Collaborating Centre for Healthy Public Policy, 2019); health impacts that meet the following criteria, should be assigned more weight:

- supported by evidence extracted from a variety of sources;
- supported by evidence that is consistent across sources;
- has the potential to impact more than one area of health;
- has actionable health implications, or is highly modifiable;
- impacts a significant portion of the population;
- impacts vulnerable populations, in particular; and,
- significantly impacts the contextual circumstances surrounding the proposal (Harris et al., 2007).

Thus, integration of the HIA in normative architectural practice could enable architectural designers to become more effective champions of public health-related social justice issues, and to contribute to improving population health and health equity through architectural design. As well, findings from this review indicate that the HIA has strong potential to be an effective tool in normative architectural practice. This suggests that aspiring for architectural design in support of social justice is not a misplaced dream, but can, in fact, become a reality through a commitment to changing the practice of architecture.

CHAPTER 6
Integration of the HIA in Normative Architectural Practice

6.1 Introduction

This chapter attempts to illustrate the envisioned potential of integrating the HIA in normative architectural practice. A scenario of potential steps that architectural designers could take to implement the HIA are outlined for a fictional, condominium project. In this illustration, description of each phase of the HIA demonstrates how the tool can enable architectural designers to achieve higher-quality decision outcomes and realize efficiencies in the design ideation process by utilizing a standardized and structured process that is based on the evidence-informed decision-making model typical of public health practice. Additional benefits, beyond health promotion, that can be realized through the integration of the HIA (or similar rigorous and evidence-informed processes) in normative architectural practice, are also enumerated.

6.2 Illustrating the Application of the HIA in a Fictional Condominium Project

Based on HIA best practices and scoping review findings, the HIA could be integrated in normative architectural practice in either one of two ways:

- **Scenario One (S-1) The HIA is applied at the beginning of the design process**—the HIA will be applied to design ideation from design planning through to the development of a preliminary architectural design proposal ('preliminary design proposal'), replacing traditional design ideation methods (i.e. heuristics, exploratory and evaluative thinking); or,

- **Scenario Two (S-2) The HIA is applied upon completion of the preliminary design proposal**—the HIA will be conducted to critically assess the health impact of a preliminary design proposal that was developed utilizing traditional design ideation methods.

In the following example of a hypothetical, architectural project, the HIA was used to assess an existing preliminary design proposal of a condominium (i.e. S-2).

INTEGRATION of the HIA in NORMATIVE ARCHITECTURAL PRACTICE

Fictional Condominium Project Background—to set the scene, it is 2023, the global COVID-19 pandemic has largely been controlled and public life has been regaining momentum. Prior to the pandemic, an architectural firm had been commissioned by a development company to design a condominium, located on the fringes of a Canadian urban centre. A preliminary design had been generated based on the developer's design brief, but it had yet to be approved; the developer put the project on hold in the early months of the outbreak. Work on the project had resumed, and the architectural team, along with the developer, were reconsidering the preliminary design developed pre-COVID-19. The global pandemic had brought issues of public health, systemic inequities, and their connections to the design of the built environment to the forefront of public consciousness. The developer felt that her clientele and the general public expected more from the buildings that impact their neighbourhoods and reassurance that any new development projects will not negatively impact their health. Having recently learned of the HIA through the architectural team, the developer decided to explore the potential value and feasibility of conducting an HIA to identify and mitigate any negative and/or maximize any positive health benefits health impacts associated with the preliminary design proposal. Through negotiations with the municipal and regional governments, the developer and architectural team were able to engage staff from the municipal urban-planning and regional public health departments to collectively assess whether or not an HIA should be conducted in this project. An external HIA expert was also retained by the developer to provide assistance.

Site and Preliminary Design Description—the property on which the project is sited is:

- approximately 1.5 acres—three distinct lots have been approved to be combined as one;
- located on the north-east corner of a main and a side street that leads to a residential neighbourhood, primarily population with post-war, single-family homes; and,
- adjacent to a car dealership, to the south (see Figure 14.).

The preliminary design developed prior to the global pandemic is reminiscent of traditional condominium design: a podium with a point tower seated on top, and includes:

- a 25-storey mixed-use building that features: a two-storey podium and a 23-storey point tower;
- a parkette, east of the building;
- two levels of underground parking;
- 24 surface parking spaces;
- ground-floor podium level featuring street-related retail units;
- second-floor podium level featuring office units;
- podium roof-level featuring indoor and outdoor amenity spaces;
- a compact tower floor-plate that features a central circulation core designed to maximize the usable floor area for the units; and,
- 196 family-oriented dwelling units—specifically: live-work and one- to four-bedroom units (see Figures 15 – 20).

Figure 14. Condominium Project Context—this figure describes the location of the condominium project. The property on which the project was sited is approximately 1.5 acres—three distinct lots have been approved to be combined as one; located on the north-east corner of a main and a side street that leads to a residential neighbourhood, primarily population with post-war, single-family homes; and, adjacent to a car dealership, to the south. (source: figure by author; adapted from a project by Kirkor Architects and Planners, n.d.)

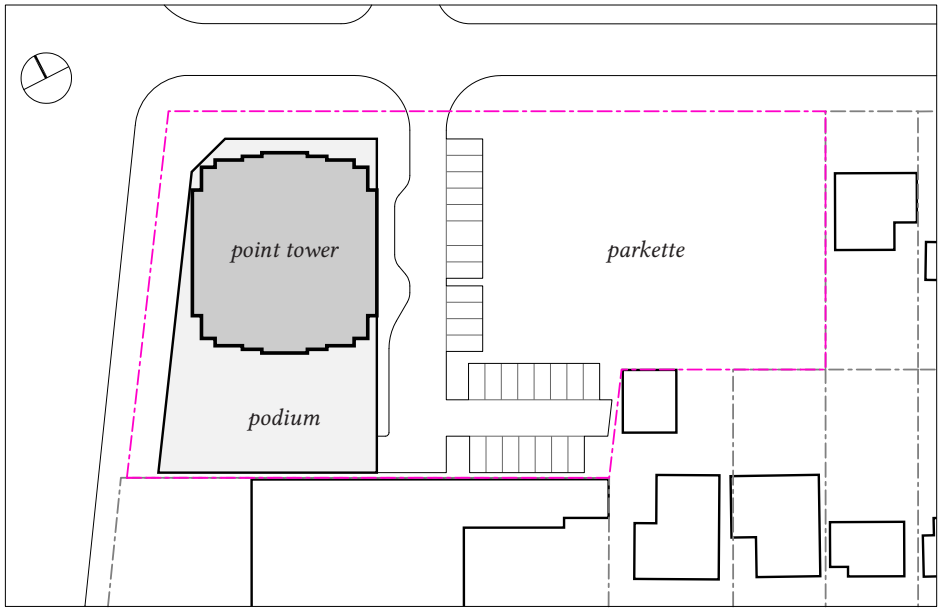


Figure 15. Condominium Project Site Plan—this figure illustrates the condominium project site plan, as developed prior to the global pandemic. The proposed design featured a parkette, east of the building; access to underground parking; ground-floor retail space, coupled with access to the residential areas; and, 24 surface parking spaces. (source: figure by author; adapted from a project by Kirkor Architects and Planners, n.d.)

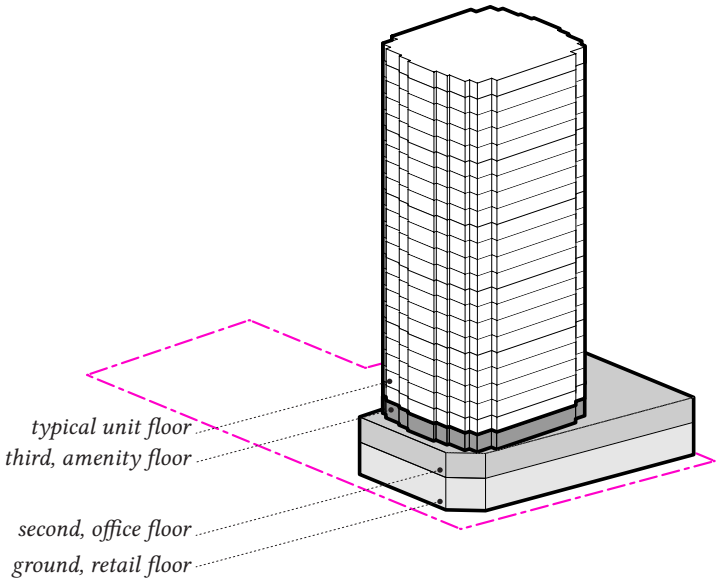


Figure 16. Condominium Project Massing—this figure illustrates the condominium project's massing, as developed prior to the global pandemic. The design is reminiscent of traditional condominium design: a podium with a point tower seated on top. The design features a 25-storey mixed-use building with a two-storey podium and a 23-storey point tower. (source: figure by author; adapted from a project by Kirkor Architects and Planners, n.d.)

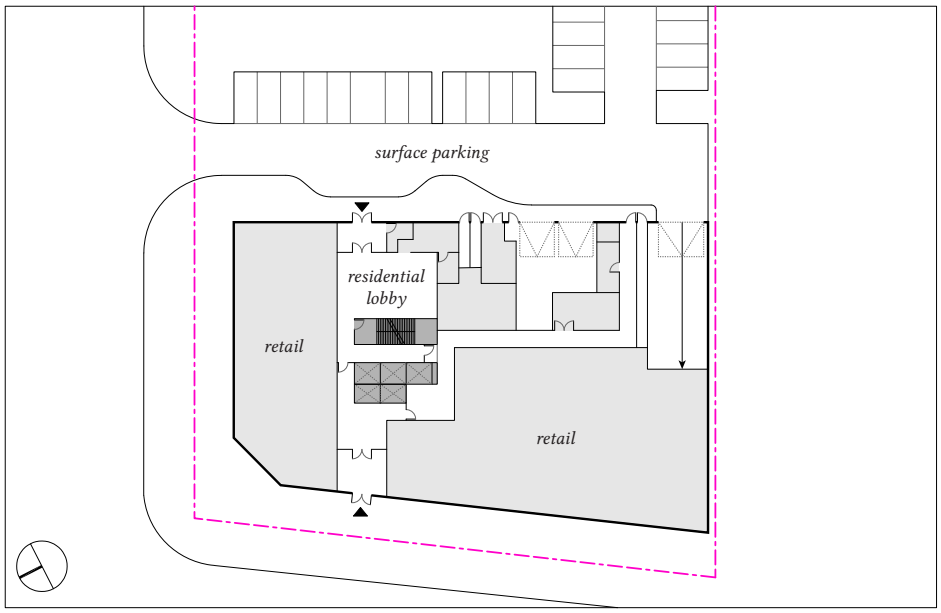


Figure 17. Condominium Project Podium Plan: Ground, Retail Floor—this figure illustrates the schematic layout of the condominium project's ground floor, as developed prior to the global pandemic. The plan features retail space, residential access, services spaces, and access to the underground parking. (source: figure by author; adapted from a project by Kirkor Architects and Planners, n.d.)

Figure 18. Condominium Project Podium Plan: Second, Office Floor—this figure illustrates the schematic layout of the condominium project's second floor, as developed prior to the global pandemic. The plan primarily features office space. (source: figure by author; adapted from a project by Kirkor Architects and Planners, n.d.)

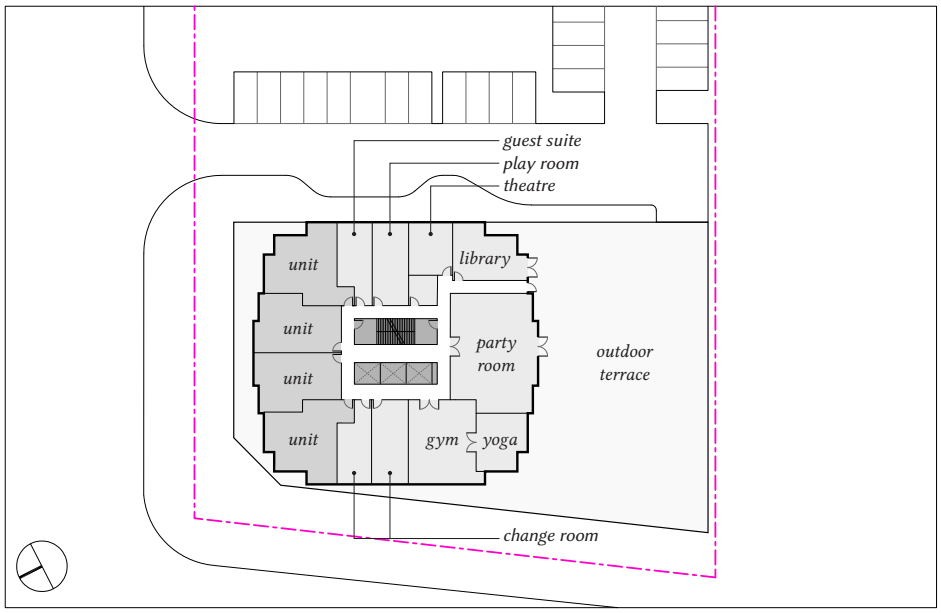


Figure 19. Condominium Project Podium Plan: Roof, Amenity Floor—this figure illustrates the schematic layout of the condominium project's podium roof level (the third floor), as developed prior to the global pandemic. The plan features both indoor and outdoor amenity areas for the building residents. (source: figure by author; adapted from a project by Kirkor Architects and Planners, n.d.)

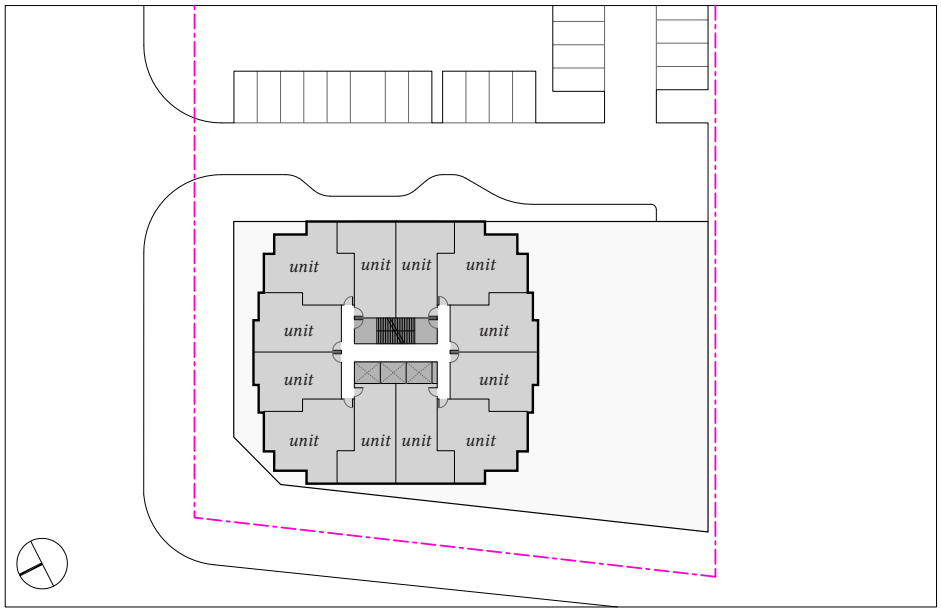


Figure 20. Condominium Project Typical Unit Floor Plan—this figure illustrates the schematic layout of the typical condominium unit floor, as developed prior to the global pandemic. The plan was designed to have a compact floor-plate, and features a central circulation core designed to maximize the usable floor area for the units. 196 family-oriented dwelling units—specifically: live-work and one- to four-bedroom units—are intended for the project. (source: figure by author; adapted from a project by Kirkor Architects and Planners, n.d.)

6.3 Screening Phase

6.3.1 Phase Overview

During the Screening Phase, background information relevant to the architectural project and its connections to health will be reviewed and discussed by an intersectoral team (generally) comprised of:

- project decision-makers;
- practitioners and professionals who share intimate understanding of the project, health, and/or affected populations; and,
- key project stakeholders.

Architectural designers will contribute to this phase with project-specific knowledge and architectural expertise regarding potential design-related recommendations. At the conclusion of the Screening Phase, a collective decision will be established concerning whether or not to:

- (S-1) employ an HIA approach to the design ideation process to develop a preliminary design proposal; or,
- (S-2) proceed with a full HIA to assess a preliminary design proposal that was developed utilizing traditional design ideation methods.

6.3.2 Additional Benefits of Integrating the HIA in Normative Architectural Practice

The Screening Phase can enable architectural designers to:

1. identify the design decision problem; and,
2. assess the value and feasibility of employing a standardized and structured design ideation process.

Higher-quality decisions are achieved and/or efficiencies are realized during this phase by:

- discussing potential impact with individuals knowledgeable about health determinants—to explore the plausible connections between architectural design and health.
- working across sectors to examine the decision-problem from a multitude of perspectives, or 'frames'—to clearly identify a thoughtful and rich design decision-problem.
- considering the magnitude of an architectural project's potential (health) impact relative to the project's contextual circumstances (e.g. project-delivery timelines, budgets, available expertise, political capital, support from the project proponent, etc.)—to assess the value and feasibility of either employing an HIA approach (i.e. S-1) or conducting a full HIA (i.e. S-2)

INTEGRATION of the HIA in NORMATIVE ARCHITECTURAL PRACTICE: SCREENING PHASE

A formal 'screening' meeting was convened and guided by the HIA expert to establish whether it was worthwhile and feasible to proceed in conducting a full assessment of the preliminary architectural design proposal.

Participants included:

- the developer and (senior members of) architectural team;
- municipal urban-planning and regional public health department staff;
- public officials; and,
- representatives from local community organizations.

The background information reviewed included:

- health, demographic, and environmental data of the population(s) potentially affected by the project;
- summary of the project's objectives, priorities, and potential health impact(s);
- summary of the project's design iterations thus far, including justification for the preliminary architectural design proposal; and,
- decision-making timelines.

The HIA was deemed to be a worthwhile pursuit for a number of reasons, such as:

- the project could have had direct impact on a number of health determinants, including: *housing type*, *availability and quality*; *access to public and private services*; *development of strong social support networks; neighbourhood aesthetics and livability*; *access to greenspace*; *residential segregation*; and, *engagement in physical activity*.
- development of the preliminary architectural design proposal was at a stage when impactful changes could still be made without high cost implications.

- the project was situated along a corridor identified for intensification in the municipality's 'Secondary Plan'; the intensification process was still at an early stage and, as such, the group agreed that the project had potential to greatly influence future development in the area;
- the assessment process will enable local residents to provide meaningful contextual information and confront any assumptions that the developer and architectural team may have had when developing the initial design; and,
- the resources necessary to conduct the assessment were available:
    - the developer agreed to fund and facilitate: the architectural team, Steering Committee meetings, and external consultants as necessary.
    - the regional government agreed to provide public health staff support and, the municipal government, urban-planning staff support; both governments noted the opportunity to: **(1)** strengthen the working relationships between the public health and urban-planning departments and between the local governments and private sector; **(2)** build internal HIA capacity; and, **(3)** support the private sector in health promotion.

6.4 Scoping Phase

6.4.1 Phase Overview

Through consensus, the scope of the architectural project (i.e. S-1) or HIA (i.e. S-2) will be determined; work plans for each subsequent phase will be outlined; and, Terms of Reference—specifying the content of the architectural project (i.e. S-1) or HIA (i.e. S-2), the frameworks for its execution, and the expectations for all those involved—will be drafted. Architectural designers will contribute to this phase with project-specific knowledge and architectural expertise. At the conclusion of the Scoping Phase, those involved will have an understanding of:

- the scope of the architectural project (i.e. S-1) or HIA (i.e. S-2);
- their role(s) and responsibilities;
- the methods to be used throughout; and,
- how resources will be allocated during each phase.

6.4.2 Additional Benefits of Integrating the HIA in Normative Architectural Practice

The Scoping Phase can enable architectural designers to:

1. unpack complex, societal problems;
2. define the limits of an architectural design project; and,
3. plan the design ideation process.

Higher-quality decisions are achieved and/or efficiencies are realized during this phase by:

- defining scope parameters (e.g. spatial, temporal, and demographic scopes and (health) impacts to be assessed)—to address complex, societal problems as though they were discrete architectural projects.
- developing work plans for each step—to plan the design ideation process (i.e. S-1) or assessment (i.e. S-2) and to allocate responsibilities and resources in advance.
- developing Terms of Reference—to ensure that all assumptions are clarified and that protocols required to resolve future disputes are outlined in advance.

INTEGRATION of the HIA in NORMATIVE ARCHITECTURAL PRACTICE: SCOPING PHASE

A formal 'scoping' meeting was convened and guided by the HIA expert to establish the limits of the assessment, work plans for each subsequent phase, individual roles and responsibilities, timelines, allocation of resources throughout, and Terms of Reference.

Participants included those involved in the Screening Phase and:

- the president of the ratepayer's association who presided over the neighbourhood in which the project was situated;
- local residents who were engaged by a community partner organization; and,
- academics from the School of Public Health at the local university.

The group identified the following:

- **Project Team**—two regional public health department staff, one of whom was appointed to act as the HIA lead with external support from the HIA expert; two municipal urban-planning department staff; and two senior members of the architectural team, who would enlist additional architectural support from their firm as needed.
- **Steering Committee**—the developer, municipal officials, the regional medical officer of health, academics from the local School of Public Health, and local residents.

The original scope of the architectural design project was expanded to include:

- **Temporal Scope**—consideration of potential health impact(s) associated with the Design and Operation stages of this building's lifecycle; the group agreed that these stages could both have significant influence on short- and long-term health outcomes of building stakeholders and end-users and neighbourhood stakeholders, including local residents.
- **Spatial Scope**—consideration of potential health impact(s) at

the human-, building- and neighbourhood-scales, specifically:
    - human- and building-scales—public and communal areas within the building, such as the building's podium, amenities, and circulation spaces, and the building's immediate surroundings, such as the parkette and street frontage.
    - neighbourhood-scale—project site as well as the surrounding neighbourhood; a circular boundary, defined by a one-kilometre radius that extended from the project site, was demarcated to define the area of impact under consideration.
- **Demographic Scope**—consideration of the following populations within the defined Impact Area:
    - general populations:
        - general building end-users,
        - local residents,
        - local businesses, etc.
    - vulnerable sub-populations:
        - vulnerable building end-users: children and young families, renters, and older adults, including those on fixed-incomes; and,
        - vulnerable local residents: children and young families, older adults, and low-income individuals and families.
    - The developer intended the project to be family-oriented and to provide opportunities for multi-generational living. As well, there were high numbers of low-income individuals and families with children within in the area, and few housing options to allow persons to age-in-place.
- **health impacts to be assessed**—consideration of the impact of the project's design on physical activity and social cohesion. It was agreed that these health determinants would become the focus of the HIA given the: (1) high-incidence of obesity and overweight within the community; (2) far-reaching and positive influence of strong social support networks on population health and health equity outcomes; and, (3) assessment resources available.

The HIA was to be completed in six months, so that the preliminary design could be revised with sufficient time remaining to develop and refine the project, receive the necessary permits and approvals, and to begin construction as scheduled.

6.5 Assessment Phase

6.5.1 Phase Overview

Assessment Phase activities will be conducted to identify appropriate solutions to mitigate any negative or maximize any positive health impacts associated with:

- (S-1) potential design solutions; or,
- (S-2) the preliminary design proposal.

(Senior members of) the architectural team will collaborate with intersectoral partners, with additional internal or external support (as necessary), to conduct the assessment activities. At the conclusion of this phase, all the assessment findings necessary to generate appropriate recommendations will have been established.

6.5.2 Additional Benefits of Integrating the HIA in Normative Architectural Practice

The Assessment Phase can enable architectural designers to:

1. identify appropriate design solutions in the face of uncertainty.

Higher-quality decisions are achieved and/or efficiencies are realized during this phase by:

- utilizing high-quality, scientific research evidence (in addition to other evidence-types)—to translate the best, current, and *a posteriori* scientific research into practice.
- employing a mixed-methods approach—to ensure that decision-makers have a complete understanding of a project's potential (health) impact and, to validate findings across evidence sources.
- considering the research and contextual information (e.g. client or community preferences, economic impact, etc.) relevant to a project—to critically compare the quality of or trade-offs between design alternatives.
- characterizing the (health) impacts associated with a project based on certain criteria—to ensure that recommendations are prioritized accordingly in the subsequent phase.

INTEGRATION of the HIA in NORMATIVE ARCHITECTURAL PRACTICE: ASSESSMENT PHASE

The Project Team employed a mixed-methods approach to inform future recommendations, using evidence from the following sources:

- official health and environmental data;
- spatial analysis;
- available scientific and grey literature;
- architectural precedent review;
- key informant interviews;
- design analysis; and,
- quantitative forecasting.

The purpose of each of the evidence sources used is described in Table 27.

The Project Team, with additional architectural support:

- developed a community health and environmental profile using official health and environmental data;
- conducted spatial analyses;
- conducted a thorough review of relevant public health, urban-planning, and architectural design literature;
- conducted informal interviews with the staff of a property management company responsible for overseeing the operation of a number of condominiums constructed by the developer;
- developed an online, community-wide survey;
- synthesized findings;
- developed and tested potential evidence-informed design strategies and alternatives;
- discussed findings with the Steering Committee; and,
- characterized the **likelihood** (unlikely vs. very likely), **direction** (positive vs. negative impact), **magnitude** (low vs. high degree of impact), **duration** (short- vs. long-term), **distribution** (disproportionate vs. proportionate harm/benefits between populations) of the health impacts associated with the project and **strength of evidence** supporting each health impact; and,

- prioritized health impacts according to these characterizations, weighting impacts that are of high importance and high modifiability more.

The online, community-wide survey was developed with support from academics at the local School of Public Health; student researchers administered and analysed the survey results. Notice of the survey was communicated to local residents via public officials, existing public health networks, and existing community partner organization networks; paper surveys, accompanied with pre-paid postage, were provided to residents upon request. A health economist was engaged to forecast the health and economic impacts of potential design alternatives that were being explored. A traffic engineer was engaged to assess the feasibility of alternative vehicular routes connecting the side street to the surface and underground parking.

Evidence source	Purpose
official health and environmental data	• to establish and validate the baseline community health and environmental conditions; and, • to verify the appropriateness of decisions made during the Scoping Phase.
spatial analysis	• to establish and validate relationships between health and place; • to verify the appropriateness of decisions made during the Scoping Phase.
scientific and gray literature	• to establish and validate causal relationships between health, features of the built environment, and engagement in physical activity and development of social support networks; • to identify potential design strategies; and, • to verify the appropriateness of decisions made during the Scoping Phase.
architectural precedent review	• to identify potential design strategies.
key informant interviews	• to identify potential barriers to and facilitators for physical activity engagement and development of social support networks in condo-dwellers.
community-wide survey	• to supplement official community health and demographic data; and, • to understand community: o self-reported physical activity levels and behaviours; o perceptions of the design of the built environment and its impact on physical activity levels and behaviours; and, o barriers to and facilitators for physical activity engagement; o self-reported strength of existing social networks; o perceptions of the design of the built environment and its impact on social cohesion; o barriers to and facilitators for the development of social connections.
design analysis	• to ensure that proposed design strategies effectively address health while responding to code, structural, and regulatory restrictions and requirements.
quantitative forecasting	• to understand the health and economic impacts (e.g. profitability versus healthcare savings) of design alternatives.

Table 27. Purpose of Evidence Sources Used—this table identifies the intended purpose of each of the evidence sources used in this HIA. The Project Team utilized a mixed-methods approach, using a variety of evidence-types to inform design decision-making. (source: table by author)

6.6 Recommendations Phase

6.6.1 Phase Overview

Findings from the assessment activities will be used to generate recommendations for:

- (S-1) one or more preliminary design proposal(s); or,
- (S-2) revisions to the preliminary design proposal.

(Senior members of) the architectural team will collaborate with intersectoral partners, with additional internal or external support (as necessary), to generate a draft set of recommendations. Together with the Steering Committee, those involved will refine and/or enhance the recommendations.

6.6.2 Additional Benefits of Integrating the HIA in Normative Architectural Practice

The Recommendations Phase can enable architectural designers to:

1. generate a pragmatic, scientific and contextual evidence-informed architectural proposal capable of withstanding subjective criticism (from the client, regulatory bodies, and/or public); and,
2. generate an architectural proposal that is both relevant and capable of influencing positive (health) outcomes in society.

Higher-quality decisions are achieved and/or efficiencies are realized during this phase by:

- developing pragmatic, evidence-informed recommendations, through consensus, based on high-quality, scientific research evidence and contextual information relevant to the architectural project—to strengthen support for design proposals.
- developing both design and design-support recommendations—to address the holistic impact of an architectural project.

6.7 Reporting Phase

6.7.1 Phase Overview

The decision-making process and resultant recommendations, including their rationale, will be documented and communicated to all those involved in or affected by the architectural project. (Senior members of) the architectural team will collaborate with intersectoral partners, with additional internal or external support (as necessary), to document and communicate the decision-making process and preliminary recommendations. As well, they will provide written responses to any potential public criticisms and revise the recommendations as necessary. As the conclusion of this phase, the architectural client will accept or reject the recommendations. Note: the client should be included throughout as a member of the Steering Committee to ensure recommendations are swiftly accepted. Following acceptance of the recommendations (and any necessary design or re-design work), the architectural team will transition from design ideation to design refinement and implementation (i.e. Design Development, Construction Documentation, Bidding and Negotiation, and Construction-Contract Administration).

6.7.2 Additional Benefits of Integrating the HIA in Normative Architectural Practice

The Reporting Phase can enable architectural designers to:

1. increase support for an architectural proposal; and,
2. provide potential critics with insight into the rationale behind decisions made; this, in turn, can help to increase the value of architectural design in society.

Higher-quality decisions are achieved and/or efficiencies are realized during this phase by:

- proactively soliciting and responding to feedback from those involved in or affected by the architectural design project—to increase their support.
- documenting and reporting on the decision-making process to all those involved in or affected by an architectural design project—to transparently describe the rationale behind decisions made.

INTEGRATION of the HIA in NORMATIVE ARCHITECTURAL PRACTICE: RECOMMENDATIONS PHASE

The Project Team considered the assessment findings and generated a draft set of design and design-support recommendations to:

- mitigate negative and maximize positive health impacts associated with the Design and Operation stages of the project; and,
- ensure that the final iteration of the proposal is most favourable to health (see Table 28. for sample recommendations).

Together with the Steering Committee, they refined the recommendations.

INTEGRATION of the HIA in NORMATIVE ARCHITECTURAL PRACTICE: REPORTING PHASE

The Project Team held a town hall with local residents to present assessment findings and solicit feedback. The Project Team provided written responses to criticisms made by the public, finalized the recommendations, and compiled an HIA report. A digital copy of the final HIA report was posted on an HIA website developed. In addition, a hardcopy was made available at the local City Hall. Public officials agreed to include an announcement about the availability of the report in their bi-weekly, community e-newsletters.

FUNDAMENTAL DESIGN MODIFICATIONS		
Strategy	Recommendation	Justification
Whole Population Benefit	• promote use of the stairs by able-bodied building end-users by reconfiguring the tower's central core such that the proposed scissor stair is separated into two fire stairs, each: o conveniently located; o larger in width and length than building code requirements; and, o aligned to an exterior wall, offering views to the outside.	• the scissor stair that was initially proposed, while spatially efficient, is utilitarian in its design and does not encourage habitual use by building end-users; through separation of the scissor stair, from one to two fire stairs, encouragement of healthy physical activity behaviours is prioritized over profitability. • the literature revealed: o stairs can be designed to encourage their use by building end-users; and, o stairs should be designed to be comfortable and conveniently located. • design analyses revealed that reconfiguring the tower's central core will result in fewer units available to be sold by the developer. However, the quantitative analysis identified that the potential long-term healthcare costs recovered as a result of increased physical activity levels in building end-users, far outweigh the construction premiums and lost revenues in the short-term.
Whole Population Benefit	• the lobby, circulation areas, and amenities spaces should be reconfigured to provide: o varying types of space; o views between spaces; o unobstructed, dignified entryways; and, o structured and unstructured spaces for structured and unstructured activities.	• the literature revealed: o development of social connections particular are best supported when autonomy is encouraged in end-users; autonomy not only promotes self-esteem, but it can also encourage mutual respect among disparate groups; o a variety of spaces, in size and supporting different activity levels can allow building end-users to engage or withdraw from activities as they like; spaces include resting spots, alcoves, seating areas surrounding the main activity space and separate spaces for same-aged peers; o views into and out of spaces provide passive cues between generations and, in turn, help to dissolve any preconceived fears of the other and encourage socialization; and, o spaces with multiple entryways, clear of obstacles, allow end-users to engage in or withdraw from activities as they desire, heightening emotional comfort for building end-users; o structured spaces, such as a gym or an intergenerational kitchen, with structured activities allow for formal interactions between generations and can also stimulate informal interactions surrounding the activity; o unstructured spaces, such as circulation routes, allow for spontaneous informal interactions; o structured spaces within close proximity to one another, that are surrounded by unstructured space, allow greater opportunity for high-quality interaction;

		○ age-segregated spaces located near shared spaces can permit privacy for same-aged peers while simultaneously encouraging interaction.
Whole Population Benefit	• promote healthy eating by ensuring that a full-service grocery store is located at the ground level of the podium.	• the literature revealed that physical activity engagement is supported by the availability of healthy food options. • as well, while not yet designated as a food desert, spatial analysis identified there are few food retail services located nearby; demand healthy food options will inevitably increase with the influx of condo residents.
Whole Population Benefit	• allocate a portion of the proposed ground floor retail space to a de-commercialized, multi-purpose community space—ideally located at the north-east corner of the podium, adjacent to the parkette.	• spatial analyses identified that there exists a lack of accessible community spaces within the area. • in the community-wide survey, young families and low-income residents expressed that there are few indoor spaces for residents to communally gather that are free to access or have admissions fees geared-to-income; as well, outdoor, communal activities are not always feasible in the Canadian climate. • key informants expressed concern that the deposits, as well as the non-refundable cleaning fees, often required to use amenity spaces and/or equipment are cost-prohibitive for many building end-users—particularly for renters, young families, and older adults on fixed incomes. • the literature also revealed that children who live high-rise buildings are more likely to develop behavioural issues as a result of a lack space to run around, play, etc.; opening elements of the building to the local community can generate activity and increase opportunities for informal interactions between building end-users and community members.
Whole Population Benefit	• ensure a variety of outdoor environments are designed that are suitable for different weather conditions (e.g. areas protected from sun or wind, areas that can accommodate a skating rink in winter or splash-pad in summer, etc.)	• the literature has revealed that access to outdoor spaces is associated with increased physical activity engagement. • in the community-wide survey, local community residents suggested that outdoor, communal activities are not always feasible in the Canadian climate.
Targeted Population Benefit	• do not specify a conventional playground to be constructed in the parkette. • instead, design outdoor play areas within the parkette that encourage gross motor play (e.g. tricycle track or climbing mound) and fine motor skills development (e.g. water features, sandbox).	• the literature has revealed that: ○ increased physical activity engagement in children is associated with access to outdoor space; and, ○ children who play in more 'natural' settings have been shown to be more physically fit than those who play on conventional playgrounds.

SECONDARY DESIGN MEASURES		
Strategy	Recommendation	Justification
Whole Population Benefit	• integrate raised speed bumps and paving design to ensure that building end-users can cross safely between the condo building and parkette.	• vehicular access from the side street to the surface and underground parking presents risk of injury to those who wish to access the parkette; children and older adults are especially vulnerable; • the literature revealed that road safety concerns negatively impact engagement in physical activity—especially in children; this was corroborated with the community-wide survey findings; • as well, the literature revealed that crash reduction measures, such as speed bumps and paving design, can reduce incidence and severity of pedestrian-vehicular crashes; and, • despite best efforts, no feasible design alternative to the existing route proposed to access the surface or underground parking was identified; as such, secondary design measures were recommended to reduce the risk of harm to building end-users and local residents.
Whole Population Benefit	• ensure that there are flexible seating options in the building amenities and the parkette.	• the literature revealed that public seating that can be reconfigured: o encourages use of the space; o provides end-users with a sense of agency over their environment; and, o better supports the mobility needs of older adults.
Whole Population and Targeted Population Benefit	• integrate positive signage in the parkette, such as "please do not feed the pigeons" instead of "DO NOT feed the pigeons". • as well, ensure that signs are multi-lingual and easy to read.	• the literature revealed that positive signage has been associated with increased civic trust; and, • the community-wide survey revealed that English was not the primary language spoken in residents' homes.
Targeted Population Benefit	• integrate seating and handrails throughout the circulation spaces to accommodate the physical limitations often experienced by older adults.	• the literature revealed that safety concerns negatively impact engagement in physical activity in older adults; and, • in the community-wide survey, older adults explained that they feel less inclined to be active when they are uncertain about potential risks to their physical safety.
DESIGN-SUPPORT RECOMMENDATIONS		
Recommendation Domain	Recommendation	Justification
Further Research	• further research should be conducted to investigate potential materials (floor coverings, wall coverings, tempered	• the literature revealed that stairs can be designed to encourage their use by building end-users;

	glazing, etc.) and motivational signage to be incorporated in the fire stair design so that the stairs are inviting, comfortable, and playful.	• the literature revealed that stairs should be designed to be comfortable and conveniently located; the proposed scissor stair, while spatially efficient, is utilitarian in its design and does not encourage habitual use by building end-users.
Training or Education Programs	• interactive workshops should be held to educate children and their families on road safety—with particular emphasis on safe access to the condo parkette.	• the literature revealed that road safety concerns negatively impact engagement in physical activity—especially in children; this was corroborated with the community-wide survey findings. • despite best efforts, no feasible design alternative to the existing route proposed to access the surface or underground parking was identified; as such, secondary design measures were recommended to reduce the risk of harm to children and their families in particular.
Policy Development	• specify contractual requirements between future landlord and retailer: utilize a 'Request for Proposal' process to select a grocer for the proposed grocery store who will commit to promoting health by: o offering a full range of healthy food options; and, o designing the space to encourage healthy behaviours: stocking shelves near the cash registers with healthy food options.	• the literature revealed that physical engagement is supported by the availability of healthy food options. • the literature revealed that visual cues and easy access to healthy food options can encourage healthy eating behaviours.
Policy Development	• ensure that condo by-laws, which are typically developed and approved by the condominium corporation, encourage individuality in building end-users and acknowledge the needs and preferences of all residents, including home-owners, renters, low-income individuals, and families with children.	• the literature revealed that: o buildings that encourage socialization should be flexible or customizable; o customizable spaces empower end-users to make modifications as necessary either to support their changing needs over time or to personalize their surroundings according to their preferences. • key informants explained: o that condo-bylaws prohibited individuality by controlling what residents can and cannot do to or in their homes; for example, in an existing condominium, residents are not allowed to ornament their front doors and must only have white window coverings. o while many condominium by-laws are instituted to protect residents from hazards, such as fire and second-hand smoke, there are also many that aim to maintain the uniform 'look and feel' of a building and ultimately bar residents from curating their homes as they like. o renters are particularly vulnerable to the negative impacts of condo by-laws because they are not able to participate in the voting process; renters are not a recognized class in the Condominium Act—voting for

		or against proposed condo by-laws is generally restricted to home-owners.
Development of Partnerships	• develop partnerships between the preferred property management corporation (who will inevitably operate the building), the municipality, the local business improvement association, and the rate-payer's association to: o facilitate implementation, operation, and maintenance of the recommended de-commercialized, multi-purpose community space; o facilitate outdoor community activities events in the parkette or on the surface parking (e.g. farmer's markets, barbeques, etc.)	• assessment findings indicate that there are few indoor community gathering spaces that are free to access or with admission fees geared-to-income. • further, the literature revealed that allocation of physical space for communal gathering alone will not encourage the development of social connections alone; activities and events must also be programmed within the space (e.g. movie nights, intergenerational reading clubs).
Development of Partnerships	• develop a partnership between the preferred property management corporation (who will inevitably operate the building) and the local school board to facilitate a 'walking school bus' program for young children living in the condo.	• the literature revealed that road safety concerns negatively impact engagement in physical activity—especially in children; this was corroborated with the community-wide survey findings. • 'walking school bus' programs—in which a group of children gather at a particular time and place and are led to and from school by a trained volunteer—have been shown to improve road safety and increase physical activity engagement in children.

Table 28. Sample Selection of Recommendations—this table provides examples of recommendations that were generated when the HIA was integrated in normative architectural practice on this condominium project. Multiple strategies, including both design and design-support recommendations, were proposed by the Project Team. In keeping with HIA best practices, the Project Team has provided their justification for each of the proposed recommendations. (source: table by author)

6.8 Evaluation and Monitoring Phase

6.8.1 Phase Overview

During the design ideation process (i.e. S-1) or the assessment of a preliminary design proposal (i.e. S-2), evaluation and monitoring plans will be detailed. That said, depending on the approach to evaluation and monitoring, the activities prescribed could be conducted at any point in an architectural project following the transition from design ideation to design refinement. (Senior members of) the architectural team will contribute to this phase with project-specific knowledge and architectural expertise in order to develop evaluation and monitoring plans alongside intersectoral partners. As well, architectural designers could be involved in evaluation and/or ongoing monitoring activities. Evaluation and monitoring activities will be documented and communicated to all those involved in or affected by the architectural project. Further modifications to the design should be made as necessary (and as feasible) following the construction of the architectural project.

6.8.2 Additional Benefits of Integrating the HIA in Normative Architectural Practice

The Evaluation and Monitoring Phase can enable architectural designers to:

1. critically assess the design decision-making processes, any externalities, and built outcomes;
2. manage unintended decision impacts; and,
3. make modifications, as necessary, following the construction of an architectural project.

Higher-quality decisions are achieved and/or efficiencies are realized during this phase by:

- outlining monitoring plans in advance—to ensure that recommendations are implemented as intended and that unintended (health) impacts are managed appropriately.
- evaluating the decision-making process, externalities, and/or (health) impacts—to improve the quality of future decision-making and to make modifications, as necessary, following the following building construction

INTEGRATION of the HIA in NORMATIVE ARCHITECTURAL PRACTICE: EVALUATION & MONITORING PHASE

The Project Team, with support from the HIA expert:

- developed an Implementation Management Plan, which included descriptions of each recommendation, the timelines and parties responsible for their implementation, as well as the criteria necessary to determine successful implementation; and.
- outlined future evaluation and monitoring activities.

Process evaluations were proposed to assess:

- commitment to HIA best practices;
- the influence of the HIA process on the final condo design; and,
- the experiences with and perceptions of the HIA process by the architectural team, including implementation barriers and facilitators, as well as lessons learned.

An impact evaluation was proposed to assess:

- implementation of design recommendations in the revised design.

Outcome evaluations were proposed to assess changes to community:

- self-reported physical activity levels and behaviours;
- perceptions of the design of the built environment and its impact on physical activity levels and behaviours; and,
- barriers to and facilitators for physical activity engagement;
- self-reported strength of existing social networks;
- perceptions of the design of the built environment and its impact on social cohesion;
- barriers to and facilitators for the development of social connections.

The Project Team, with support from the Steering Committee, committed to conduct and report on the process and impact evaluations following the approval of the revised condo design by the developer. As part of ongoing community health surveillance

efforts, the Public health department staff agreed to collect the necessary data to conduct and report on the outcome evaluations, 18 months following construction. Following construction, the Project Team members co-authored a paper summarizing the HIA methods, findings, final condo design, and lessons learned; it was later submitted to be published in a well-read architectural journal. As well, the Principal architect involved presented the project at a local School of Architecture; public health department staff, at a public health conference; and, urban-planning department staff, at an urban-planning conference. The developer addressed the development community about the HIA process and its potential benefits to industry at the BILD (Building Industry and Land Development Association) awards gala.

Preliminary Outcomes:

The architectural team revised the preliminary design according to the recommendations accepted by the developer. The approved design was later developed and detailed during the remaining phases of the standard architectural project-delivery framework (*Design Development*, *Construction Documentation*, *Bidding and Negotiation*, and *Construction-Contract Administration*). The developer was able to negotiate with the City to increase the height of the building by another level to compensate for some of the units lost by reconfiguring the tower's central core from a scissor stair to two separate fire stairs with views to the outside, designed to encourage physical activity in building end-users. The architectural team was able to build capacity for the HIA. Team members identified their increased confidence in their abilities to systematically gather scientific research and contextual evidence and expressed excitement about the prospect of having a new tool to reconsider architectural design and building. The public health and urban-planning departments involved continued to develop their relationship; together, managers from both departments identified future projects to collaborate on.

Lessons Learned:

Those involved noted that the process was resource-intensive, but could be adapted as needed to suit the resources available. It was concluded that efficiencies would likely be gained if an HIA approach was employed at the start of an architectural project (i.e. S-1), as opposed to assessing the health impact of an existing

preliminary design proposal (i.e. S-2). Further, it was difficult to engage future building end-users directly; until the building is constructed, little can be known about who will ultimately inhabit the building beyond the best guesses of those involved. However, the developer and architectural design team agreed that this can be overcome, to some extent, by routinely conducting Post-Occupancy Evaluations—whether coupled with an HIA or not—in order to learn more about building end-users' experiences with and perceptions of certain building-types. While everyone involved expressed that conducting the HIA was a valuable exercise, they feared that other development companies would not voluntarily conduct HIAs unless incentivized or required to do so through legislation.

CHAPTER 7
Conclusion

7.1 Overview

The HIA of today is a structured, scientific and contextual evidence-informed public health tool that aims to prioritize the public's health in policies, plans, programs, and projects—particularly in those outside of the health sector (Quigley et al., 2006). It has been regularly employed across diverse disciplinary and political settings to examine the population health and/or health equity impacts of a wide-range of decisions, especially including urban- and transportation-planning design decisions. That said, the HIA has yet to be used with any degree of regularity in normative architectural practice to anticipate and evaluate the health impacts of architectural design decisions.

Scientific research has demonstrated that the design of the built environment can negatively contribute to not only 'mortality' (life/death) outcomes in populations, but also to 'morbidity' (overall health and well-being) outcomes. Moreover, the design of the built environment has been shown to enable the inequitable distribution of deleterious health impacts across particularly vulnerable, sub-populations—as compared with the general population. Based on theoretical understandings of the mechanisms through which health is determined, there exists an opportunity for architectural designers to contribute to promoting population health and health equity through architectural design. However, of the values considered within normative architectural practice, public health in aggregate—in particular, the impact of design decisions on building end-user- and community-health and well-being—is generally not at the top of the list, if it is even there at all. Further, existing design decision-making models and tools in normative architectural practice are limited in their ability to address complex public health problems. While architectural designers work to *protect* health by designing buildings such that they do not bring harm to building end-users or the surrounding communities, architectural designers do not generally work to actively *promote* health—unless specifically called for by a client or regulatory body, or unless an individual architect chooses to prioritize health promotion as part of the overall project mission.

Architectural designers are generally not instrumental actors in the overall development of an architectural project. The regulatory bodies who govern the design and construction of buildings and the architectural clients who commission the projects have greater influence, and can work to promote health with more urgency than architectural designers alone. Regulatory bodies can establish and implement frameworks for HIA integration within normative architectural design development processes, and architectural clients can support these efforts by paying architectural designers to complete the work necessary—without additional architectural fees, the work is likely to be unfeasible. Though the task may seem impossible, architectural designers can work to leverage the

little control that they do have through a voluntary shift in practice by educating themselves and their clients, and working to inform legislation.

Despite the limitations of architectural designers' agency, the purpose of this thesis is to assess the potential of integrating the HIA in normative architectural practice in order to promote population health and health equity in design decision-making. The specific research questions (see RQ following) pursued in this thesis include:

- *RQ 1:* **(a)** In what ways could integration of the HIA's more scientific and evidence-informed methodology improve the quality of decision-making in normative architectural practice **in general**? **(b)** Would such integration press normative architectural practice toward a more scientific model of empiricism and away from its more heuristically- and iteratively-informed practical empiricism?

- *RQ 2:* More limited in scope, but more realistic is the question: How could the improved decision-making quality realized by integrating the HIA in normative architectural practice plausibly promote population health and health equity in design decision-making?

A scoping review of seven case study HIAs—all focused on modifying the built environment—was conducted in order to respond to these questions. Though limited by the inclusion of only two building-based projects, the conclusions drawn from this review suggest are summarized below. Additional benefits of integrating the HIA tool in normative architectural practice beyond health promotion are also described.

7.2 Addressing RQ 1: Summary Conclusions

(a) The ways in which integration of the HIA's more scientific and evidence-informed methodology could improve the quality of decision-making in normative architectural practice (i.e. RQ 1 (a)) were identified through the case study scoping review. Findings suggest that integration of the HIA could enable improved decision-making quality in normative architectural practice **in general** by:

- facilitating public participation in the architectural design process;
- enabling greater accountability for decision-making and the impact of design outcomes on society; and,
- enabling use of a more science-based, analytical decision-making model to inform the best course of action to take to address complex, societal problems, such as population health and health equity, in the face of uncertainty.

Improved decision-making quality in normative architectural practice can increase the likelihood of high-quality decision outcomes and, in turn, increase the inherent potential of architectural design to have positive impact on society

at-large, and offer expanded opportunities for the profession and practice of architecture.

(b) Based on conceptual understandings of the scientific and contextual evidence-informed approach of the HIA, as well as evidence-informed approaches in general, utilization of an evidence-informed approach to design in normative architectural practice is more likely to complement existing heuristically- and iteratively-informed approaches than a purely evidence-based approach to design. However, an evidence-informed approach to design is also likely to necessitate improvements to the level of rigour and transparency with which practical knowledge is both derived and applied in normative architectural practice today. Implementation of an evidence-informed approach to design, in situ, in normative architecture would likely provide more realistic insight into the potential implications of such an approach.

7.3 Addressing RQ 2: Summary Conclusions

The ways in which improved decision-making quality realized by integrating the HIA in normative architectural practice could plausibly promote population health and health equity in design decision-making (i.e. RQ 2) were also identified through the scoping review. Findings suggest that integration of the HIA in normative architectural practice could enable population health and health equity promotion in design decision-making and, in turn, architectural design, by:

- enabling use of a more science-based, analytical decision-making model to inform the best course of action to take to address population health and health equity;
- facilitating the consideration of the impact of architectural design on the wider determinants of health;
- facilitating the consideration of the health of both those directly and indirectly impacted by architectural design;
- facilitating the consideration of the particular needs and preferences of vulnerable end-users;
- facilitating the development of multiple intervention strategies to address the impact of architectural design on population health and health equity outcomes; and,
- enabling architectural designers to account for health impacts associated with a building throughout its lifecycle—from design through construction, operation, and renovation or demolition.

Architects work through their own heuristically- and iteratively-informed practical empiricism throughout the design decision-making process. As the design of the built environment has influence over population health and health equity outcomes, architectural designers can find use in the more science-based HIA methodology, and move to the forefront of contributing to improving population health and to reducing or eliminating health disparities through architectural design. Given what is known about the mechanism through which

health is determined and the global shift toward urbanization, architectural design interventions have the power to positively impact the health of a great number of people. That said, buy-in is necessary from architectural clients who commission architectural projects and the regulatory bodies who govern the design and construction of buildings.

7.4 Overarching Conclusions

As outlined above, findings from the case study scoping review suggest that the HIA has strong potential to be an effective tool in normative architectural practice given that:

- the HIA has been used to assess the health impacts of design interventions across many design scales and in varied political circumstances;
- the unique position of architectural designers as influential generalists, professionals, and interdisciplinary project managers when an architectural project is underway;
- the optimal timing of the HIA assessment process aligns well with existing project-delivery frameworks used in normative architectural practice.

Implementation of the HIA could conceivably be facilitated, for example, by leveraging legislation governing the profession of architecture, such as through existing licensure policies or the Architects Act, to ensure that both candidates and members of the profession develop capacity for HIA practice and increase their awareness of the connections between the wider determinants of health and the design of the built environment. While there are number of potential limitations that may present challenges in the integration of the HIA in normative architectural practice, many of these limitations could be overcome especially by an active professional body. Ultimately, integration of the HIA in normative architectural practice could facilitate a paradigm shift in architectural practice by challenging previous developer-driven, financially-speculative design approaches and assumptions in architectural decision-making with a fundamental shift in thinking from that of market justice to social justice. Thus, aspiring for architectural design in support of social justice is not a misplaced dream, but can, in fact, become a reality through a commitment to changing the practice of architecture.

7.5 Additional Benefits of Integrating the HIA in Normative Architectural Practice

Beyond health promotion and reducing the burden on the health sector, the HIA could offer additional benefits to architectural designers and the architectural community at-large. The HIA can improve the efficiency and effectiveness of the design ideation process, and improve the likelihood of achieving high-quality

built outcomes. Integration of HIA in normative architectural practice has the potential to:

1. increase the likelihood of achieving higher-quality decision outcomes (i.e. built outcomes) through application of an evidence-informed decision-making model to:
   - apply a more rigorous method of decision-analysis,
   - consider higher-quality information from a variety of evidence-sources;
   - validate design decisions with higher-quality, *a posteriori* scientific evidence;
   - critically assess the design decision-making processes following project implementation, any externalities, and built outcomes.

2. improve the efficiency and effectiveness of the design ideation process through application of a standardized and structured design ideation process to:
   - unpack complex, societal problems, and identify a thoughtful and rich design decision problem;
   - assess the value and feasibility of investing project and office resources into a more deliberate and thorough decision-analysis; and,
   - collaborate across disciplines and sectors.

Ultimately, integration of the HIA in normative architectural practice can improve the quality of architectural services overall, and this, in turn, can lead to improved firm profitability and client satisfaction. Hopefully, it can increase society's value of and appreciation for architectural design and the work of architectural designers as well.

7.6 Recommendations for Moving Forward as a Coherent Discipline

The architectural discipline must work to view itself not strictly as a 'technological designer' or 'advisor', but rather as a 'promoter' tasked with reifying the nature of its work in the pursuit of a better, fairer world. Given that the scientific evidence supporting the associations between health and the design of the built environment is freely available for architectural designers to incorporate into architectural design, designers should not wait on their clients or regulatory bodies to act. It is my personal belief that if we, architectural designers, ignore the scientific evidence, or wait to act until we are asked to by a higher authority, we are effectively complicit in negatively contributing to the complex, societal problems bedeviling our world today.

These problems are in our face, ranging from the global pandemic that will not easily—or maybe never—go away, increasing climate change, and the breakdown of global ecosystems, including economic, social, political, or environmental

systems. The surface effects of these systemic issues result in inequitable outcomes for all, especially in regards to public health and to the availability of affordable housing—the touchstone failure of architecture to do well by people. If life is a struggle now for middle-income individuals and families, it is far worse for the poor, the racialized, and the marginalized populations throughout the world. I concede that my personal expectations of the architectural discipline are high, but I truly believe that we, as architectural designers, have an obligation to reconsider our practices and to develop coherent disciplinary values and approaches in order to address complex, societal problems, such as improving population health and health equity outcomes for all.

Relative to other disciplines, the architectural discipline generally lacks disciplinary coherence—this is seemingly true of many design disciplines. In order to become more effective members of society, we must work to better establish the *intrinsic* disciplinary values and objectives that underpin our *extrinsic* disciplinary values and objects. It will be impossible to improve the impact and effectiveness of the architectural discipline if we continue to approach architectural design with such diversity between designers, firms, and maybe even educational institutions. Establishing disciplinary coherence does not mean to say that there will be no room for individuality or creative freedom. It means that we, together through rigorous analysis, identify, for example, the threshold between what we, as a discipline, consider to be opinion versus organized knowledge; the fundamental design principles that we, as a discipline, consider to be best suited for contemporary society; or, the ethical obligations that we, as designers, have to contemporary society as a whole.

Individuals within our discipline, such as Italian 'socialist' architect Giancarlo de Carlo, have started to address some of these very issues. However, the architectural discipline—as a whole—has not yet shown, through rigorous academic study, these pursuits to be particularly urgent or necessary; this is evidenced by the relatively recent establishment of Masters programs in architectural education and the general lack of Doctoral programs specific to architecture. There are other specialist (practical or applied) disciplines—such as public health, engineering, law, or medicine—that have generally established better balances between the rigour with which they pursue both intrinsic and extrinsic disciplinary values and objectives, as well as the rigour with which they pursue solutions-focused decision-making. We should assess their successes and failures in order to gauge what a coherent architectural discipline could look like. Giancarlo de Carlo did not build many buildings throughout his lifetime, but his legacy lives on through the ideas he articulated. He has taught us that there is more to being a 'good' Architect than simply designing and constructing buildings.

7.7 The Broader Intent of this Thesis

Though it is by no means perfect, this thesis, wherein I conducted a case study scoping review, in and of itself is intended to demonstrate that the rigour with which scientific study is conducted can complement—as opposed to infringe upon—existing architectural research, which seemingly relies on methods akin to art (or architecture) criticism to generate 'new' knowledge or insights. Case studies are often used in architectural study and to inform practice. The steps that were taken in this thesis in order to make it more 'scientifically' rigorous include:

- identifying a 'knowledge gap';
- conducting an 'a posteriori' investigation;
- contextualizing the research, and anticipating the outcomes and implications of this work;
- explicitly describing and justifying the methods and limitations of the investigation;
- systematically identifying a sample of case studies by developing explicit inclusion/exclusion criteria—so as to not impart my own biases in the case study selection process; and,
- supporting the conclusions drawn from the investigation with reference to the existing literature.

I concede that 'further research is required' to validate the impact and effectiveness of the HIA as a health promotional tool in normative architectural practice, but there is still value in this thesis. A transparent and systematic approach to research enables the researcher to minimize her bias and to have a more complete understanding of the topic of study, and allows others to more easily evaluate the validity of her claims and build upon her research. Knowledge builds upon other knowledge. Improving the rigour of our research can only stand to strengthen the validity of our existing architectural theories and empirical evidence.

7.8 A Business Case for Improving Disciplinary Coherence and Rigour

If I have not yet been able to convince you, the reader, of the importance of working to improve the coherence of the architectural discipline or the rigour with which design decisions are made, then I offer you my best business case: In order to establish their sustained footholds in the marketplace and minimize their exposure to risk, businesses will diversify—expand their services, products, or what have you. Architecture designers are actors, including business owners, within the marketplace through their provision of architectural services. At the moment, in normative architectural practice, architectural designers design buildings, public spaces, installations, objects, and more—and they do these things very well—but *design* (and the management of its realization) is generally all that they do. Anecdotally, architectural clients are increasingly asking for greater

reassurance that architectural designers' proposed design solutions will, in fact, result in the outcome(s) they intend. This will require more rigorous and deliberate analysis throughout design decision-making processes and thereafter. As a result of the global pandemic, I anticipate that the demand for this type of analysis will only increase; the public, too, will want reassurance.

More academically rigorous disciplines—such as computer science or engineering—are beginning to usurp the architectural design space; there are, for example, a growing number of technology companies and researchers that are utilizing data and artificial intelligence to automate building design. Architectural designers know that there is more to architectural design than simply developing a structurally sound and functional building. Their real expertise is in endowing a building with a soul. Without the rigorous methods or tools in normative architectural practice necessary to provide clients with the answers they are after, clients will inevitably defer to those who can and seek architectural services elsewhere; buildings, designed by any other discipline, will likely become devoid of character.

I think it would be naïve to assume that the professional protections that architectural designers have today will prevent this from happening. These regulations can easily be changed, especially when architectural designers are not known to ask for what they deserve. Architectural design fees are very low relative to a developers' profits. As well, architectural designers often work extraordinary amounts of unpaid overtime. By improving disciplinary coherence and rigour, architectural designers could diversify their services and begin to compete with the other disciplines that are patiently biding their time as the marketplace sorts itself out. They could also demonstrate, more rigorously, the value of their work in society. I have no doubts that as architectural designers, we are all capable of the work necessary to establish disciplinary coherence and rigour—we just have to be willing to put in the effort.

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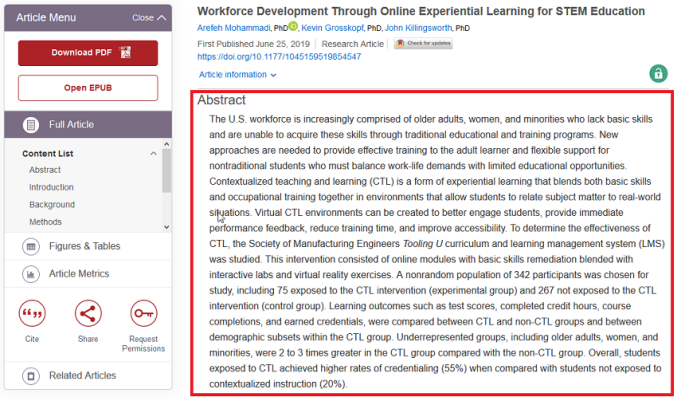

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APPENDIX A

HIA Best Practices

This appendix chapter is intended to be descriptive; to provide readers with the foundation necessary to understand the HIA methodology and best practices.

A.1 Screening Phase

Purpose:

The Screening Phase allows appraisers to systematically consider whether:

- a proposal has the ability to influence health;
- conducting a Health Impact Assessment (HIA) would add value to a proposal; or,
- an HIA would be feasible given a proposal's contextual circumstances (Bhatia, 2011; Birley, 2011; Harris et al., 2007), such as the political climate or availability and reliability of evidence.

In some instances, another assessment tool, such as an Environmental Impact Assessment (EIA) or Social Impact Assessment, may be better suited to addressing the concerns of a proposal (Harris et al., 2007). There are a number of instances when an HIA may be useful:

- when there is significant scientific evidence, but a lack of support from the public, stakeholders, or decision-makers—an HIA can illustrate the health impacts of a proposal (Bhatia, 2011);
- when health impacts are unequally distributed across populations, avoidable, or unjust—an HIA can improve a proposal by better balancing health disparities (Bhatia, 2011); Harris and colleagues suggest (2007) that an Equity-Focused HIA be conducted if equity concerns are fundamental to the proposal; or,
- when the health impact of a proposal is uncertain or controversial (Bhatia, 2011).

Screening ensures that often limited resources are suitably allocated (Harris et al., 2007). At the conclusion of this phase, an informed decision whether or not to proceed with a full HIA should be made.

Actors Involved:

Decisions made during the Screening Phase should be established through a consensus-based approach (Harris et al, 2007). Suggested participants include:

- decision-makers who are familiar with the proposal itself, informed of the relevant decision-making processes and structures, and who can influence proposal outcomes (Bhatia, 2011; Harris et al., 2007; National Collaborating Centre for Healthy Public Policy [NCCHPP], 2019);
- the proposal proponent (if not the decision-maker) (Harris et al., 2007);
- representatives of the population(s) affected by the proposal; and,
- key stakeholders, such as community organizations or local businesses (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019); and,
- key informants who are knowledgeable about health, the proposal context (including the community impacted) as well as local health characteristics (Birley, 2011; Harris et al., 2007).

Birley (2011) asserts that the individuals involved in the Screening Phase should possess certain combined skillsets. In particular, he recommends that the screening process be facilitated by a health professional who has been educated in HIA practice and has comprehensive understanding of the determinants of health. Other participants should, at a minimum, have knowledge of the activities involved in conducting an HIA; however, these individuals may not necessarily come from a health background (Birley, 2011).

Activities Involved:

There are three steps involved in the Screening Phase: Pre-Screening, Screening, and Reporting Recommendations. Activities involved in these steps include:

- collecting, organizing, and reviewing pertinent background information concerning the proposal;
- developing screening criteria, or selecting and adapting an existing screening tool;
- assessing the feasibility and value of conducting an HIA;
- establishing whether or not to proceed with a full HIA; and,
- notifying those involved in or impacted by the proposal of the final decision.

Pre-Screening:

During Pre-Screening, the particulars of the proposal are clarified. Pertinent background information is collected and organized, which may contain a basic overview of:

- health, demographic, and environmental data of the affected population(s);
- summary of the proposal's objectives, priorities, and potential health impact(s); and,
- decision-making timelines.

As well, appraisers will either develop appropriate screening criteria or select an existing screening tool.

Screening criteria specify guidelines that are used to assess the potential value of conducting an HIA. For other impact assessments, such as the EIA, screening criteria are mandated (Birley, 2011). Currently, no formal HIA screening criteria exist (Birley, 2011). HIA guidance suggests several factors to be considered when evaluating a proposal, including:

- significance (scale and degree) of the proposal's impact on health and the affected population(s) (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019);
- distribution of health impact(s) between sub-populations: whether there is differential (or unequal) distribution (Bhatia, 2011; Harris et al., 2007);
- decision-maker's readiness to make changes (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019);
- timeliness of the HIA: whether or not there is sufficient time within the decision-making process to influence outcomes (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019);
- availability and quality of health evidence to thoroughly assess potential health impact(s) and develop thoughtful recommendations (Harris et al., 2007);
- access to resources and the capacity of those involved to support assessment process (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019);
- ability to manage the health impact(s) of the proposal if an HIA is not conducted (Bhatia, 2011);
- context: whether controversy or concerns exist surrounding the potential health impacts (Bhatia, 2011);
- regulatory requirements (Bhatia, 2011); and,
- the value-added achieved through conducting an HIA (NCCHPP, 2019); for example, an HIA could enable local residents to provide meaningful contextual information to support decisions made surrounding implementation of a proposal, or to confront any assumptions that decision-makers may have had.

There are a number of HIA screening tools available to assist appraisers with systematically assessing screening criteria. One such tool is the Screening Tool for Health Impact Assessment (see Figure 21.). This tool elicits hypotheses concerning potential positive, negative, intended, or unintended health impacts—as well as issues of health equity across populations—associated with the proposal. The tool also has a 'checklist' component, which enumerates many of the important factors related to the decision to undertake an assessment. The checklist presents a series of yes- or no-response questions, which are pre-assigned to one of two positions: for or against conducting an HIA. By tallying the number of responses in support of each position, users will be provided with an approximate indication of whether or not to proceed with a full HIA. Screening tools, however, do not suit all scenarios perfectly, and should be modified to satisfy the nature and objectives of the HIA (NCCHPP, 2019).

Screening:

A meeting should be held to review the background information gathered during Pre-Screening, and to consider the feasibility and value of conducting an HIA (Harris et al., 2007). An HIA may not be warranted:

- when a proposal's connections to health are limited or weak (Harris et al., 2007);
- when existing regulations are in place to protect health; or,
- when health is already being considered as part of another assessment (Bhatia, 2011).

As well, if the timeline of the decision-making process does not allow for changes to be made to a proposal, it may be unwise to allocate limited resources toward conducting an HIA (Harris et al., 2007). In cases such as this, an HIA can still be worthwhile when used as an advocacy tool to promote future health and well-being (Harris et al., 2007). Conducting a full, in-depth assessment may not be necessary if an HIA with shared characteristics and similar contexts has already been completed and the health impacts, thoroughly assessed (Harris et al., 2007). Instead, those involved can suggest changes to the proposal based on recommendations made in the completed HIA (Harris et al., 2007). The screening meeting should result in a collective decision, recommending next steps.

Reporting Recommendations:

A screening report should be developed to provide justification for the recommendation to proceed or not proceed with an HIA (Bhatia, 2011; Birley, 2011). If a decision is made to proceed, then those impacted by the proposal—including the proponent, decision-makers, key stakeholders, and public officials—should be notified (Bhatia, 2011; Birley, 2011). However, if it is determined that it is not worthwhile to proceed, recommendations can still be made to mitigate any negative and/or maximize any positive health impact(s). Further investigation can also be advised, and plans can be drafted to provide instruction on actions to be taken in the event that health impacts manifest following the implementation of a proposal (Harris et al., 2007).

Screening Tool for Health Impact Assessment

Based on:

- *Screening Tool for Health Impact Assessment* Queensland Health HIA Framework Draft 20 February 2004
- *Seahorse HIA Planning & Report Writing Toolkit* Salim Vohra et al version 4 October 2003, adapted from a tool developed by Erica Ison.
- CHETRE Screening Checklist, HIA Training 2004

1. What is the proposal about?

……

……

……

2. What is the context outlined for the proposal? (eg policy context, history)

……

……

……..

3. Does the proposal concern any of the following determinants?

Lifestyle	Yes/No
Physical environment	Yes/No
Social/economic environment	Yes/No
Capacity of the health system to impact on these determinants	Yes/No
Other, please specify …….	Yes/No

4. What are the assumptions embedded in or underpinning the proposal?

……
……
……

5. Why does this proposal have potential to impact on health?

……
……
……

What are the:

Potential positive impacts

……
……
……

Potential negative impacts

……
……
……

Intended consequences

……
……
……

Possible unintended consequences

……
……
……

6. Describe any information which identifies the nature and extent of the impacts on health for this type of proposal

……

……

……..…..

7. List the groups most likely to be affected by this proposal

……

……

……..

8. What are some of the potential equity issues?

Desirable

……

……

……..……

……..…

Undesirable

……

……

……

……

9. Checklist

Answers favouring doing a HIA	To your knowledge	Answers favouring not doing a HIA
	Health impacts	
Yes / not sure Yes / not sure	Does the initiative affect health directly? Does the initiative affect health indirectly?	No No
Yes / not sure	Are there any potentially serious negative health impacts that you currently know of?	No
Yes / not sure	Is further investigation necessary because more information is required on the potential health impacts?	No
No	Are the potential health impacts well known and is it straightforward to suggest effective ways in which beneficial effects are maximised and harmful effects minimised?	Yes
No	Are the potential health impacts identified judged to be minor?	Yes
	Community	
Yes / not sure	Is the population affected by the initiative large?	No
Yes / not sure	Are there any socially excluded, vulnerable, disadvantaged groups likely to be affected?	No
Yes / not sure	Are there any community concerns about any potential health impacts?	No
	Initiative	
Yes / not sure	Is the size of the initiative large?	No
Yes / not sure	Is the cost of the initiative high?	No
Yes / not sure	Is the nature and extent of the disruption to the affected population likely to be major?	No
	Organisation	
Yes	Is the initiative a high priority/important for the organisation/partnership?	No
Yes	Is there potential to change the proposal?	No
For =	**TOTAL**	Against =

Checklist continued

Health Impact Statement	Type of HIA	Comprehensive
Yes	Is there only limited time in which to conduct the HIA?	No
Yes	Is there only limited opportunity to influence the decision?	No
Yes	Is the timeframe for the decision-making process set by external factors beyond your control?	No
Yes	Are there only very limited resources available to conduct the HIA?	No

External	Assessors	Internal
No	Do personnel in the organisation or partnership have the necessary skills and expertise to conduct the HIA?	Yes
No	Do personnel in the organisation or partnership have the time to conduct the HIA?	Yes

10. Is a HIA appropriate? Yes/No

Why or why not?

……

……

……

……

……

If yes, what type and how?

……..……..

……..…

Figure 21. Screening Tool for HIA—this figure collection illustrates a screening tool developed for HIA practice to assist decision-makers in assessing the value and feasibility of conducting an HIA. (source: Stapleton & Cheney, 2004)

A.2 Scoping Phase

Purpose:

During the Scoping Phase, appraisers will define the limits of the proposal (in other words: what is to be included and excluded from investigation) (Harris et al., 2007). Work plans for each phase of the HIA will be drafted to guide all activities involved in the assessment process. Hypotheses concerning the connections between the proposal and health will be further detailed and preliminarily validated. Additionally, health impacts to be assessed, as well as related health determinants to be addressed, will be selected (Harris et al., 2007). The more considered the approach to the HIA, the more likely a successful outcome (Harris et al., 2007); in part because:

- clear benchmarks will have been determined (Harris et al., 2007);
- resources will be allocated more appropriately (NCHHPP, 2019); and,
- time, as well as effort, will be saved in subsequent phases (Harris et al., 2007).

Harris and colleagues describe the Scoping Phase as, "the key step, if not the most important step, in the HIA process" (Harris et al., p. 12).

Actors Involved:

Similar to the Screening Phase, the Scoping Phase should involve a broad range of actors, such as the proponent of the proposal, decision-makers, key stakeholders and informants, as well as representatives of affected populations (Bhatia, 2011; Birley, 2011). According to Bhatia (2011), by considering a variety of perspectives, the likelihood of introducing bias into decisions made during the Scoping Phase is reduced. It is desirable for one or more participants involved in Scoping to possess public health expertise. Public health practitioners have comprehensive understanding of the factors influential to health. As well, as continued health surveillance is often the responsibility of public health departments, public health practitioners will have knowledge of the availability of health evidence and the appropriate research methodologies required to investigate the health impact(s) associated with a proposal. Depending on the nature of the proposal under assessment, practitioners from other disciplines may also be required (Bhatia, 2011).

Activities Involved:

Activities conducted in the Scoping Phase include:

- establishing the Project Team and the Steering Committee (Harris et al., 2007);
- establishing values to inform execution of the assessment (Harris et al., 2007);
- developing work plans for each phase (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019);

- developing a preliminary causal model to illustrate plausible connections between the proposal and health (Bhatia, 2011; NCCHPP, 2019);
- choosing the health impact(s) to be assessed (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019); and,
- developing 'Terms of Reference' (Birley, 2011; Harris et al., 2007).

The Scoping Phase results in a clearly defined plan for the execution of the HIA (NCCHPP, 2019).

Establishing a Project Team:

The Project Team will be responsible for managing and executing the activities involved in the HIA, under the supervision of the Steering Committee (Harris et al., 2007). It is imperative that all phases of the HIA be executed by qualified individuals (Freeman, 2019). Table 29. outlines the varying skill-levels of participants involved in HIA practice along with the descriptions of the experience required and potential contributions at each level. Birley (2011) also suggests that appraisers have the following generalist skills:

- project management and negotiation;
- community engagement and collaboration; as well as,
- research experience.

Project Team members can be recruited internally, from one or more of the partners involved in the HIA, and/or externally (Birley, 2011).

Skill-Level	Experience of Individual	HIA Contributions
Awareness	Has attended an introductory HIA course.	Knows what activities are involved in an HIA and what needs to be managed.
Knowledge	Has attended an advanced HIA course; and, Has a basic understanding of health determinants and their influence on health.	Can contribute to an HIA as a Project Team member.
Skilled	Has advanced HIA training; individual has participated in one or more HIAs; and, Comes from a health background.	Can lead an HIA.
Expert	Has substantial experience in HIA; Has an international reputation based on her knowledge of HIA; and, Comes from a health background.	Can improve upon HIA methods and procedures.

Table 29. The Experience Required and Potential Contributions of Individuals Involved in HIA Practice—this table outlines the various skill-levels of potential HIA participants and their respective contributions to the assessment. (source: Birley, 2011).

Establishing a Steering Committee:

Leading HIA guidance recommends that a multi-sectoral, multi-disciplinary Steering Committee be formed at that outset of the Scoping Phase (Birley, 2011; Harris et al., 2007). The Canadian National Collaborating Centre for Healthy Public Policy suggests, however, that this be done earlier, during the Screening Phase (NCHHPP, 2019). Whether the Steering Committee is formally organized in the Screening or Scoping Phase, many of the individuals involved in Screening will remain as part of the formal Steering Committee. Either way, similar to the Project Team, Committee members will maintain their roles throughout the entirety of the HIA process (Harris et al., 2007).

The Steering Committee's primary responsibilities are to oversee the HIA process while controlling for possible bias throughout (Birley, 2011; NCCHPP, 2019). They achieve these objectives by:

- assisting in defining the scope of the assessment;
- providing input on the methodological approach(es) for:
    - engaging community members and other key stakeholders;
    - gathering of existing evidence;
    - data collection and analysis;
    - formulation of recommendations; and,
    - reporting, monitoring and evaluation procedures;
- allocating the budget;
- procuring the consultants to be engaged during the Assessment Phase (Birley, 2011);
- assisting in prioritizing health impact(s) (Harris et al., 2007); and,
- providing input on the recommendations proposed (Birley, 2011).

Steering Committee Membership:

Steering Committee members are integral to facilitating access to relevant information and data, and gaining the necessary support from stakeholders (Birley, 2011). As a collective, the Committee should be knowledgeable about the proposal; the population(s) impacted; the social, economic, and physical determinants of health; and, issues related to health equity (Harris et al., 2007). Ideally, they should have a wealth of technical, practical, and contextual knowledge, as well as strong community and industry connections. They should also possess the skills necessary to effectively engage the local community, analyze policy documents, and negotiate with disparate groups (Harris et al., 2007). The Committee Chair is instrumental in the HIA process, and, as such, should be appointed thoughtfully (NCCHPP, 2019). While it is not essential that the Chair come from a health background, she should have had experience leading diverse committees and be invested in the HIA process (Harris et al., 2007). Forming a Steering Committee with adequate representation is not easily

accomplished (Birley, 2011). The size of the committee itself is an important variable to consider:

- too small, there will be too few members to achieve the diversity required to execute a fair assessment;
- too large, the Committee can become unmanageable (Harris et al., 2007).

Preferably, the Committee should include no more than eight individuals (Harris et al., 2007). In general, the Steering Committee should include—at a minimum—the proponent of the proposal, decision-makers, key stakeholder groups impacted by the proposal, and representatives of the population(s) impacted (NCCHPP, 2019).

Establishing Values:

Once formed, the Steering Committee should work to establish a core set of values to guide their decision-making processes throughout the HIA (Harris et al., 2007). The Committee should consider:

- how they define 'health' and 'health equity';
- the validity and weight of certain evidence types (e.g. scientific literature versus the concerns of local residents), as well as criteria for their evaluation;
- the value of public consultation processes, including the range of stakeholders, informants, and/or local residents to be consulted and how they should be consulted; and,
- establishing a process for formulating recommendations following the assessment of the health impact(s) (Harris et al., 2007).

Defining a clear set of values upfront will provide clarity in times of ambiguity or disagreement, facilitating consensus (Harris et al., 2007).

Developing Work Plans:

The purpose of the work plan is to describe how each phase will be conducted, providing clear direction for the Project Team and Steering Committee (Harris et al., 2007). A thoughtful work plan is critical to the success of the HIA. The more detailed and more well-considered, the more likely the HIA will be successful. The Project Team, together with the Steering Committee, will work to establish these plans, however, they must be endorsed by the Steering Committee. Table 30. outlines the information required for a work plan specific to each phase of the assessment.

Phase of HIA	Information Required
Scoping	Clear identification of all of the components to be assessed. Approach to establishing the health impacts to be assessed.
Assessment	Temporal, Spatial and Demographic Scope parameters established. Level of inquiry to be undertaken; Source(s) of evidence to be used; and, Assessment methodologies to be used, including: public consultation and quantitative forecasting methods, as well as criteria for health characterization and prioritization processes.
Recommendations	Preliminary approach to developing recommendations to improve the proposal.
Reporting	Preliminary approach to documenting and disseminating the final HIA report.
Evaluation and Monitoring	Preliminary approach to evaluating and monitoring.
Common Throughout	Identification of roles and responsibilities for all individuals and parties involved (Project Team, Steering Committee, proponent, decision-makers, consultants retained, stakeholders, etc.). Resources to be used, including budget allocation. Timelines for each phase, including deadlines for deliverables.

Table 30. Information to be Identified in Work Plans—this table outlines the information that should be identified or described in the work plans developed for each phase of the assessment process. (source: table by author; information sourced from Bhatia, 2011; Birley, 2007; Harris et al., 2007; North American HIA Practice Standards Working Group [NAHPSWG], 2009; NCCHPP, 2019).

Developing a Work Plan—Scoping Phase:

The Scoping work plan will inform how the connections to health will be developed and detailed in the latter stage of this phase, including by identifying who will be involved, the approach(es) to be used, and how resources will be allocated (NCCHPP, 2019). As discussed, the health impact(s) of a proposal are loosely established during the Screening Phase. It is during Scoping when the health impact(s) will be detailed further and their connections to the proposal, illustrated in diagrammatic form. The intent of this exercise is to formulate educated hypotheses, which will then be validated using more rigorous methods in the Assessment Phase (NCCHPP, 2019). As such, the Canadian National Collaborating Centre for Healthy Public Policy (NCCHPP) asserts that the predictions made in the Scoping and Screening Phases be based, primarily, on the background knowledge of those involved, and not on any new research conducted (NCCHPP, 2019). Other HIA guidance, however, does not rule out engaging in new research activities (Bhatia, 2011; Birley, 2011; Harris et al., 2007). That said, HIA resources are often limited (Birley, 2011), so it is essential to optimize research efforts. As well, Bhatia (2011) suggests that the Screening and Assessment Phases can be iterative; as new information is learned during the validation processes, the hypotheses and scope can be re-worked as necessary.

Developing a Work Plan—Assessment Phase:

During the Assessment Phase, appraisers will assess, characterize, and prioritize health impact(s) associated with the proposal (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019). Due to the number and complex nature of the tasks involved, the Assessment Phase will require the most planning (NCCHPP, 2019). It is first necessary to define the temporal, spatial, and demographic parameters of the proposal, and to also determine the level of inquiry to be conducted in order to bound what will be assessed (Birley, 2011; NCCHPP, 2019). The sources of evidence to be used and assessment methods should be identified. Decisions made should align with the intent of the HIA, the resources available, and the health impacts and determinants to be studied (NCCHPP, 2011).

Temporal Scope—appraisers may define Temporal Scope in terms of either timescale of impact (NCCHPP, 2019) or stage of project (Birley, 2011). The health impacts associated with a proposal can be experienced at a number of different timescales: short-, medium-, and/or long-term impact(s). Air pollution, for example, in the short-term can temporarily cause pneumonia, bronchitis, irritation of the throat, nose, eyes or skin, and headaches in humans. (National Geographic Society, n.d.). Whereas, the long-term effects of exposure to air pollution can lead to chronic health issues, including heart and respiratory diseases, brain and nerve damage, and impaired kidney function. (National Geographic Society, n.d.). Temporal Scope can also be limited to one or more stages of a proposal's life; health impacts will be different depending on the

stage(s) of focus (Birley, 2011). For example: in a built environment-related project, these stages may include Design, Construction, Operation, and Demolition (or Renovation or Decommissioning).

- **Design**—not only can the health impacts of a proposal's design be scrutinized, but so too can the design process itself. The Design stage of a proposal can last many years and leave local residents in a state of uncertainty, unsure how the proposal will impact their future lives. Existing in a constant state of unpredictability can have tremendous impact on residents' mental health (Birley, 2011).
- **Construction**—Many construction materials are composed of cancer-causing compounds, which can be particularly harmful to the health of the construction workers, those nearby, and the environment (U.S. National Library of Medicine [USNLM], 2019). As well, the interruption of sidewalks or streets is linked to decreased levels of physical activity, and, in turn, increased incidence of overweight and obesity. Particularly in urban centres, construction sites can impede pedestrian traffic and safety for years at a time.
- **Operation**—the construction of a new development will inevitably encourage an influx of people, concentrated in a particular area. If additional resources, such as access to healthcare or healthy food options, have not been allocated in advance to meet the increased demand, existing resources can become strained and residents' (both old and new) health, negatively impacted.
- **Demolition (or Renovation or Decommissioning)—t**earing down a building or decommissioning an infrastructure project, for instance, can release toxins from older materials (e.g. asbestos, formaldehyde, etc.) into the environment (USNLM], 2019). As well, diesel-fueled construction equipment can contribute to increased air pollution (USNLM, 2019).

Spatial Scope—depending on the type of proposal, its impact could be bound in a number of different spatial dimensions, primarily in terms of physical area and scale. The 'Impact Area', or the 'Area of Influence', demarcates the physical space in which impact(s) connected to the proposal will be assessed (Birley, 2011). On a proposal related to the built environment (e.g. infrastructure, community planning, or building project), for example, the Impact Area may be defined as a circle of a certain radius in kilometres extending from the proposal site (Birley, 2011). Assessment of the proposal's potential positive or negative health impact(s) will be limited to everything inside the circle's circumference. Additionally, the scale—or the position within a spatial hierarchy—at which the proposal's impact will be assessed, can also be outlined (NCCHPP, 2019). A proposal can have local to regional to national or even global impact(s).

Demographic Scope—key stakeholders and local residents to be included in data collection and analysis should be identified (Birley, 2011; NCCHPP, 2019). Concerning local residents: distinctions should be made between general and vulnerable populations. Characteristics considered may include identifiers, such as: age, gender, occupation, socio-economic or health status. Table 31. lists potential population sub-groups.

Potential Population Sub-Groups
Age: children, youth, middle-aged adults, or older adults (65+).
Gender: women, men, transgender, gender-fluid, non-binary, or two-spirit. **includes issues related to pregnancy and maternity*
Disability: persons with physical impairments, learning disabilities, sensory impairments, long-term medical conditions, or mental health conditions.
Race and Ethnicity: persons from minority ethnic groups, including: non-English speakers, gypsies or travelers, migrant workers, or Indigenous peoples.
Immigration Status: citizens, permanent residents, refugees, asylum seekers, or undocumented individuals.
Religion and Beliefs: persons of different religions or beliefs, including those without.
Sexual Orientation: lesbian, gay, bisexual, queer, or heterosexual persons.
Marital Status: persons who are married, unmarried, divorced, in a civil partnership, or a common-law relationship.
Looked-After and Accommodated Children and Young People (i.e. children and youth who live with foster carers or in care homes)
Carers: persons caring for another individual, including: those who are paid/unpaid and family members.
Homeless: persons who may be living on the street, temporarily with friends/family, or in short-term accommodations (e.g. hostels).
Offenders: persons who are or have been involved in the criminal justice system, including: offenders either in prison, on probation, or ex-offenders.
Addiction Issues: persons who are addicts, recovering addicts, or with a history of substance abuse.
Employment Status: persons with full- or part-time employment, voluntary, or precarious employment.
Income Level: persons in poverty, with low-income, middle class, upper-middle class, or high-income.
Literacy Level: persons with low literacy.
Environmental Surroundings: persons living in deprived, remote, or rural areas.
Discrimination / Stigma: persons experiencing discrimination.

Note: this list is not exhaustive, and care should be taken to identify all populations relevant to a proposal.

Table 31. Potential Population Sub-Groups—this table describes potential population sub-groups to be considered in an HIA. (source: adapted from Population Groups, n.d.)

Determine Appropriate Level of Inquiry for HIA—HIAs can be executed according to varying levels of depth, from part-time, desk-based activities involving one or two individuals to full-time, multi-modal undertakings supported by a multi-disciplinary group. There are four levels of HIA: Desk-Based, Rapid, Intermediate and Comprehensive (see Figures 22 and 23.). The more in-depth the inquiry, the greater the number of health impacts related to a proposal-will be assessed (Harris et al., 2007).

- **Desk-Based HIA**:
  - largely relies on collecting and analysing existing literature and data, and will provide a broad overview of a proposal's impact(s) on health;
  - is often conducted entirely in-house—as such, external assessors are not outsourced;
  - typically requires two to six weeks worth of work for one person, full-time (Harris et al., 2007).
- **Rapid HIA**:
  - existing literature and data are collected and analyzed by the Project Team (Harris et al., 2007; NCCHPP, 2019).
  - stakeholders, informants, and experts may be consulted to supplement off-the-shelf information (Harris et al., 2007; NCCHPP, 2019).
  - typically requires six to 12 weeks worth of work for one person, full-time (Harris et al., 2007).
- **Intermediate HIA**:
  - requires collection and analysis of existing literature and data.
  - new data is gathered more extensively from the community, stakeholders or key informants (Harris et al., 2007; NCCHPP, 2019).
  - typically requires 12 weeks to six months worth of work for one person, full-time (Harris et al., 2007).
- **Comprehensive HIA**:
  - are the most thorough, and include significant participation from the public and stakeholders alike (NCCHPP, 2019).
  - new data of all types (qualitative and quantitative) are gathered from a variety of sources (Harris et al., 2007).
  - typically requires six to 12 months worth of work for one person, full-time (Harris et al., 2007).

Understandably, Desk-based and Rapid HIAs require fewer resources, while Intermediate and Comprehensive HIAs require significant resources (Harris et al., 2007).

The four levels and their resource and practice implications (adapted from[15]):
Resources and practice guide to each level of depth in HIA

DESK BASED	RAPID	INTERMEDIATE	COMPREHENSIVE
2-6 weeks for one person full time*.	6 to 12 weeks for one person full time.	12 weeks to 6 months for one person full time.	6 to 12 months for one person full time.
Provides a broad overview of potential health impacts.	Provides a more detailed overview of potential health impacts.	Provides a more thorough assessment of potential health impacts, and more detail on specific predicted impacts.	Provides a comprehensive assessment of potential health impacts.
Could be used where time and resources are limited.	Could be used where time and resources are limited.	Requires significant time and resources.	Requires significant time and resources.
Is an 'off the shelf' exercise based on collecting and analysing existing accessible data.	Involves collecting and analysing existing data with limited input from experts and key stakeholders	Involves collecting and analysing existing data as well as gathering new qualitative data from stakeholders and key informants.	Involves collecting and analysing data from multiple sources (qualitative and quantitative)
Activities include accessing off the shelf resources and synthesising and appraising information.	Activities include accessing resources, hosting and supporting meetings, and synthesising and appraising information. If capacity does not exist in-house, consideration should be given to commissioning external assessors.	Activities include accessing resources, hosting and supporting meetings, identifying stakeholders and key informants, gathering and analysing qualitative and quantitative data, and synthesising and appraising information. If capacity does not exist in-house, consideration should be given to commissioning external assessors.	Activities include accessing resources, hosting and supporting meetings, identifying stakeholders and key informants, gathering and analysing qualitative and quantitative data, and synthesising and appraising information. If capacity does not exist in-house, consideration should be given to commissioning external assessors.
LESS IMPACTS →			MORE IMPACTS

*The time involved will vary depending on the number of people actively involved in undertaking HIA tasks. For example a comprehensive assessment may take a team of four people three months to complete.

Figure 22. Level of Inquiry in HIA Practice—this figure outlines the various levels of inquiry typical of HIA practice. As well, it suggests the resources required for each, and the number of health impacts to be considered. (source: Harris et al., 2007)

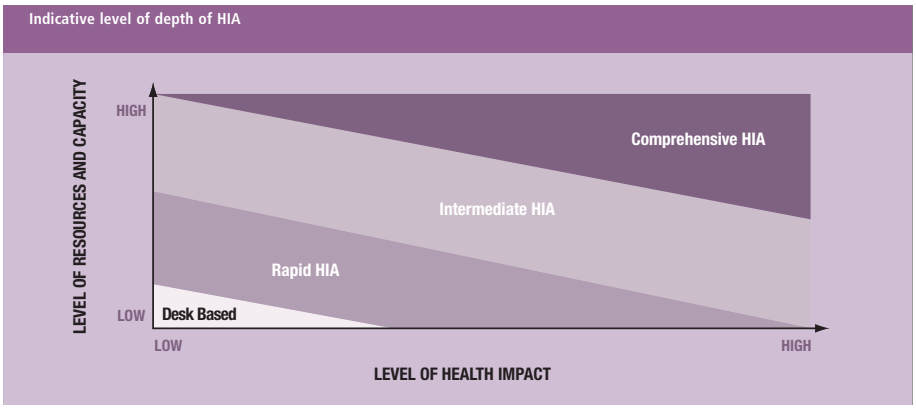

Figure 23. Resources and HIA Capacity as Compared with Health Impact—figure illustrates the levels of resources and HIA capacity of those involved typical of each level of inquiry, as compared with the potential level of health impact. (source: Harris et al., 2007)

The nature of the proposal itself, as well as the contextual circumstances that surround it, influence the appropriate level of depth for conducting the inquiry (see Table 32.) (Harris et al., 2007). Factors that should be considered include:

- scale—or size and relative importance to health—of the proposal;
- magnitude of the impact(s);
- degree of uncertainty of the impact(s);
- degree and complexity of political, professional, and/or public interest;
- dependence of other projects or proposals on the proposal itself, as well as their coordinated timelines;
- time available to influence decision-making;
- internal and external staffing resources, and capacities;
- funding resources; and,
- availability and accessibility of data and research evidence (Harris et al., 2007).

In general, Desk-Based and Rapid HIAs are chosen when resources are limited and there is a significant amount of existing literature and data (Harris et al., 2007). Intermediate and Comprehensive HIAs, on the other hand, are selected when the scale of a proposal and its connections to health are large and complex, substantial gaps exist in the literature, and there are sufficient resources in place (Harris et al., 2007).

Evidence Sources, Methods, and Criteria for Health Characterization and Prioritization—HIA guidance recommends the use of a variety of evidence types and methods for data collection and analysis in order to validate the health impact(s) associated with a proposal. However, the scope of these will depend on the values of the HIA, time and resources available, access to experts, and the availability of evidence in the existing scientific literature (Harris et al., 2007). It may be necessary for the Project Team to conduct original research. Following data collection and analysis, appraisers will characterize and prioritize health impacts assessed. Criteria for characterizing and prioritizing the health impact(s) are identified in the Scoping Phase. Evidence types and methods typical in HIA practice (including public consultation and quantitative forecasting), as well as health characterization and prioritization processes, are described in more detail in subsequent description of the Assessment Phase.

← LESS COMPREHENSIVE the HIA	MORE COMPREHENSIVE the HIA →
Smaller-scale proposal	Larger-scale proposal
Less important to health	More important to health
Smaller magnitude of potential positive and negative health impacts	Greater magnitude of potential positive and negative health impacts
Lesser degree of uncertainty surrounding health impacts	Greater degree of uncertainty surrounding health impacts
Lesser degree and complexity of political, professional, and/or public interest in the proposal	Greater degree and complexity of political, professional, and/or public interest in the proposal
Less urgency	Greater urgency
Connected to other projects or proposals with narrow timeframes	Not connected to other projects or proposals with narrow timeframes
Less time available to influence decision-making	More time available to influence decision-making
Few staff available (internal or external) to participate	High number of staff available (internal or external) to participate
Low staff capacity to conduct HIA	High staff capacity to conduct HIA
External expertise less available and less accessible	External expertise more available and more accessible
Limited funding available	Greater funding available
Limited health data and/or research evidence available and accessible	Extensive health data and/or research evidence available and accessible

Table 32. Factors Influencing the Level of Inquiry in HIA Practice—this table described potential factors influencing whether a less or more comprehensive HIA should be undertaken. The nature of the proposal itself, as well as the contextual circumstances that surround it, influence the appropriate level of depth for conducting the inquiry. (source: table by author; information sourced from Harris et al., 2007)

Developing a Work Plan—Recommendations Phase:

Following analysis of the health impact(s) related to a proposal as well as potential options for its improvement, appraisers will then formulate recommendations to mitigate negative and/or maximize positive health impact(s) associated with the proposal. During the Scoping Phase, is important to for appraisers to establish criteria and factors to be considered, individuals or groups to be involved, and activities to be carried out, such as a public consultation, in advance of recommendation development (NCCHPP, 2019). Development of recommendations is described in more detail in subsequent description of the Recommendations Phase.

Developing a Work Plan—Reporting Phase:

The results of the HIA will be summarized and distributed to all those invested in or impacted by the proposal during the Reporting Phase (Harris et al., 2007). Considerations should include: individual(s) responsible for compilation of the report, opportunities for public review, timing of its release, and form of communication, such as a distribution of a comprehensive report or launch of a media campaign (Bhatia, 2011; NCCHPP, 2019). The preliminary work plan developed during the Scoping Phase should outline the approach that will be undertaken to document and disseminate the final HIA report (NCCHPP, 2019). Note: it is important to plan the most opportune release of the report in conjunction with decision-making processes (NCCHPP, 2019). Reporting activities are described in more detail in subsequent description of the Reporting Phase.

Developing a Work Plan—Evaluation and Monitoring Phase:

Evaluation and monitoring activities are typically carried out following the acceptance of the final HIA report by the proponent or decision-makers. The preliminary work plan developed in the Scoping Phase should describe the individuals or groups responsible for evaluation and/or monitoring activities, the methods to be employed, as well as the resources to be allocated (NCCHPP, 2019). Evaluation and monitoring activities will be described in more detail in subsequent description of the Evaluation and Monitoring Phase.

Choosing Impacts to be Assessed, Determinants to be Addressed, and Developing a Causal Model

A causal model (also known as a health pathway diagram) should be developed to illustrate the plausible connections, or pathways, between the proposal components, health determinants, and potential health impact(s) (Bhatia, 2011). This will help to guide the selection of health impact(s) to be assessed and health determinant(s) to be addressed (Bhatia, 2011). All potential connections should be explored, and not simply be limited to the impacts of interest to those involved in or affected by the proposal (NAHPSWG, 2009). Typically included in a causal model are descriptions of the 'Proposal Components', 'Proximal Impacts', 'Intermediate Outcomes', and 'Health Outcomes' (NCCHPP, 2019). Once the causal model has been developed, it should undergo a review process: first, by knowledgeable experts from the scientific community in order to validate the connections made; and, second, by the proposal proponent in order to ensure that the plan, policy, or project has been accurately interpreted (NCCHPP, 2019).

Figure 24. illustrates a causal model developed as part of an HIA with the aim of identifying and assessing the health impacts of a new town centre development. 'Proposal Components' refers to the design interventions included in the project. 'Proximal Impacts' refers to changes that occur as a result of the proposed design interventions. 'Intermediate Outcomes' refers to changes that occur as a result of the proximal impacts, and are directly linked to the final health outcome(s); and, 'Health Outcomes' refers to positive or negative changes to health that occur as a result of the design interventions. 'Morbidity' refers to the prevalence, or level, of ill-health. While 'Mortality' refers to the prevalence, or risk, of death as a result of ill-health. The arrows throughout connect the proposal components with their associated proximal impacts, intermediate and health outcomes, as well as to morbidity and mortality. For example: in the new town centre development, a series of proposed design interventions will improve access to services for local residents (food, health, or otherwise), a health determinant. Increased access to services (a proximal impact of the proposed design interventions) is associated with improved diet and nutrition (an intermediate outcome). Improved diet and nutrition decrease hypertension, rates of obesity and diabetes (or the final health outcomes). Decreased hypertension, rates of obesity and diabetes result in improved health and well-being (morbidity) and risk of death (mortality). This causal model demonstrates the proposed developments' upstream influence on health determinants, and subsequent downstream impacts to population health.

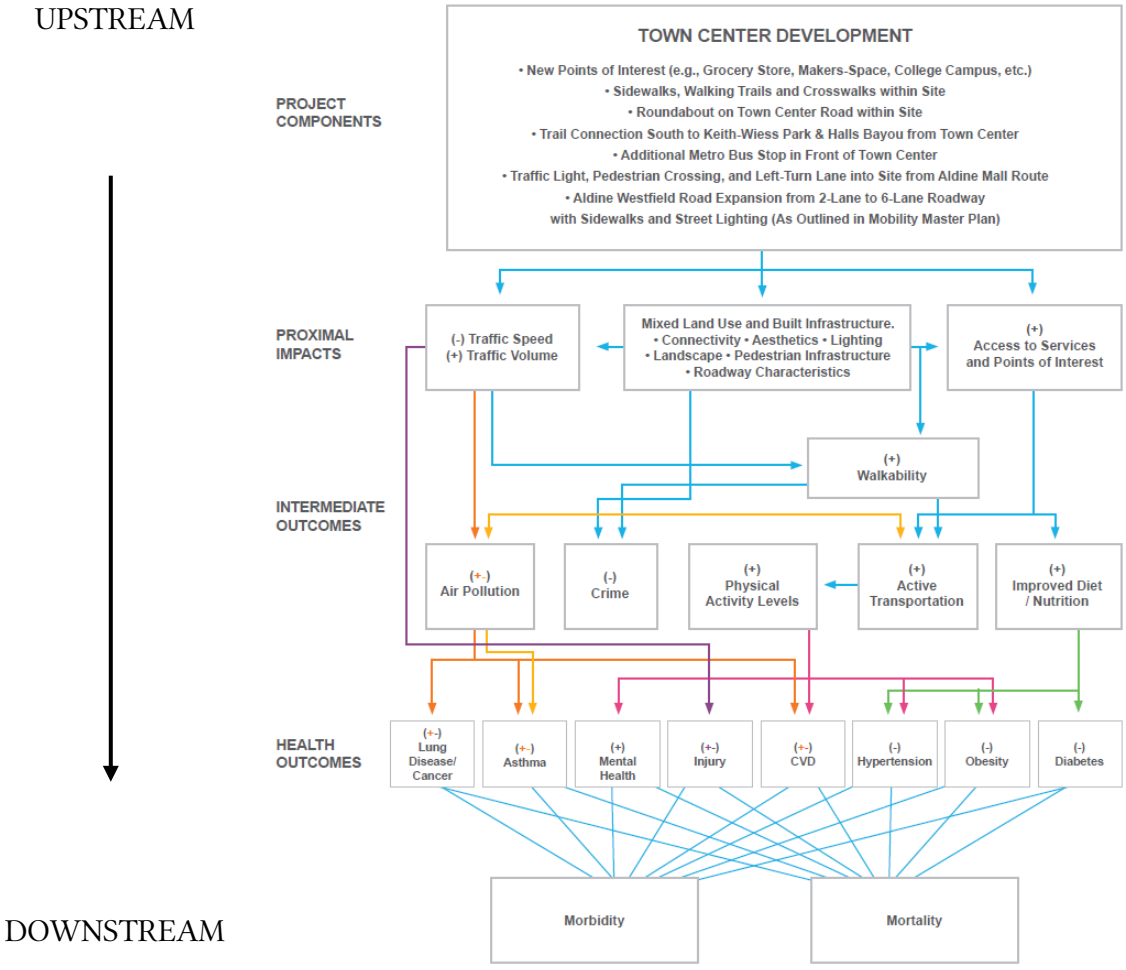

Figure 24. Causal Model Developed During an HIA—this figure illustrates a causal model developed for an HIA that was conducted to identify and assess the health impacts of a new town centre development. The town centre's design has potential to negatively influence downstream health outcomes in populations. (source: Cummings et al., 2016a).

While theoretical, causal models are essential to the HIA process (Bhatia, 2011; NCCHPP, 2019). Through diagrammatic illustration of a proposal's connections to health outcomes, all those involved in or affected by the proposal are enabled to understand the potential impacts, as well as their relative importance (Bhatia, 2011). Causal models can help to identify the components of a proposal (and related health determinants) that can be acted upon upstream in order to improve population health outcomes downstream (Bhatia, 2011). Causal models can also reveal whether uncertainty exists between cause and effect relationships (Bhatia, 2011). As well, they assist those involved in prioritizing the health determinants to be addressed and health impacts to be evaluated during the Assessment Phase (Bhatia, 2011). Ultimately, the health impact(s) selected for assessment will be drawn from the causal model, and will be based on the level of inquiry of the HIA, the proposal itself, and contextual circumstances that surround it (see Table 33.) (Bhatia, 2011; Harris et al., 2007).

DESK BASED	RAPID	INTERMEDIATE	COMPREHENSIVE
No more than three impacts, assessed in less detail	No more than three impacts, assessed in more detail	Three to ten impacts, assessed in detail	All potential impacts, assessed in detail
Provides a broad overview of potential health impacts	Provides a more detailed overview of potential health impacts	Provides a more thorough assessment of potential health impacts, and more detail on specific predicted impacts	Provides a comprehensive assessment of potential health impacts

Table 33. Health Impacts (Number and Depth) at Each Level of Inquiry in HIA Practice—this table identifies the number and depth of health impacts that are typically assessed at each level of inquiry in HIA practice. Generally, the greater the level of depth of HIA inquiry, the more health impacts will be assessed and at a greater depth of inquiry. (source: Harris et al., 2007)

Establishing Terms of Reference

The Project Team, with input from the Steering Committee, should develop and record 'Terms of Reference' (ToR) to guide the HIA (Harris et al., 2007). The ToR will specify the content of the assessment, the frameworks for its execution, and the expectations for all those involved (Birley, 2011; Harris et al., 2007). Table 34. further details the suggested information to be included in the final ToR document. The ToR will become the contractual agreement between the proposal's proponent, Project Team, Steering Committee, and consultants engaged throughout the process (Birley, 2011). As well, the success of the HIA will be judged according to how well the assessment followed the instructions outlined in the ToR (Birley, 2011).

Suggested Information to be Included in the 'Terms of Reference'	
Project Description	• description of the proposal, as well as the objectives, values and intent of HIA; and, • scope of work to be conducted (temporal, spatial, and demographic).
Definitions of Underlying Concepts	• definition of terms related to the proposal to ensure that there is no ambiguity (e.g. 'health' and equity'); and, • description of the approach to health taken (e.g. environmental, social, or equity).
Identification of all personnel involved, including descriptions of the limitations and responsibilities of each role	• proponent of the proposal; • decision-makers (if not proponent); • Steering Committee; • Project Team; and, • consultants or experts to be engaged.

Project Administration	• timelines;
	• frequency and dates of meetings to be held between Project Team and Steering Committee;
	• content and deadlines for deliverables;
	• budget;
	• funding sources; and,
	• protocols to govern:
	  ○ how conflicts will be resolved, should any arise;
	  ○ how changes to the scope or ToR will be made;
	  ○ how data will be shared between individuals or groups; and,
	  ○ how findings will be published, including such concerns as intellectual property, confidentiality, and copyright.

Table 34. Suggested Information to be Included in the 'Terms of Reference' Document—this table identifies the information that should be described in the 'Terms of Reference' document developed during the Scoping Phase of the HIA. The Terms of Reference document will specify the content of the assessment, the frameworks for its execution, and the expectations for all those involved. As well, the success of the HIA will be judged according to how well the assessment followed the instructions outlined in the Terms of Reference. (source: table by author; information sourced from Birley, 2011; Harris et al., 2007).

A.3 Assessment Phase

Purpose:

During the Assessment Phase, the hypotheses made during the Scoping Phase concerning associations between a proposal and a population's health are assessed in order to reveal the extent of a proposal's impact on health (NCCHPP, 2019). By examining the health impact(s) related to a proposal on the surrounding population, appraisers can identify potential differences that may exist between communities and develop pragmatic recommendations, tailored to the community's particular needs (both present and future). The Scoping and Assessment Phases are often conducted iteratively: as new information is learned, research questions and/or methods may be revised to reflect new findings (Bhatia, 2011).

Actors Involved:

The Project Team is often responsible for collecting, organizing, and analyzing relevant data and evidence (Bhatia, 2011). They work alongside the Steering Committee to evaluate the information gathered and to deliberate the influence of the findings on future decision-making (Bhatia, 2011). The views of experts, key stakeholders, informants, and/or the local community are considered when assessing the potential health impact(s) of a proposal (Bhatia, 2011; Harris et al., 2007). This process general relies on consensus building (Bhatia, 2011).

Activities Involved:

Health impact analysis is often complex, and should be conducted in a logical, structured, and replicable sequence (Bhatia, 2011). Activities involved in the Assessment Phase include:

- evaluating causal relationships;
- developing a community health and environmental profile to describe the existing, baseline conditions;
- quantitatively forecasting future impact on those affected by the proposal;
- characterizing the health impact(s) associated with the proposal in terms of nature, likelihood, distribution of impact, etc.; and,
- prioritizing the health impact(s) according to their health characterizations and the objectives of the HIA (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019).

Appraisers will gather, analyze, and interpret data of a variety of types and sources in order to make detailed and informed judgements concerning the health impact(s) of a proposal (Harris et al., 2007). It is, therefore, important to

understand the distinctions between various approaches to data collection and data types, including their inherent strengths and weaknesses.

Prior to description of the Assessment Phase activities, high-level overviews will first be provided of:

- primary and secondary data;
- qualitative and quantitative approaches to data collection;
- mixed-methods research;
- evidence sources commonly used in HIA practice; and,
- the steps required to ensure that high-quality evidence is used with transparency.

REQUISITE CONCEPTS

Primary and Secondary Data—primary data accounts for new information collected in support of the HIA process, while secondary data is data that has been collected for another purpose at another point in time, but remains relevant to the HIA. Examples of primary data include: transcripts from focus groups, original community-wide surveys, or local air samples collected by the Project Team. Examples of secondary data include: journal articles, government reports, or crime statistics from the local police department. The type of data (primary or secondary) gathered during the Assessment Phase will depend on the level of HIA conducted (Harris et al., 2007). When appraisers are conducting more in-depth HIAs, such as Intermediate or Comprehensive, they are more likely to collect their own primary data than when conducting HIAs of lesser depth, such as Rapid or Desktop (Harris et al., 2007). That said during Rapid or Desktop HIAs, appraisers may conduct limited, first-hand research through stakeholder interviews (Harris et al., 2007). All HIAs will incorporate secondary data to assess health impact(s) (Harris et al., 2007).

Qualitative Approach and Data—a qualitative approach seeks to understand phenomena from a multitude of perspectives and experiences, in natural settings (The Center for Health Design, 2018). When employing a qualitative approach, researchers utilize **inductive reasoning**[1] to formulate probable hypotheses and theories, grounded in their observations (The Center for Health Design, 2018; NCCHPP, 2019). It is underpinned by a **constructivist** philosophical paradigm, and accepts that reality is socially constructed (The Center for Health Design, 2018). Qualitative data can be both verbal or non-verbal data (The Center for Health Design, 2018). Verbal data include, for example, transcripts from structured or unstructured interviews or focus groups, responses to open-ended questionnaires, or even a researcher's field notes. Non-verbal data include drawings developed during a community design

charrette or photographs taken by youths as part of a PhotoVoice exercise (a community-based research method whereby members of marginalized groups are tasked with capturing images of their neighbourhoods that relate to a particular research theme). When collecting qualitative data, it is important to make all attempts to achieve empirical saturation (NCCHPP, 2019). Empirical saturation is the point at which no new information is learned from the data collection process, which implies that the researcher is then able to confidently draw strong conclusions (NCCHPP, 2019). Qualitative research is, by nature, an **exploratory** exercise.

By employing a qualitative approach, appraisers can develop more comprehensive understandings of the impacts to health by considering the lived experiences and perspectives of those affected by the proposal, experts, and/or key informants (Harris et al., 2007). In doing so, this contributes to ensuring that the HIA remains a democratic process instead of a technocratic exercise (Harris et al., 2007). Additionally, qualitative data—in HIA practice—can either be primary or secondary (Harris et al., 2007). Primary qualitative data collection is typically more feasible during HIAs than primary quantitative data collection because qualitative studies can be less rigid in their designs (EcoPlan, n.d.).

[1] An example **inductive reasoning** includes: if there is a collection of coloured balls concealed in a bag, and you remove seven balls and discover that they are all red, one might logically infer that all the balls in the bag are red.

Quantitative Approach and Data—a quantitative approach seeks to establish causal relationships between phenomena through statistical analysis (The Center for Health Design, 2018; NCCHPP, 2019). When employing a quantitative approach, researchers utilize **deductive reasoning**[2] to test their predictions, developed based on established theory (The Center for Health Design, 2018). It is underpinned by a **positivist** philosophical paradigm, and asserts that there exist natural laws governing human behaviour that can objectively be measured and validated through scientific study. Quantitative data is numerical, or 'quantifiable'. Examples include: responses from multiple choice questionnaires or statistical information from government sources. Quantitative research is, by nature, a **confirmatory** exercise.

Appraisers can instill greater confidence in decision-makers when supporting their assessment findings or recommendation alternatives with quantitative analyses—due to the increased precision of the analysis (EcoPlan, n.d.). That said, not all health impacts can be quantified, and those that are easily measurable are often environmental (air, water, or soil pollutants, for example) (Harris et al., 2007). Quantitative data—in HIA practice—can either be primary or secondary (Harris et al., 2007). However, primary quantitative data

collection is typically more amenable to Comprehensive HIAs (Harris et al., 2007).

[2] An example **deductive reasoning** includes: if all women are mortal, and Sarah is a woman; Sarah must also be mortal.

Mixed-Methods Approach—HIAs should utilize both qualitative and quantitative evidence in order to achieve a holistic understanding of a proposal's impact (NCCHPP, 2019). This approach is referred to as a mixed-methods approach, which builds upon the inherent weaknesses of quantitative and qualitative approaches (The Center for Health Design, 2018). In order to control certain variables, quantitative research is often conducted in artificial environments (The Center for Health Design, 2018). As such, a study's findings may not be truly representative of reality (The Center for Health Design, 2018). Qualitative approaches, on the other hand, are primarily conducted in natural environments, however, interpretation of the results is subject to research bias (The Center for Health Design, 2018). As well, the qualitative findings established in one setting may not apply to another (The Center for Health Design, 2018). When combined—as in a mixed-methods approach—the two approaches supplement the information learned from the other and provide researchers with a more complete understanding of a proposal's impact (The Center for Health Design, 2018).

In mixed-methods research, best practices suggest that a variety of evidence sources be used to strengthen, or triangulate, findings (Harris et al., 2007). Triangulation refers the use of two or more types of evidence, such as a literature review and structured interviews, or local health data and a community-wide survey, in order to validate findings between sources (The Center for Health Design, 2018). In HIA practice, appraisers can more easily argue the need for a particular recommendation when the findings on which it is based are confirmed by multiple sources (Harris et al., 2007). For example: in an HIA conducted to assess the impact of a policy on population growth, appraisers validated their findings and, as a result, were able to stress to decision-makers that youth physical activity levels were impacted greatly by the policy (Harris et al., 2007). In this assessment, appraisers had been able to corroborate the results of local primary data they collected through key stakeholder interviews with secondary information, sourced from the literature (Harris et al., 2007). The two sources of evidence referenced, which arrived at similar conclusions, provided more weight to the appraisers' recommendations (Harris et al., 2007).

Common Sources of Evidence in HIA—In the scientific community and beyond, there has long been controversy surrounding the validity of certain evidence sources, data collection methods, and approaches: with many believing that quantitative data is far more rigorous, and therefore more accurate, than qualitative data (NCCHPP, 2019). A key tenet of HIA practice, however, is the belief that all evidence is valuable (Bhatia, 2011). Common sources of evidence in HIA practice include: local population, health, and environmental data; epidemiologic studies; spatial analysis; literature reviews; reports from completed HIAs; and, stakeholder and affected population engagement activities. Each of these sources (and related data collection methods) requires a varying amount of resources (see Figure 25.).

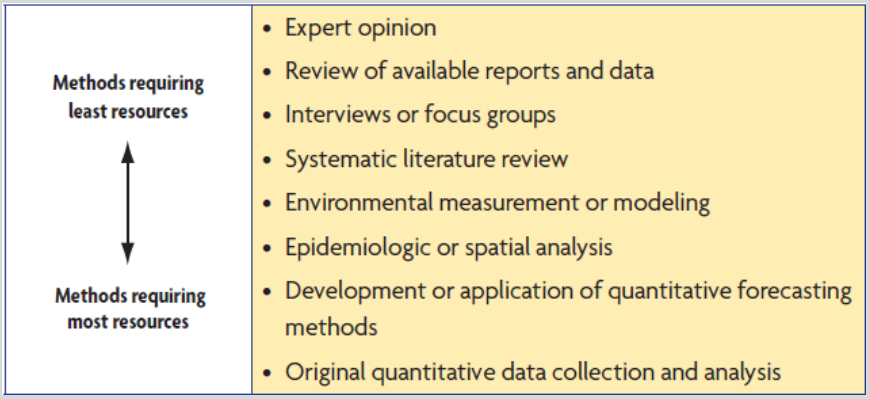

Figure 25. Data and Information Collection Methods Typical in HIA Practice—this figure illustrates the types of data and information often collected or used in HIA practice, and identifies which types of data/information generally require the least versus the most resources to gather. Conducting original research is generally more resource-intensive than consulting the available literature, for example. (source: Bhatia, 2011) Reprinted with permission from the publisher.

Local Health and Environmental Data—local health and environmental data provide appraisers with a greater understanding of the circumstances surrounding a proposal. Many local health departments track demographic and health indicators, and these statistics can be a valuable resource to appraisers (Bhatia, 2011). Note: health indicators are measures that can be monitored over time to describe the health of, or changes in health to, a particular population. Demographic data may include: population size, density, or distribution; age and gender; birth rates; ethnicity; employment rate; socio-economic status; or, any demographic trends (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019). Whereas, health data may include: life expectancy; hospitalization or injury rates; prevalence of disease; self-perceived health; or, health behaviours prevalent within the population, such as diet, smoking or alcohol use, and levels

of physical activity (Bhatia, 2011; Harris et al., 2007). As well, local, regional, and federal governments track a diverse range of environmental indicators, which are often made available to the public (Bhatia, 2011). Environmental data gathered may include: housing type, quality, and location; air, water, and soil quality; design and location of water supply systems, including their proximity to pollutants or effluent disposal; transportation infrastructure; land-use type and zoning bylaws; access to green space, recreation areas, and natural environments; access to public services, such as healthcare; or, access to private services, such as healthy food options.

Epidemiologic Studies—epidemiology is the study of the distribution and determinants of disease (both infectious and non-infectious) in human and animal populations (Kobayashi, n.d.). For example: epidemiologists investigate the transmission of the influenza virus or determinants of risky health behaviours, such as smoking or drug abuse. Epidemiologic studies are very relevant to HIA practice because phenomena are examined under real-life, human circumstances. As well, they can describe, quantitively, the level of association between a health determinant and a particular health outcome (Bhatia, 2011). Appraisers can either source published epidemiologic studies or conduct their own investigations. However, epidemiologic studies can be time and resource-intensive (Bhatia, 2011).

Literature Reviews—literature reviews are typically scholarly papers, developed by their author(s) to gather and synthesize existing knowledge related to a particular topic or research question in order to appreciate what has been established to date and to identify where there are gaps in understanding. There are many types of literature reviews, each requiring different levels of rigour. In HIA practice, systematic reviews, general literature reviews, and grey literature reviews are most commonly used (Harris et al., 2007). Systematic reviews methodically collect, critically appraise, and synthesize findings from the existing literature published in peer-reviewed journals. They are the most rigorous of review-type and, as such, considered the gold standard (Harris et al., 2007). That said, there have been limited systematic reviews conducted concerning the health impacts, or related health determinants, most often assessed by HIAs (Harris et al., 2007). General literature reviews are usually not as systematic in their execution and, as a result, may not provide a thorough understanding of a given topic. Grey literature reviews are focused on collecting relevant information from unpublished sources, such as government reports, conference proceedings, or policy documents. Appraisers can use existing literature reviews and/or conduct their own (Harris et al., 2007).

Previous HIAs—other HIAs can be invaluable resources, saving appraisers time and effort when the proposal under scrutiny is similar in nature to those previously conducted (Harris et al., 2007). They can assist appraisers in understanding:

- the anticipated health impact(s) of certain elements of a proposal;
- the outcomes of the completed HIA, including if predictions made have been verified; and,
- the characteristics of recommendations developed to mitigate or maximize health impact(s) of interest (NCCHPP, 2019).

There are now a number of online databases that house reports from completed HIAs, representing a variety of sectors, locations, affected populations, research methods, health impacts, locations, and levels of decision-making (local, regional, federal, etc.). The Health Impact Project (https://www.pewtrusts.org/en/research-and-analysis/data-visualizations/2015/hia-map?sortBy=relevance&sortOrder=asc&page=1) and HIA Connect (http://hiaconnect.edu.au/reports/) are but two of a growing number of databases available.

Spatial Analysis—spatial analysis can be conducted to reveal:

- existing relationships between health and place; and,
- projected relationships between health and place.

Spatial Analysis is described in more detail below.

Stakeholder and Affected Population Engagement—by engaging those affected by a proposal, appraisers can obtain relevant information that they may not have otherwise discovered through reviewing the existing literature or data (Harris et al., 2007). Stakeholder and affected population engagement are fundamental to ensuring a community's right to self-determination and sustaining a democratic assessment process.

Stakeholder and affected population engagement can:

- reveal a population's specific concerns related to health or a proposal;
- validate or invalidate findings extracted from the literature;
- confirm or refute connections established between a proposal and health during the Scoping Phase; and,
- contribute quantitative and qualitative data based on expert and practical experience.

Potential engagement strategies include:

- interviews with key stakeholders, experts, or community representatives;
- discussion groups—such as workshops, charettes, forums, or focus groups—with stakeholders and/or members of the community; and,
- community surveys.

These approaches are especially helpful when the impacts being assessed have not been widely studied or specific data is not available (NCCHPP, 2019). Effective stakeholder and affected population engagement, however, demands careful planning and skilled leadership (Harris et al., 2007). Those organizing engagement activities need to, for example, identify any established community networks and consultation processes that can be leveraged; identify underrepresented or marginalized groups within the affected population; and, maintain a strong rapport with those consulted by informing them throughout the HIA process of significant developments (Harris et al., 2007). Groups or individuals consulted may include the decision-makers and/or the proposal proponent; experts from academia or industry; local or regional governmental agencies or councils; or, local business owners, community organizations, or community boards and associations (Harris et al., 2007). Figure 26. describes potential engagement activities that may be conducted depending on the level of depth chosen for the HIA.

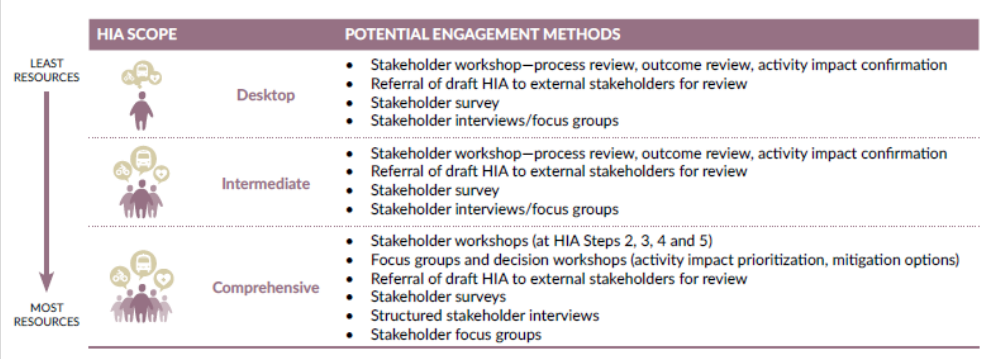

Figure 26. Potential Stakeholder and Affected Populations Engagement Activities—this figure describes potential stakeholder and affected population outreach and engagement activities conducted at varying levels of HIA inquiry. Generally, the more comprehensive the HIA inquiry, the more comprehensive the stakeholder and affected population outreach and engagement activities. (source: EcoPlan, n.d.).

Quality of Data—when sourcing evidence, appraisers must first critically appraise the quality of the information before it is to be included in the HIA; not all information, after all, is created equal. In general, the study's design should be scrutinized to ensure that it aligns with the researcher's stated research question(s) and if the researcher's findings fit the methods and question(s) asked (Harris et al., 2007). When evaluating the quality of a systematic literature review, for example, the following should be considered:

- whether the stated research questions were focused and clear;
- whether inclusion/exclusion criteria specifying the characteristics used to identify relevant studies were described, and if the criteria align with the stated research question(s);
- the thoroughness of the search strategies; a comprehensive search strategy will source studies from a variety of different databases and rely on multiple search strategies, such as locating unpublished (grey) literature, reviewing the reference lists of other, relevant studies, or asking knowledgeable informants for study suggestions;
- whether the studies included were assessed for quality, and the suitability of criteria on which they were judged; and,
- whether the data support the author's interpretation of the findings (Health Evidence, 2018).

There are a number of tools and resources available to assist appraisers in assessing the quality of information. In particular, the Canadian National Collaborating Centre for Methods and Tools is a federally-supported organization that focuses on identifying, developing, and evaluating methods and tools to assist practitioners in evidence-informed decision-making affecting public health (National Collaborating Centre for Methods and Tools, n.d.). HIA findings and recommendations will only be as strong as the information used to assess a proposal's impact(s). As such, appraisers must be cognizant of the quality of the information that will be used throughout.

Transparency—it is critical that the HIA process remain transparent in order to uphold the fundamental values of the HIA: democracy, equity, and ethical use of evidence, in particular. The rationale behind the inclusion or exclusion of certain methods and evidence sources should be explicitly stated. For example: constrained resources (e.g. limited funding and staff) may hinder the types of data collection methods available (Bhatia, 2011; NAHPSWG, 2009). Some health impacts have been studied in greater detail than others; as such, the data necessary to support the development of recommendations may not yet exist, remains weak, or is of low-quality (Harris et al., 2007; NCCHPP, 2019). It is, therefore, imperative to identify any gaps in the existing literature, the strength or quality of the evidence used, and to describe any assumptions or inferences made (Harris et al., 2007; NAHPSWG, 2009; NCCHPP, 2019). Key stakeholders, as well as the population(s) impacted by the proposal, should be provided opportunity to comment on the findings and their applicability (NAHPSWG, 2009). Transparent and conscientious record keeping can help to ensure that decisions-making remains impartial throughout the execution of the HIA.

Evaluating Causal Relationships:

A causal relationship exists when one variable produces a change in another. Appraisers should evaluate whether causal relationships exist between the proposal (or related health determinants) and any anticipated health impact(s) (Bhatia, 2011). Conclusions made should be based on the best available evidence (Bhatia, 2011). Appraisers can review existing, empirical research; however, it may be necessary for appraisers to conduct original studies (qualitative or quantitative). Methods used, decisions-made, as well as any limitations (e.g. knowledge gaps in research) must be recorded in order to provide context for future recommendations.

Developing a Community Health and Environmental Profile:

HIA guidance recommends that a community health and environmental profile be developed. A strong community health and environmental profile will help to describe a population more clearly, by revealing at-risk groups and identifying factors unique or significant to the population, such as vulnerability or resiliency factors. A population, for example, that experiences a high prevalence of chronic disease may be more vulnerable to the negative health impacts associated with increased exposure to pollutants (Bhatia, 2011). Conversely, a community that has established a robust social-support network, may be more resilient to short-term, negative health impacts associated with a lowered employment rate (Bhatia, 2011). A community health and environmental profile should:

- characterize the population(s) impacted (Harris et al., 2007), as well as the existing environmental conditions (Bhatia, 2011);
- identify any particular sensitivities or vulnerabilities that exist within the community (Harris et al., 2007);
- identify resources or assets to be leveraged and/or hazards to be minimized (Bhatia, 2011);
- identify sub-populations who may be more vulnerable to the health impact(s) associated with the proposal (Harris et al., 2007);
- establish if variations in health exist between sub-populations, and if any may be related to place;
- establish reference points, or baselines, for anticipating impact(s) and/or comparing changes to health following a proposal's implementation in order to determine whether additional intervention is required (Bhatia, 2011; Birley, 2011; Harris et al. 2007); and,
- evaluate the condition of existing health determinants to guide further research and contextualize any later findings from the scientific literature (Harris et al., 2007).

This exercise largely relies upon an assemblage of existing data; however, original data may need to be collected (NCCHPP, 2019). Note: appraisers can build upon the information gathered during the Screening and Scoping Phases

concerning community health and environmental conditions (Bhatia, 2011; Harris et al., 2007).

Spatial analysis can be conducted to reveal existing relationships between a population's health and place, including spatial inequities. Maps can be developed by overlaying environmental data with a population's demographic characteristics and/or health statistics. An HIA, for example, was conducted in the City of Hoboken, New Jersey to identify and assess the health impacts of chronic flooding (Carnegie et al., 2016). The appraisers established that the areas continually affected by flooding were home to the majority of the City's impoverished and low-income residents (see Figures 27. – 29.) (Carnegie et al., 2016). As well, minorities and residents with physical, emotional, or mental disabilities were also concentrated in these areas (see Figure 30.) (Carnegie et al., 2016). The vulnerable populations identified became a focus of the HIA because by mapping population and environmental data, it was determined that they would benefit most from improved flood mitigation strategies.

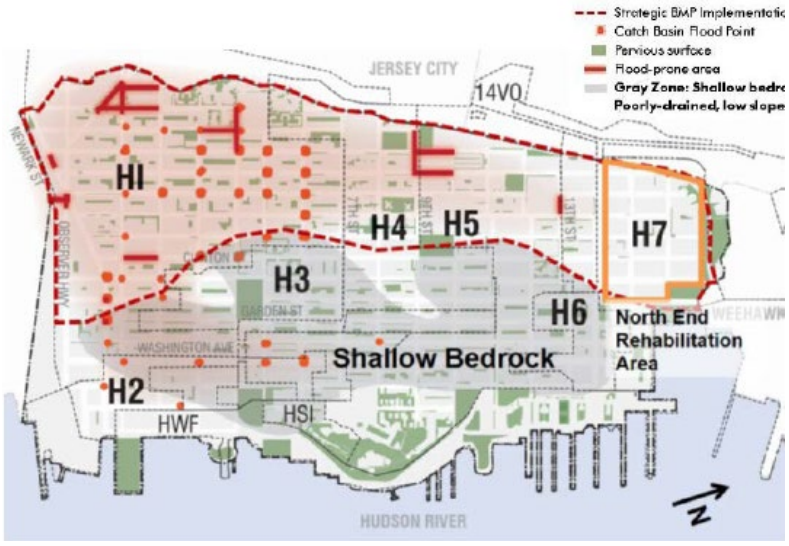

Figure 27. HIA Spatial Analysis: Flood-Prone Areas in Hoboken, New Jersey—this figure illustrates the spatial analysis conducted by appraisers involved in an HIA conducted to identify and assess the health impacts of chronic flooding in Hoboken, New Jersey. The appraisers identified where the most flood-prone areas of the city were located. (source: Carnegie et al., 2016)

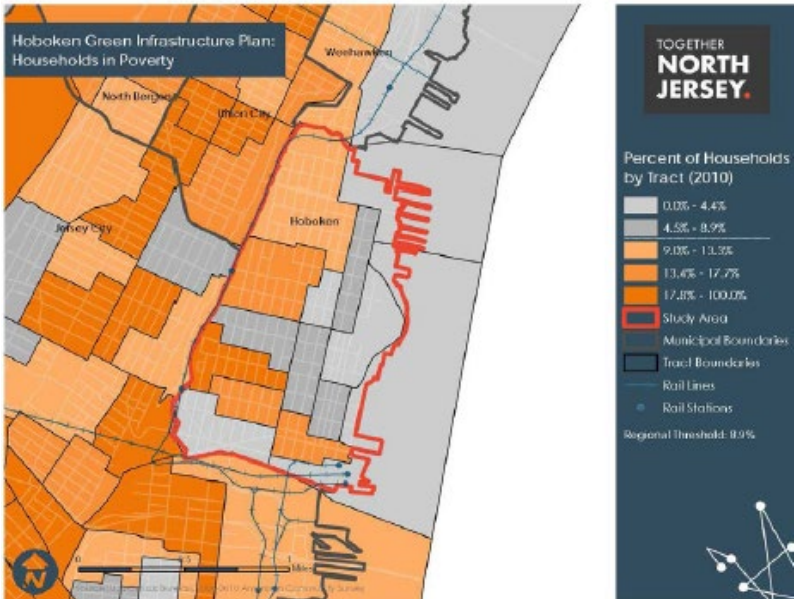

Figure 28. HIA Spatial Analysis: Households Living in Poverty in Hoboken, New Jersey—this figure illustrates the spatial analysis conducted by appraisers involved in an HIA conducted to identify and assess the health impacts of chronic flooding in Hoboken, New Jersey. The appraisers established that the City's most impoverished individuals and families were located in the most flood-prone areas. (source: Carnegie et al., 2016)

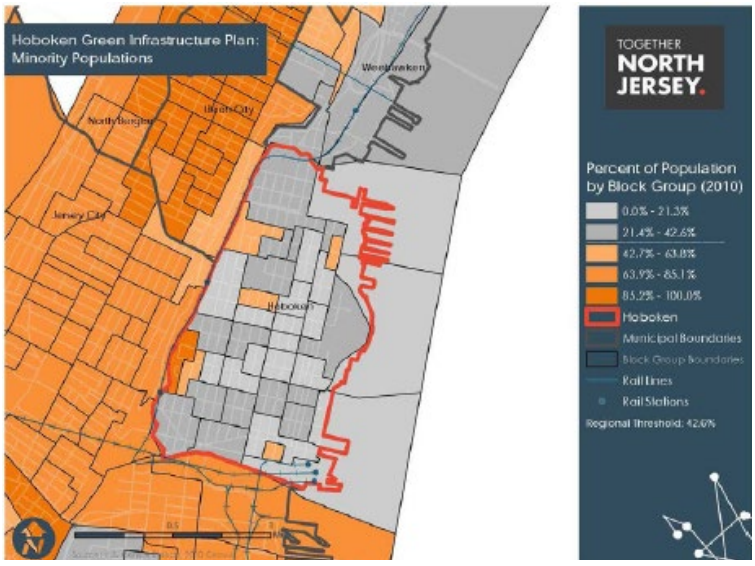

Figure 29. HIA Spatial Analysis: Minority Populations in Hoboken, New Jersey—this figure illustrates the spatial analysis conducted by appraisers involved in an HIA conducted to identify and assess the health impacts of chronic flooding in Hoboken, New Jersey. The appraisers established that the majority of the City's minority populations were located in the most flood-prone areas. (source: Carnegie et al., 2016)

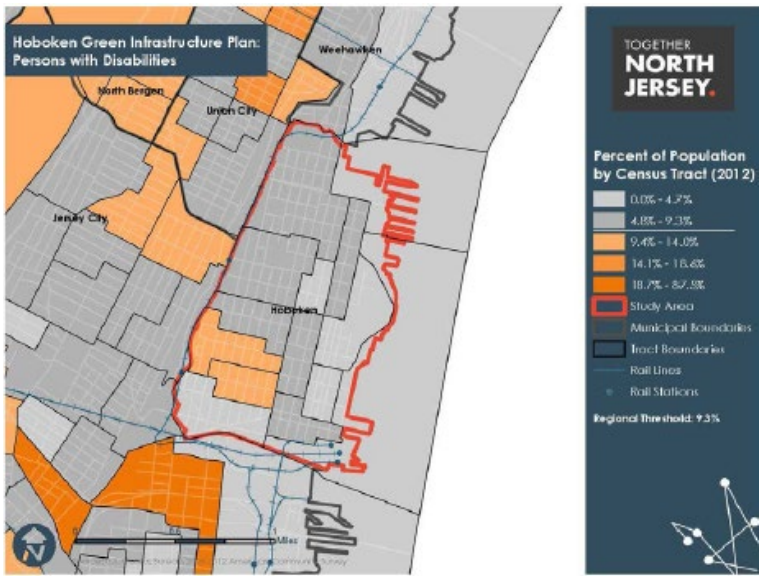

Figure 30. HIA Spatial Analysis: Populations with Physical, Emotional, or Mental Disabilities in Hoboken, New Jersey—this figure illustrates the spatial analysis conducted by appraisers involved in an HIA conducted to identify and assess the health impacts of chronic flooding in Hoboken, New Jersey. The appraisers established that the majority of the City's populations living with physical, emotional, or mental disabilities were located in the most flood-prone areas. (source: Carnegie et al., 2016)

Quantitatively Forecasting Impacts:

Where feasible, predictions should be made to quantitatively forecast impacts associated with a proposal (Bhatia, 2011). Quantitative estimates can offer more precise understandings of the degree of impact a proposal might have (Bhatia, 2011). In HIA practice, forecasting efforts generally focus on establishing health or economic impacts. For example: an HIA conducted in East Aldine Management District (East Aldine), Texas sought to identify and assess the health impacts associated with the development proposed for a new town centre. Appraisers forecasted changes to pedestrian-vehicular collisions, as well as the financial costs to be incurred as a result of increased collision rates and injuries. Not all impacts can be evaluated quantitively, however (Bhatia, 2011).

Mathematical prediction models are often used in HIA to predict impact (Bhatia, 2011; Birley, 2011). After a suitable prediction model has been selected for use, appraisers should determine if there is enough data available to proceed with calculating impact (prediction models typically require significant amounts of information) (Bhatia, 2011). Estimates for health or economic impacts associated with each decision alternative should then be computed (Bhatia, 2011). Any limitations in the data or methods, uncertainty of predictions, or assumptions made should be described (Bhatia, 2011).

Spatial analysis can also be conducted to reveal projected relationships between a population's health and place (Breysee et al., 2016). Maps can be developed by overlaying forecasted data with existing information. For example: in St. Paul, Minnesota, an HIA was completed to assess the impact of transit-oriented development policy on the local community (Breysee et al., 2016). Appraisers compared the anticipated housing growth pattern with information about the existing sidewalk infrastructure (see Figure 31.) (Breysee et al., 2016). It was established that the proposed policy, as it was, would not provide the community health benefits anticipated because the quality of the existing sidewalk infrastructure was inadequate to support walking and cycling (Breysee et al., 2016).

Birley (2011) argues that, in advance of disclosing any forecasted impacts, it must be made clear to decision-makers that the HIA should not be regarded as a rigorous prediction tool used to validate hypotheses. After all, decision-makers are likely to make decisions to accept or reject recommendations according to the predictions presented to them. Recommendations developed in HIAs do not propose actions best suited for an ideal world. Rather, they are pragmatic in that they suggest actions to improve health a degree more than the initial proposal. Recommendations are, therefore, inherently imperfect solutions and, as such, any predicted outcomes cannot be tested (Birley, 2011).

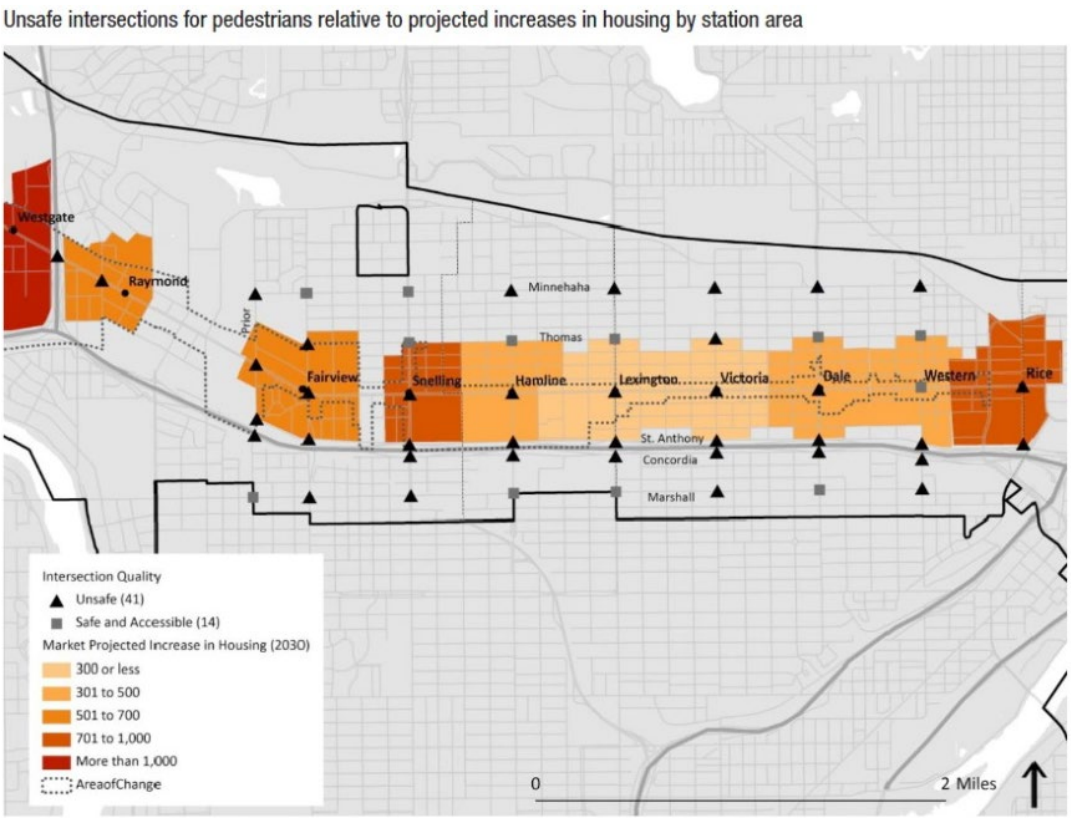

Figure 31. HIA Forecasting: Projected Housing Growth Patterns as Compared with Existing Sidewalk Infrastructure—this figure illustrates the spatial analysis conducted by appraisers involved in an HIA conducted to assess the health impacts of transit-oriented policy on the local community in St. Paul, Minnesota. Appraisers projected the housing growth patterns with information about the existing sidewalk infrastructure. It was established that the existing sidewalk infrastructure would be inadequate to accommodate the anticipated growth. (source: Breysee et al., 2016).

Characterization of Health Impacts:

The health impact(s) associated with a proposal should be characterized following the gathering and analysis of evidence and, if conducted, any quantitative forecasting (Bhatia, 2011). Characterization involves synthesizing and interpreting all the information learned throughout the Assessment Phase in order to provide clear description of the health impact(s). Best practices for characterizing health impacts do not yet exist. However, the Project Team and Steering Committee typically work together to develop an understanding of each health impact through logical reasoning. Key stakeholders and/or experts can also be engaged to critique and strengthen the characterizations made (Bhatia, 2011). Common factors considered when characterizing health impact(s) in HIA practice, include:

- strength of evidence (Bhatia, 2011);

- nature of impact (Harris et al., 2007; NCCHPP, 2019);
- likelihood of impact (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019);
- timing of impact (Harris et al., 2007);
- severity of impact (Bhatia, 2011);
- magnitude of impact (Bhatia, 2011; NCCHPP, 2019); and,
- distribution of impact (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019).

The **strength of evidence** refers to the level of confidence in the validity of the information gathered in support of the association between the proposal and health impact (Bhatia, 2011); and, can be described as insufficient, sufficient, or strong (Cummings et al., 2016a). Gaps in knowledge, data limitations, and assumptions made, for example, should be considered when judging strength (Bhatia, 2011). The **nature of impact** refers to the directionality of influence expected of the health impact (Harris et al., 2007; NCCHPP, 2019); and, can be described as positive, negative, undetermined, or no effect (Cummings et al., 2016a). The **likelihood of impact** refers to the probability the health impact will occur following implementation of the proposal (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019); and, can be described as definite, probable, or speculative (Harris et al., 2007). The **timing of impact** refers to the timeframe in which the health impact is expected to manifest; and, can be described as short-, medium-, or long-term (Harris et al., 2007). The **severity of impact** refers to the gravity of the health impact, resulting from the proposal, on human well-being, function, or longevity (Bhatia, 2011); and, can be described as low, medium, or high (Cummings et al., 2016a). A high level of severity implies that the impact is chronic, irreversible, or fatal (Cummings et al., 2016a). Whereas, a low level of severity implies that the impact can be addressed quickly or easily, or does not require any intervention (Cummings et al., 2016a). The **magnitude of impact** refers to the scale or proportion of impact on the affected population (NCCHPP, 2019); and, can be described as limited, moderate, or substantial (Cummings et al., 2016a). The **distribution of impact** refers to the spread of impact across populations, and whether it is shared equally, or solidifies or reverses baseline inequities (Bhatia, 2011). In order to evaluate the distribution of impact, the following must be considered:

- the direct impact on vulnerable populations (Bhatia, 2011);
- the impact on other factors, which may in turn put vulnerable populations at risk of experiencing negative health outcomes (Bhatia, 2011); for example: a health impact may influence the availability of clean water or sanitation, (eupati) the effects of which may pose greater threat to the elderly, whose immune systems are weakened, or young children, whose immune systems are immature; and,
- finally, the scale (magnitude) of impact on vulnerable populations compared with the general population (Bhatia, 2011).

The number of factors considered when characterizing health impacts should align with the level of inquiry undertaken (Bhatia, 2011). Fewer health impacts will be considered in lesser detail during the execution of a Desktop HIA than

during a Comprehensive HIA (Bhatia, 2011). Table 35. illustrates how health impacts were characterized for the HIA conducted in EA, Texas to identify and assess the health impacts associated with the development proposed for a new town centre.

East Aldine District Health Impact Assessment Table

Table 5. Characterization of Potential Health Impacts of East Aldine's Town Center Development*

Specific Development Features or Outcomes	Associated Intermediate Outcomes	Direction	Strength of Evidence	Likelihood	Severity	Magnitude of Association	Distribution
Grocery store	Improved access to fresh foods	Positive	Sufficient	Likely	Low to High	Limited	Population within walking, biking, driving, or transit distance to the grocery store
Federally qualified health centers (FQHC)	Improved access to care	Positive	Strong	Likely	Medium to High	Limited	Population within walking, biking, driving, or transit distance to the health center; Hispanics may benefit more than whites
Increased traffic volume	Increased pedestrian-vehicle collisions	Negative	Strong	Likely	Medium to High	Substantial	Population that walks along Aldine Mail Route and Aldine Westfield
Recreation facilities	Increased physical activity	Positive	Sufficient	Possible	Low to High	Moderate	Population within walking, biking, driving, or transit distance to the recreation facility
Connectivity	Increased active transportation or physical activity	Positive	Sufficient	Likely	Low to High	Moderate	Population within walking, biking, driving, or transit distance to the town center
Mixed land use and trip generators	Increased active transportation or physical activity	Positive	Sufficient	Likely	Low to High	Substantial	Population within walking, biking, driving, or transit distance to the town center
Pedestrian/cyclist trails	Increased active transportation or physical activity	Positive	Insufficient	Possible	Low to High	Limited	Population within walking, biking, driving, or transit distance to the additional sidewalks and trails

*Developed based on "Health Impact Assessment: A Guide for Practice" by Rajiv Bhatia (2011) and "A Health Impact Assessment Toolkit: A Handbook to Conducting HIA, 3rd Edition" by Human Impact Partners (2011)

Table 35. Characterization of Potential Health Impacts—this table describes the characterizations of health impacts anticipated with the implementation of a proposed new town centre in East Aldine Management District, Texas. Health impacts (and subsequently, recommendations) should be prioritized based on these characterizations. (source: Cummings et al., 2016a)

Prioritization of Health Impacts:

The final step of the Assessment Phase requires that the Project Team and/or Steering Committee rank—or prioritize—the health impacts associated with the proposal (Harris et al., 2007; NCCHPP, 2019). Health impacts should be prioritized according to their characterizations (NCCHPP, 2019). Harris and colleagues (2007) suggest health impacts that meet the following criteria, be assigned more weight:

- supported by evidence extracted from a variety of sources;
- supported by evidence that is consistent across sources;
- has the potential to impact more than one area of health;
- has actionable health implications, or is highly modifiable;
- impacts a significant portion of the population;
- impacts vulnerable populations, in particular; and,

- significantly impacts the contextual circumstances surrounding the proposal (Harris et al., 2007).

The decisions made, as well as the criteria used to prioritize health impacts, should be thoroughly documented (Harris et al., 2007). If conflict arises during the prioritization process, it is recommended that those involved defer to the HIA's guiding principles, as well as the values established during the Scoping Phase, and/or engage key informants or stakeholders to discuss potential solutions (Harris et al., 2007). In order to influence the proposal, actionable recommendations should be formulated in the subsequent phase based upon the prioritization of health impacts, and will focus on those of high importance and high modifiability (Harris et al., 2007; NCCHPP, 2019).

A.4 Recommendations Phase

Purpose:

During the Recommendations Phase, appraisers will consider the assessment findings and devise suitable strategies to improve a proposal's impact on health. By developing justifiable recommendations, appraisers can influence the decision-making process to ensure that the final iteration of a proposal is most favourable to health—which is a fundamental aim of the HIA (Birley, 2011; NCCHPP, 2019). Recommendations may suggest that fundamental changes be made and/or secondary or compensatory measures be added to a proposal (NCCHPP, 2019). On occasion, it may be recommended that a proposal not proceed at all (Harris et al., 2007). Not all proposals, however, will benefit from recommendations; some proposals may be best left unchanged (Harris et al., 2007).

Actors Involved:

The Project Team, as well as the Steering Committee, will work together to propose suitable recommendations in order to minimize negative or maximize positive health impact(s) associated with a proposal (NCCHPP, 2019).The appraisers involved, however, may not always possess the expertise required to suggest design alternatives or mitigation strategies; and, as such, may find it necessary to engage policy-makers, experts, and/or key stakeholders in order to devise pragmatic and feasible solutions (Bhatia, 2011; NAHPSWG, 2019).

Activities Involved:

A draft set of action-oriented recommendations is typically first developed by the Project Team. The Steering Committee will then work to enhance and later endorse the recommendations proposed (NCCHPP, 2019). The final set of recommendations will be compiled into a report—summarizing the HIA process and providing justification for each recommendation—and passed onto the decision-maker, who will then decide whether to accept or reject the strategies proposed (NCCHPP, 2019). Development of the HIA report is described in more detail in subsequent description of the Reporting Phase. Birley (2011) notes that decision-makers are often more likely to accept a recommendation when they share a strong working relationship with the appraisers involved. As such, it is advisable to include decision-makers early on in HIA process, for example, as part of the Steering Committee (Birley, 2011).

Formulating Recommendations:

The recommendations formulated should be supported by empirical evidence, and be based upon the prioritization of health impacts (as determined during the Assessment Phase) (Harris et al., 2007; NCCHPP, 2019). As well, strategies proposed should focus on health impacts deemed to be of high importance and high modifiability (Harris et al., 2007). and, should align with the values and objectives of the HIA (as described in 'Terms of Reference' document) (Birley, 2011). All recommendations should be accompanied by an explanation to justify their implementation and to encourage decision-makers to base implementation decisions on merit rather than cost (as they are so often inclined) (NCCHPP, 2019). Optimal recommendations will seek to influence multiple health determinants and also extend benefits to the surrounding community (Birley, 2011). Factors to consider when developing recommendations include:

- the scope of the HIA, as well as the health determinant(s) impacted (Bhatia, 2011);
- the activities involved, resources required, and party (or parties) responsible for their implementation (Harris et al., 2007; Birley, 2011);
- the likelihood of implementation (NCCHPP, 2019);
- the timing of implementation (short-, medium-, or long-term) (NCCHPP, 2019);
- the technical feasibility, including economic, social, and/or political barriers to implementation (NCCHPP, 2019);
- the monitoring processes required to ensure proper and timely implementation (NCCHPP, 2019); and,
- the level of support from key stakeholders, as well as the populations affected by the proposal (NCCHPP, 2019).

Formal criteria to evaluate the strength of recommendations does not yet exist in HIA practice. However, Birley (2011) has developed standards to suggest what constitutes a strong recommendation (see Table 36.). It should be noted that negative impacts, or externalities, may still occur despite the implementation of proposed mitigation strategies (Birley, 2011). If only partial relief from a health impact is anticipated, this should be clearly described in the final HIA report (Birley, 2011).

Recommendations should…
• "be supported by empirical evidence (i.e. not based solely on theory) and justified; • be practical; • aim to minimize health loss and maximize health gain; • be socially acceptable; • align with laws, government policies and program; • consider the cost of implementation; • consider the opportunity cost (i.e. could the money be better spent elsewhere?); • include preventative as well as curative measures; • be prioritized as short-, medium-, or long-term; • identify the drivers and barriers for change; • identify a lead agency or individual to implement and fund it; • be capable of being monitored and evaluated; • improve social equity; • be specific to the stage of the proposal; • address a priority impact based on consequence of the effect and the probability that it will occur; • affect a number of health determinants at once; • be technically adequate; • include a method of monitoring; and, • be sustainable."

Table 36. HIA Recommendation Standards—this table describes standards developed by Martin Birley, HIA expert and practitioner, to suggest what constitutes a strong recommendation. (source: quote from Birley, 2011 adapted into a table by author).

Types of Recommendations—generally, there are two types of recommendations:

1. those that seek to mitigate negative health outcomes; and,
2. those that seek to maximize positive health outcomes.

Borrowing from the field of Occupational Health and Safety, Birley (2011) proposes two recommendation hierarchies: one for the mitigation of negative health impact(s) (see Table 7. located in the main body of this thesis) and another, for the maximization of positive health impact(s) (see Table 8. located in the main body of this thesis).

Mitigation of Negative Health Impact—mitigation recommendations that suggest fundamental changes to a proposal in order to avoid the negative impact(s) to health entirely, should be of highest priority. Recommendations that suggest measures be added to a proposal, either on-site or off-site, to minimize impact, should then be considered. Next: recommendations that suggest measures to repair any negative impact(s) associated with a proposal. When all other options have been exhausted, recommendations should then be proposed to offset any negative impact incurred (Bhatia, 2011).

Maximization of Positive Health Impact—conversely, health maximization recommendations that suggest fundamental changes to a proposal in order to benefit all populations impacted, should be of highest priority. Recommendations that suggest targeted strategies to address the specific health needs of vulnerable populations in order to ensure they experience the most benefit from the proposal, should then be considered. Next: recommendations that suggest measures be added to a proposal in order to promote positive health behaviours in individuals. Of lowest priority are recommendations that suggest programs, presentations, or the like to proactively educate individuals, so that they can make informed decisions about their health (Birley, 2011).

A.5 Reporting Phase

Purpose:

During the Reporting Phase, the results of the HIA will be summarized and distributed to all those invested in or impacted by the proposal, such as the proponent, decisions-makers, and public (Harris et al., 2007). Decision-makers will ultimately consider the information contained within the HIA report to inform further action to be taken: whether to modify the proposal or not (Harris et al., 2007). As well, the Reporting Phase allows the public opportunity to appraise the assessment findings and recommendations, and to provide feedback. Documentation of the HIA can also contribute to advancing HIA practice (Harris et al., 2007). The exact approach to documenting and disseminating the final HIA report should have been decided upon during the Scoping Phase.

Actors Involved:

The Project Team, with input from the Steering Committee, is typically responsible for the development of the report. It may also be necessary—or advantageous—to enlist external communications support to devise innovative marketing strategies in order to ensure the successful promotion of the report (Bhatia, 2011). Additionally, stakeholders can be recruited to communicate the principle findings and recommendations in situations where language barriers exist or there is distrust of authority (Bhatia, 2011).

Activities Involved:

Activities involved in the Reporting Phase include:

- developing a draft report;
- enabling opportunity for public review; and,
- disseminating the final HIA report.

Effective reporting strategies are paramount to the successful promotion and implementation of the proposed recommendations (Harris et al., 2007).

Develop Draft Report:

A draft report should be developed to provide the intended audience(s) with a complete overview of the assessment process, findings, and recommendations (Harris et al., 2007). The length of the report will depend on the level of HIA undertaken (Desktop, Rapid, Intermediate, or Comprehensive), however, all reports should offer insight into the following aspects of the assessment:

- the proposal under evaluation, as well as the social, political, and economic circumstances that surround it (NCCHPP, 2019);

- the individuals involved, including description of their roles, contributions, and any acknowledgment of conflicts of interest (Bhatia, 2011; NAHPSWG, 2009);
- the funding sources or sponsors of the HIA (Birley, 2011);
- the methods employed (data collection, analytic, etc.), and their rationale (Bhatia, 2011; NCCHPP, 2019);
- the existing community health and environmental conditions (Bhatia, 2011; NAHPSWG, 2009);
- the availability of evidence related to each health impact assessed, including identification of gaps in knowledge and/or assumptions made (NAHPSWG, 2009);
- the criteria used to characterize and prioritize each health impact (Bhatia, 2011; NAHPSWG, 2009); and,
- the action-oriented recommendations proposed, including detailed description of the findings used to justify each, the party or parties responsible for their implementation, and identification of their priority and feasibility (Bhatia, 2011; EcoPlan, n.d.; NAHPSWG, 2009;

To improve effectiveness of HIA practice, it is also beneficial to include a transparent evaluation of the HIA process itself (Harris et al., 2007), to describe any lessons learned (NCCHPP, 2019) or limitations experienced (Bhatia, 2011). Plans for monitoring changes to health over time should be outlined (Bhatia, 2011). Evaluation and monitoring methods will be discussed in more detail in subsequent description of the Evaluation and Monitoring Phase. The report should be clear and succinct, and framed according to the language, culture, and education-level of the intended audience (Bhatia, 2011). In order to facilitate compilation of the report, it is recommended that appraisers rigorously document the assessment process—in writing—as it unfolds (Harris et al., 2007).

Opportunity for Public Review:

Stakeholders, as well as the population(s) affected, should be given opportunity to review and criticize the draft report prior to its acceptance by the proponent (Bhatia, 2011; Harris et al., 2007). Public review can, for example, piggyback on existing regulatory processes, such as public hearings (Harris et al., 2007). Appraisers should provide formal, written responses to criticisms made and/or revise the report as necessary following the public review period (Harris et al., 2007). The final report should be made available to the public (Bhatia, 2011).

Disseminating Final Report:

HIA outreach can take many forms, including: distribution of a comprehensive report, executive summary, or fact sheet; testimony during formal decision-making processes; or even launch of a media campaign (see Table 37.). Various iterations of the report, each describing the report findings in a different way for

a different audience, may be needed to communicate the findings to a wider range of readers (Bhatia, 2011; NAHPSWG, 2009). Birley (2011, p. 126) explains, for example, "a board of directors may just need an executive summary; the press and media need a press release; academic researchers need the entire report and any other documentation; [and,] local residents need a synopsis of the report in their own language." HIA guidance suggests that it is often worthwhile for appraisers to have a face-to-face meeting with the proponent, decision-makers, and key stakeholders in order to effectively convey the primary HIA findings and recommendations, answer questions, and clarify any unfamiliar public health-related concepts (Bhatia, 2011). The scale of the communication strategies selected should align with the level of HIA undertaken (EcoPlan, n.d.).

Common Written Forms
Comprehensive HIA report
Executive Summary
Press release/Press advisory
Formal Decision-Making Process Forms
Testimony at public hearings
Public comment and response processes *(in EIA: regulatory standard setting processes, permit approval, etc.)*
Legislative briefings
Other Media for a Broader Outreach/Dissemination
Op-ed and letters to the editor
Meeting with editorial boards
Organizational newsletters, emails, outreach materials
Community workshops or panel discussions
Distribution of materials door-to-door
Distributed materials to local residents
Distributed materials to other stakeholders
Article in popular magazine
Article in peer-reviewed journal
Graphic/visual representations
Radio, TV, interviews
Websites/Blogs (distributed materials online)
Presented report findings and recommendations to public
Presented report findings and recommendations to decision-makers

Table 37. Forms of Communication in HIA Practice—this table enumerates common methods used to communicate HIA methods, findings, and recommendations during the Reporting Phase in HIA practice. (source: Bhatia, 2011) Reproduced with permission from the publisher.

A.6 Evaluation and Monitoring Phase

Purpose:

'Evaluation' refers to the comparison of the actual results, or outcomes, against the anticipated outcomes. Whereas, 'monitoring' refers to the continued observation of data over time. During this phase, evaluation and monitoring activities are planned in greater detail, but the activities are typically carried out following the acceptance of the final HIA report by the proponent or decision-makers. Despite the inherent value of each, resources are not often allocated to support evaluation or ongoing monitoring efforts following the execution of an HIA (Bhatia, 2011). Even still, HIA guidance advises appraisers to recommend that evaluation and monitoring activities be conducted (Bhatia, 2011).

There are typically three different methods of evaluation in HIA: process, impact, and outcome evaluation (see Table 8. located in the main body of this thesis). Process evaluations can help to advance HIA theory and practice (Harris et al., 2007). Impact evaluations can improve the effectiveness of the HIA as health promotion tool (NCCHPP, 2019); and, outcome evaluations can enable modifications to be made, as necessary, following implementation of recommendations (Bhatia, 2011). The particulars of these methods are outlined below.

The health impact(s) of a proposal, as well as the implementation of recommendations, can be monitored over a defined period of time. Monitoring, in general, encourages continued involvement and investment in a proposal by the proponent, decision-makers, and public (Harris et al., 2007). Monitoring health impact(s) of a proposal enables those involved to understand if the anticipated positive health impact(s) materialized or were enhanced, or if the anticipated negative health impact(s) materialized or were mitigated following implementation (Harris et al., 2007). Monitoring also assists with identifying any unintended or unanticipated health impact(s) (Harris et al., 2007). In addition, monitoring health impact(s) can be particularly useful when uncertainty exists surrounding the health impact(s) of a proposal or when health impacts are unavoidable (NCCHPP, 2019). Tracking implementation of recommendations by the parties responsible, helps to ensure their proper execution (NCCHPP, 2019). Monitoring plans can assist appraisers in tracking health impact(s) and the implementation of recommendations—the particulars of these plans are outlined below.

Actors Involved:

Evaluation requires participation from both the Project Team and Steering Committee. Key stakeholders and external evaluators may also be engaged throughout the evaluation processes, as necessary (Harris et al., 2007).

Monitoring plans should be developed with input from the proponent, individuals or organizations responsible for managing the monitoring activities, and those impacted by the proposal (Bhatia, 2011; Harris et al., 2007). Monitoring activities, however, require ongoing participation from various individuals and organizations, such as the appraisers, proponent, local government, health department, and/or residents (Harris et al., 2007). Results from evaluation and monitoring activities should be shared with all parties impacted by the proposal, including the proponent or decision-makers, key stakeholders, and public.

Activities Involved:

Those involved in the HIA process should refer to the Terms of Reference, as established by the Steering Committee during the Scoping Phase, to guide the Evaluation and Monitoring Phase. To plan the evaluation component: evaluation tasks that need to be undertaken, should be identified; the individuals to be included in the evaluation process, noted; and, the criteria on which the evaluation(s) will be judged, articulated. Depending on the method of evaluation selected, data may first need to be collected, or health indicators, 'monitored'. To plan the monitoring component: health outcomes and indicators to be monitored should be identified; implementation tasks to be monitored, described; the individuals or organizations responsible for tracking their progress, listed; and, a plan for monitoring, developed (Bhatia, 2011). Strategies should be developed to effectively communicate results of evaluation and monitoring to the proponent, decisions-makers, and public (Bhatia, 2011). As well, sufficient resources must be available to execute evaluation and monitoring activities (Bhatia, 2011).

Methods of Evaluation: Process, Impact, and Outcome:

Process and impact evaluations are more readily conducted in HIA than outcome evaluations (Harris et al., 2007). Process evaluations appraise the quality of the assessment conducted by comparing assessment procedures in practice with those that were outlined by the Project Team and Steering Committee in the Terms of Reference (Harris et al., 2007). Process evaluations will consider questions, such as: how were the health needs of vulnerable populations addressed (Harris et al., 2007; NCCHPP, 2019); or, were additional resources required to complete the assessment (NCCHPP, 2019)? Process evaluations can be conducted immediately following the assessment, and the conclusions drawn should be included in the final HIA report (NCCHPP, 2019). Impact evaluations appraise the influence of the HIA on the proposal, society, and decision-making processes (Bhatia, 2011; Harris et al., 2007; NCCHPP, 2019). Impact evaluations will consider questions, such as: were the recommendations implemented by the decision-makers, why or why not (Harris et al., 2007; NCCHPP, 2019); or, does

the public have a greater understanding of the factors influential to health as a result of the HIA process (Bhatia, 2011)? HIA guidance suggests that impact evaluations be completed 12 – 18 months following the acceptance of the final HIA report by the proponent or decision-makers (Harris et al., 2007). Outcome evaluations appraise the long-term health outcomes associated with the implementation of a proposal (Harris et al., 2007). Outcome evaluations can be methodologically complex. For example: impacts to health can take time to manifest, the data collection period prior to evaluation can be resources-intensive, and local population can change—demographically—over time (Bhatia, 2011; Birley, 2011). The majority of resources in an HIA are allocated toward the Assessment and Recommendation Phases, so it is important to align the evaluation scope and method(s) with the limited resources available (time, staff, budget, etc.) (NCCHPP, 2019).

Monitoring Plans: Implementation and Health Impact Management Plans

In HIA practice, there are primarily two types of monitoring plans: Health Impact Management Plans and Implementation Management Plans. A comprehensive Health Impact Management Plan will describe how health impact(s) should be monitored; define triggers and thresholds to indicate when unacceptable changes in health (including health inequities) occur or are about to occur; outline the actions to be taken if changes in health occur or are about to occur; and, identify the parties responsible for overseeing monitoring processes and/or executing any necessary monitoring activities (Harris et al., 2007). A comprehensive Implementation Management Plan will describe each recommendation, the timeline and parties responsible for their implementation, as well as the criteria necessary to determine successful implementation (Bhatia, 2011; Birley, 2011). Each plan should also describe their approach to disseminating the results from the ongoing monitoring activities.

APPENDIX B

Detailed HIA Case Study Scoping Review Findings

This appendix chapter expands on the more high-level findings discussed in Chapter 7. Discussed herein are the assessment characteristics, assessment resources, and methods of assessment for the HIA case studies reviewed.

B.1 Assessment Characteristics

Overview:

In all the HIAs, assessments focused on proposals for design-related policies or plans, or discrete design projects. Proposals primarily addressed design at neighbourhood- and city-scales. Design interventions evaluated included the:

- design of street elements and networks;
- design of green infrastructures and networks;
- design of district master plans;
- propagation of housing types (townhouses, patio homes, and multi-family developments), including considerations for land-use mix and infill development; and,
- curation of building program.

Collectively, assessments sought to:

- identity and assess the health impacts of proposed design interventions;
- compare the impact of two or more design alternatives;
- quantitatively forecast the impact of proposed design interventions; and/or,
- inform improvements to community engagement and outreach strategies.

Assessments were prospective, and conducted either during the proposal planning stages or following the development of a draft proposal.

Scope Parameters: Temporal, Spatial, and Demographic:

Temporal Scope—focused, generally, on the short- and long-term impacts of Design Stage decisions. However, during the Hoboken Stormwater Management HIA, appraisers identified that decisions affecting the construction and operation of their proposal could influence population health outcomes, and so broadened the Temporal Scope of the assessment to include these stages.

Spatial Scope—varied between HIAs, depending upon the design intervention-type and primary spatial scales addressed by each proposal. HIAs that addressed design at the scale of the city, tended to consider city-wide impacts. Whereas, HIAs focused on localized projects, tended to limit Impact Area to the area immediately surrounding the project site. Colorado School-Based Health Centres HIA, which assessed programmatic design interventions throughout the City, restricted Impact Area to a certain building type (K – 12 schools) within Colorado Springs.

Demographic Scope—all HIAs considered the health needs of both general and vulnerable populations, save for Colorado School-Based Health Centres HIA, which focused efforts solely on school-aged children and their families. The Colorado School-Based Health Centres HIA paid particular attention to those who may have been uninsured or underinsured, or without adequate access to healthcare services. General populations included local residents and/or end-users, such as pedestrians and cyclists, within the Impact Area of each HIA. Vulnerable populations that were considered included:

- children;
- young adults;
- young families;
- older adults;
- low- and middle-income individuals and families;
- persons with physical, mental, or emotional disabilities; and,
- persons who could not drive or were without access to a car.

Health Determinants Considered:

Combined, the HIAs considered a broad range of health determinants to be acted upon upstream in order to improve population health outcomes downstream. Health determinant domains evaluated included:

- **Individual Health**—mental well-being.
- **Behavioural Risk Factors**—diet; physical activity/inactivity; smoking; alcohol consumption; drug addiction; and, leisure and recreational activities.
- **Family and Community Structure**—civic engagement.
- **Employment and Livelihood**—employment and job security.
- **Housing**—housing safety and quality; housing supply/type, affordability, and accessibility; and, residential segregation.
- **Environmental Quality**—air quality; water quality and safety; food resources and safety; active transportation hazards e.g. pedestrian/cyclist safety; mixed land-uses; neighbourhood street infrastructure; and, access to green spaces.
- **Public Services**—educational access; healthcare access; waste systems and services; policy, security, and emergency response; recreational centres; and, public transportation.
- **Private Services**—access to retail food services.

B.2 Assessment Resources

Overview:

Consideration for the HIA process was initiated by a variety of actors, including: local and regional governments and agencies, academic institutions, and non-profit organizations. Generally, proponents of the proposals were local governments, and decision-makers were locally elected officials. For example: the proposal proponent in the Colorado School-Based Health Centres HIA was a non-profit hospital, which utilized the HIA to address regulatory requirements (community benefit activities) necessary to maintain their non-profit status. In this HIA, the decision-makers were hospital executives. Most HIAs were voluntarily conducted in partnership, or in agreement, with the proposal proponent to support decision-making processes (i.e. decision-support HIAs). Hoboken Stormwater Management HIA, however, was completed independent of the proposal proponent in order to promote health within the proposal (i.e. an advocacy HIA).

HIAs were funded through a number of sources, including: grants from research institutions or non-profit organizations (faith-based research and community organizations, or hospitals) and/or government programs. The level of inquiry conducted in some HIAs was more comprehensive than others. As such, the time required to complete each assessment ranged from 0 – 6 months to 19 – 24 months.

Project Teams:

Areas of expertise on Project Teams included: public health, planning, public works, and/or community and policy development. There was public health representation on all but one Project Team: Hoboken Stormwater Management HIA. However, public health was represented on their Steering Committee. Project Team members were either recruited internally through the HIA managers; associated with the proposal proponent; or, outsourced. In HIAs where Project Team members were not associated with the proposal proponent, the proponent acted as a key informant. As well, Project Team members with less HIA experience were typically supported by external HIA experts. Project Teams were responsible for executing the assessment activities throughout all phases.

Steering Committees (or similar):

Only three of seven HIAs examined established multi-disciplinary, intersectoral Steering Committees. Steering Committees were composed of:

- local, regional, and federal officials or government (including government agency) staff;

- academics and researchers;
- non-profit organization leaders; and/or,
- local residents.

Throughout the assessment process, Steering Committees worked alongside Project Teams to:

- judge the feasibility and value of the HIA;
- provide specialized input concerning the circumstances surrounding a proposal;
- develop goals, objectives, and research questions;
- define the assessment scope, including spatial, temporal, and demographic scopes, as well as selected health impacts and related determinants to be assessed;
- strategize research methods, including recruitment opportunities or approaches for stakeholder and affected population engagement activities;
- discuss and interpret assessment findings; and/or,
- develop and finalize recommendations.

Colorado School-Based Health Centres HIA, however, established both a Steering Committee and a formal Stakeholder Group. The Steering Committee solely provided the Project Team with methodological and content support. Whereas, the formal Stakeholder Group assisted the Project Team in refining the assessment scope, strategizing research methods, conducting assessment activities, and provided feedback on draft recommendations. Liberty Street Design HIA also formed a Stakeholder Group, which fulfilled a role similar to a traditional Steering Committee.

Stakeholders and Affected Populations Outreach and Engagement:

Outreach and engagement activities with stakeholders and affected populations were conducted throughout many phases of the HIAs included in this review. Forms of outreach and engagement included:

- community-wide resident surveys,
- interviews,
- focus groups,
- forums and/or meetings,
- PhotoVoice exercises,
- town hall meetings, and
- formal committee meetings open to the public.

The intent of these outreach and engagement activities was to:

- understand local perceptions of the built environment, and to, together, define qualities and components of a 'healthy community';
- understand local perspectives for and against design alternatives;

- identify local, priority health concerns to inform future decision-making (e.g. trade-offs);
- supplement and/or validate findings from existing data or literature;
- collect more precise and/or up-to-date information;
- investigate factors influential to current resident health behaviours (i.e. to evaluate causal relationships), including barriers and facilitators;
- understand the particular needs and experiences of vulnerable populations;
- identify assets and challenges within the community;
- discuss findings, generate recommendations, and/or solicit feedback; and,
- build or strengthen local networks.

Most importantly, the appraisers involved understood the value of enabling self-determined community change through the engagement of stakeholders and affected populations. Key stakeholders included: local residents and businesses; local and/or regional governments, including essential services; schools; drivers; and, impacted authorities and community service providers and partner organizations. For enumeration of affected populations, refer to Section B.1 Scope Parameters: Demographic Scope.

Key Informant Consultation:

The majority of HIAs in this review consulted key informants through a variety of means, such as online surveys, and structured and semi-structured interviews—either via telephone or in-person. The intent of consultation was to:

- gather local and relevant, health-related information;
- solicit input concerning potential health impact(s) associated with the proposal;
- gain insight into existing or potential implementation barriers and/or facilitators;
- assist in identifying potential stakeholders and affected populations;
- assist in recruitment efforts for and facilitation of outreach and engagement activities; and,
- compare lessons learned from informants' professional experience with findings from the literature.

For example: during the Liberty Street Design HIA, appraisers noted that the opinions of the first-responders surveyed differed from those of urban planners discovered in their literature review regarding street design. The literature revealed that urban planners tended to prefer more narrow streets, while the first-responders indicated wider streets were more amenable to faster emergency response times (Ilabaca-Somoza et al., 2016). Key informants included local and/or regional governments, including essential services; governmental consultants; and, local community service providers and leaders.

Expert Consultation:

A number of the HIAs engaged experts throughout the HIA process. Experts provided specialized knowledge and assisted in developing research methodologies. An academic partner, for example, assisted the Liberty Street Design HIA Team by conducting textual analysis of open-ended survey responses included in the community-wide survey (Ilabaca-Somoza et al., 2016). East Aldine Town Centre Design HIA Team consulted a traffic collision engineer when quantitatively forecasting the percent reduction in pedestrian-vehicular collisions expected by implementing the proposal (Cummings et al., 2016a). As well, Hoboken Stormwater Management HIA Team interviewed subject-matter experts to improve their understanding of potential health impacts associated with the implementation of green infrastructures (Carnegie et al., 2016).

B.3 Assessment Process

Overview:

Leading HIA guidance suggests that appraisers apply consensus-based, systematic approaches to address each phase of the assessment:

- **Screening Phase**—appraisers should consider the value and feasibility of conducting an HIA;
- **Scoping Phase**—appraisers should define the limits of the assessment, develop work plans for each phase, and develop a preliminary causal model to illustrate plausible connections between the proposal and health;
- **Assessment Phase**—appraisers should conduct a variety of assessment activities in order to evaluate, characterize, and prioritize potential health outcomes related to a proposal;
- **Recommendations Phase**—appraisers should devise action-oriented, evidence-based recommendations to improve a proposal's impact on health;
- **Reporting Phase**—appraisers should communicate assessment methods, findings, and recommendations to all those involved in or impacted by the proposal; and,
- **Evaluation and Monitoring Phase**—appraisers should conduct the necessary monitoring activities and compare actual outcomes against anticipated outcomes.

All seven of the HIAs examined conducted the six phases of the HIA and generally following best practices, as described. Project Teams utilized mixed-methods approaches to assess the potential health outcomes related to proposals. Stakeholders and affected populations were engaged throughout all phases, ensuring the process remained democratic. As well, both design and design-support recommendations were developed to improve each proposal's impacts on health. Assessment proceedings and recommendations were communicated to decision-makers, stakeholders, and those affected by the proposal through a variety of means. At the time of documentation, no HIA had yet completed any evaluation or monitoring activities. Four of seven HIAs described their intentions with regard to evaluation; all methods of evaluation were proposed to be undertaken: process, impact, and outcome. Monitoring activities were organized if order to collect the information necessary to support evaluation.

Screening Phase in Practice:

Actors involved in Screening Phases:

- gathered background information;
- clarified proposal components and decision(s) to be addressed;
- considered the proposal's potential impact on health;

- judged the feasibility and value of conducting an HIA;
- identified core stakeholder groups and/or vulnerable populations to be engaged and addressed; and/or,
- developed assessment objectives and goals.

In the case of Colorado School-Based Health Centres HIA, a Community Needs Health Assessment,[1] which had previously been conducted, acted as the Screening Phase of the HIA. Deviating from HIA guidance, many Project Teams, Steering Committees (or similar), and/or stakeholder groups were also formally established in this phase. For some of the HIAs examined, Screening Phase activities were carried out by Project Teams alone. For others, decisions were consensus-based, and activities were completed alongside the proposal proponent, decision-makers, key informants, and/or stakeholders. To determine the feasibility and value of executing an HIA, assessors utilized formal screening tools, existing screening criteria, or developed their own screening criteria. Screening criteria considered by those involved included:

- a proposal's impact on health;
- level of professional or community concern for the proposal's impact on health;
- scale, significance, and distribution of potential health outcomes;
- ability of the HIA to contribute new information to decision-making processes;
- timing of the HIA with respect to decision-making processes;
- ability of the HIA to influence decision-making processes (e.g. decision-maker's willingness or political barriers to institute changes);
- availability of existing data or evidence;
- availability of and access to resources required to carry out the assessment (time, funding, staff or expertise);
- value-added of the HIA process (e.g. to strengthen intersectoral partnerships, or to develop local understanding for connections between health and the built environment); and,
- value and effectiveness of the HIA as compared with alternative evaluation methods.

Primary motivations established in favour of conducting the HIAs examined, included:

- ensuring health is a key consideration within the proposal, decision-making, and implementation;

[1] a Community Health Needs Assessment (CHNA) is a systematic evaluation of a population's health, used to identify priority health needs within a community. Prior to the Colorado School-Based Health Centres HIA, the Children's Hospital of Colorado had conducted a CHNA and identified child physical activity and mental health as priority areas to be addressed through their community benefit activities in El Paso County. The CHNA provided HIA assessors with background health data, identification of priority health needs, as well as the justification and support for executing a full HIA.

- enabling self-determined community change through engagement of stakeholders and affected populations;
- building local capacity for HIA;
- identifying and assessing health impact(s) to inform future development;
- ensuring that any positive health impact(s) are maximized; and,
- addressing known preventable health impact(s) associated with the proposal.

Additional motivations as noted by appraisers in the reports examined are described in the grey box below:

To address health by:
- ensuring health is a key consideration within the proposal, decision-making, and implementation;
- identifying and assessing health impact(s) to inform changes to the proposal and/or future development;
- ensuring that any positive health impact(s) are maximized;
- ensuring that any negative health impact(s) are minimized; or,
- addressing known preventable health impact(s) associated with the proposal.

To advance evidence-based practice by:
- utilizing evidence-based approaches to inform the proposal, decision-making, and implementation;
- building local capacity for HIA; or,
- applying HIA to a new discipline or in a new context.

To address community need by:
- addressing existing concerns voiced by residents; or,
- enabling self-determined community change through engagement of stakeholders and affected populations.

To utilize the HIA as a complement other processes by:
- addressing existing recommendations for improvement; or,
- meeting regulatory requirements.

To influence or improve decision-making processes by:
- developing evidence-based recommendations for planning and implementation;
- strengthening intersectoral partnerships; or,
- allowing HIA appraisers to act as neutral third parties—e.g. moderating between local government and residents.

Scoping Phase in Practice:

Description of Scoping Phase activities, as well as the rationale supporting decisions that were made, was limited in the reports. Actors involved in Scoping Phases:

- established Steering Committees (in instances where this had not yet been done);
- developed research questions and conducted preliminary research activities, such as:
    - reviewed existing literature and data;
    - engaged stakeholder and affected populations;
    - consulted local content experts.
- developed assessment work plans, including project timelines and division of tasks between Project Team members; and/or,
- developed preliminary causal models.

For the majority of HIAs, however, causal model development did not occur until the Assessment Phase. Colorado School-Based Health Centres HIA did not describe developing a causal model at all. It remains unclear if or how values and Terms of Reference were drafted to guide each assessment, and how health impacts were selected. Generally, all Scoping Phase activities were consensus-based, involving a broad range of actors, including the proposal proponent, Project Team, Steering Committees (or similar), stakeholders, key informants, experts, and/or affected populations.

Assessment Phase in Practice:

During each Assessment Phase, hypotheses developed in Scoping Phases were validated, and any preliminary investigations conducted, expanded. Actors involved in Assessment Phases:

- collected existing research and data;
- conducted original data collection;
- detailed and evaluated causal relationships between proposals, health determinants, and health impacts;
- investigated design alternatives and compared anticipated health impacts between alternatives;
- developed community health and environmental profiles;
- quantitatively forecasted future health impacts; and/or,
- characterized health impacts.

It remains unclear if or how those involved prioritized health impacts related to proposals. As abstracted from the reports, prioritization of health impacts appeared to be based on the interests and concerns of decision-makers, stakeholders, and affected populations, rather than on the characterizations of health impacts.

Project Teams were primarily responsible for executing activities involved in Assessment Phases. As well, Project Team members contributions often aligned with their respective disciplines. For example: Omaha Street Connections and Development Review Processes HIA Team included public health and urban-planning practitioners. The public health practitioner was responsible for:

- gathering and assessing health data;
- reviewing existing literature concerning the health impacts associated with the proposal;
- developing the health-related section of the community profile; and,
- leading outreach and engagement activities.

Whereas, the urban-planning practitioners were responsible for:

- mapping and analyzing spatial data; and,
- developing the environment-related section of the community profile.

Together, they characterized the health impacts associated with the proposal. In cases where Project Team members did not possess the expertise or technical skills required, external experts or community partner organizations were engaged. In addition, Steering Committees (or similar) and stakeholders provided Project Teams with methodological advice, shared local knowledge, and/or reviewed findings.

All HIAs applied mixed-methods approaches when sourcing the evidence necessary to support assessment activities. Multiple sources were used by Project Teams to validate and strengthen findings, including:

- review of available information;
- original observational studies;
- environmental modelling or spatial analysis;
- quantitative forecasting;
- expert consultation;
- key informant consultation;
- stakeholder and affected population outreach and engagement; and,
- consultation with decision-makers and Steering Committees (or similar).

Evaluating Causal Relationships—Project Teams evaluated causal relationships between:

- **existing built environment features and current health behaviours**—by conducting community-wide surveys;
- **proposals and health**—by reviewing peer-reviewed and grey literature, and reports of completed HIAs;
- **design alternatives and health**—by reviewing peer-reviewed and grey literature, and conducting precedent analysis (e.g. site visits); and/or,

- **proposals and successful implementation strategies**—by conducting precedent analysis and interviews with key informants.

Grey literature was often consulted when evidence specific to their research question(s) was limited in peer-reviewed sources. (Pasadena) In some cases, scientific literature was not readily available to appraisers (e.g. appraisers did not have access to peer-reviewed journals). Appraisers sometimes expressed difficulty establishing direct, causal relationships between the built environment and health. Features of the built environment are multivariable and complex, making it hard to identify causation (Carnegie et al., 2016). In addition, studies of the built environmental are typically observational in their design, and as such, not as reliable as other study-types (e.g. randomized controlled trials) when examining cause-effect relationships (Carnegie et al., 2016).

Developing Community Health and Environmental Profiles—to develop community profiles, Project Teams reviewed existing reports and data. Census data, as well as local and regional surveillance data, were readily available and frequently cited as valuable resources. In some cases, however, official data:

- was not at the spatial scale or level of detail required;
- was not in a workable format to conduct statistical or spatial analyses (e.g. data had been aggregated); or,
- was based on sample sizes that were too small to provide true representation of community health status.

To supplement existing health and environmental data, a number of Project Teams conducted original research. Project Teams administered community-wide surveys, interviewed key informants and experts, and carried out observational studies. East Aldine Town Centre Design HIA Team, for example, collected data relating to existing street network infrastructure (e.g. vehicular, pedestrian, bicycle, drainage, etc.) and street elements and traffic control devices (e.g. bus stops, stop signs, ADA ramps, pedestrian crossings, etc.) within a one-mile radius of the proposal site.

Quantitatively Forecasting Impacts—few HIAs quantitatively forecasted impacts associated with the proposal, save for East Aldine Town Centre Design HIA and Pasadena Infill Development HIA. Comprehensive in their approach, the East Aldine Town Centre Design HIA Team forecasted the:

- percent reduction on pedestrian-vehicular collisions associated with the implementation of proposed crash reduction countermeasures;
- economic impacts of the change in pedestrian-vehicular collisions predicted;
- number of Disability-Adjusted Life Years (DALYs) saved following implementation;
- economic value of the yearly savings associated with DALYs saved;
- economic impacts of the proposal on property values and retail sales; and,

- cost-effectiveness of the financial outcomes of the proposal (physical activity benefits, increase in property values and retail sales, and costs associated with pedestrian-vehicular collisions) against the costs of construction.

Pasadena Infill Development HIA Team predicted neither health nor economic impacts, but rather analyzed the impact of potential changes to planning policies on housing supply. Specifically, the Project Team calculated the number of units gained if policies were relaxed to allow for denser, multi-family units on smaller lots.

Characterization of Health Impacts—not all HIAs examined described the methods used to characterize health impacts following evidence gathering and analysis. Of those that did, however, factors considered included: direction, likelihood, magnitude, duration, and distribution of impact; as well as strength of evidence supporting the anticipated impacts between proposals and health. Generally, the more comprehensive the level of inquiry, the more factors appraisers tended to consider.

Recommendations Phase in Practice:

In all of the HIAs examined, design and design-supportive recommendations, both short- and long-term, were developed to improve each proposal's impact on health. Approaches to generating recommendations varied between HIAs. Project Teams drafted, reviewed, and refined recommendations:

- without external guidance or review (from a Steering Committee or otherwise) (Douglas County Health Department, 2016; Wade et al., 2016);
- in conjunction with a Steering Committee (or similar) (Carnegie et al., 2016); or,
- with involvement from stakeholders in one or more stages of the development process (Cummings et al., 2016a; Ilabaca-Somoza et al., 2016; Rothwell et al., 2016).

Recommendations were based on empirical evidence (as opposed to theory) gathered during Scoping and/or Assessment Phase activities. Furthermore, Project Teams valued many sources of evidence when suggesting improvements to be made, including:

- peer-reviewed and grey literature;
- local health and environmental data;
- stakeholder, community, expert, and informant input; and/or
- quantitative modelling predictions.

However, justification for each recommendation was not always made explicit in the reports. All final recommendations were included in each of the HIA reports.

Recommendations primarily focused on improving a proposal's impact through local changes, limited to each defined Impact Area. Though some Project Teams

acknowledged that certain health impacts were also dependent upon factors outside of a proposal's jurisdiction, and so extended the reach of their suggestions. Hoboken Stormwater Management HIA, for example, recognized that implementation of green infrastructures within the City would not alone combat sewer system- and flooding-related issues experienced by local residents. Additional recommendations were included to encourage integration of stormwater management strategies within regional policy—specifically: North Hudson Sewerage Authority's Long-Term Control Plan, and Hudson County's Multi-jurisdiction Hazard Mitigation Plan. Similarly, East Aldine Town Centre Design HIA noted that the multi-modal transportation routes proposed within the town centre would be rendered ineffective if not extended beyond site boundaries. As a result, the Project Team specified partnerships to be developed in anticipation of upcoming construction projects within East Aldine to ensure implementation of complete multi-modal transportation routes throughout the management district.

Design Recommendations—in all of the HIAs recommendations were made to modify the design of each proposal in order to mitigate associated negative and/or maximize, positive health outcomes. Approaches taken to address proposal improvements included fundamental design modifications and secondary design measures added. Fundamental design modifications were proposed to ensure the proposal features:

- causing negative health impact(s) are eliminated (or severely reduced);
- producing positive health impact(s) benefit the whole population or target the particular needs of vulnerable sub-populations; and/or,
- influence positive health behaviours in end-users.

Moreover, fundamental modifications were proposed across all design scales: human, building, neighbourhood, and city. However, what is considered to be a fundamental design modification is contingent upon the initial scale of the design intervention under assessment. Fundamental modifications in the design of a district master plan, for example, would likely involve changes at the neighbourhood-scale. Whereas in the design of a streetscape in section, changes at a human-scale. Modifications included, for example, the conversion of an existing, controlled intersection to a single-lane roundabout or specification of certain building program. Secondary design measures were suggested to be added, either on- or off-site, to:

- minimize negative health impact(s) associated with the design;
- target the particular needs of vulnerable populations; and/or
- influence positive health behaviours in end-users.

Generally, human-scale design measures that were proposed were discrete interventions or part of larger networks, perceptible only at a neighbourhood-scale. Design measures, for example, included the addition of wayfinding signage or lighting on trails to mitigate the risk of injury to pedestrians and cyclists and/or promote active transport.

Design-Support Recommendations—design-support recommendations were proposed to ensure:

- actual implementation of proposal features;
- proper construction and/or performance of the proposal's features;
- sustained use by end-users;
- healthy behaviour changes by end-users; and/or,
- that the proposal targeted the particular needs of vulnerable populations.

To support proposal improvements, design-supportive recommendations spanned several domains:

- community engagement and outreach,
- training or education programs,
- policy development,
- creation of advisory committees (or similar),
- guidelines or standards,
- pilot projects,
- further research,
- maintenance strategies,
- creation of incentives,
- funding access strategies, and
- development of partnerships.

Through the integration of design and design-support recommendations, appraisers were better able to address the complexity of urban development.

Reporting Phase in Practice:

Only four of seven HIAs detailed the reporting activities that were undertaken. Project Teams generally spearheaded report-drafting efforts. Steering Committees (or similar), in some cases, had opportunity to review the draft report, deliver feedback, and provide their endorsement (Carnegie et al., 2016). There was no mention of opportunities for public review. The assessment proceedings and recommendations were communicated to decision-makers, stakeholders, and those affected by the proposal through a variety of means:

- **comprehensive reports**—appendices, containing more detailed or technical information for interested readers, were often included;
- **executive summary reports**—Omaha Street Connections and Development Review Processes HIA, for example, developed an executive summary report, intended to be accessible to stakeholders and affected populations;
- **presentations to the public** (stakeholders and affected populations);
- **presentations to decision-makers**;

- **graphic or visual aids**—Omaha Street Connections and Development Review Processes HIA developed a 'decision-tree' to help illustrate outcomes associated with decisions concerning the construction of new street connections; and,
- **distribution of the final report to decision-makers, stakeholders, and public**—online via institutional websites and/or hardcopies at the local institutions, such as a public library or City hall.

All four HIAs utilized multiple forms of communication to disseminate results. Furthermore, HIA reports ranged in length between 25 and 112 pages, and described assessment methods, findings, and recommendations with varying levels of detail and transparency.

Evaluation and Monitoring Phase in Practice:

Only four of seven HIAs described their intentions with regard to evaluation and monitoring activities. Between the four HIAs, three types of evaluation methods were proposed: process, impact, and outcome. To conduct a process evaluation, for example, East Aldine Centre Design HIA developed evaluation questions and identified indicators to be assessed that focused on:

- commitment to HIA best practices;
- consideration for health and health equity; and,
- barriers to and facilitators for implementation of recommendations.

To conduct an impact evaluation, Hoboken Stormwater Management HIA suggested that resident experiences with and perceptions of green infrastructures be studied. To conduct an outcome evaluation, Omaha Street Connections and Development Review Processes HIA recommended evaluation of changes to traffic volumes and speeds, pedestrian-vehicular crash rates, and community health following the construction of new street connections. Monitoring activities were proposed to collect information necessary for conducting evaluations. Tasks included: conducting biannual community-wide surveys, as well as interviews with affected populations; and, ongoing data collection of indicators. Evaluation activities were often assigned to the Project Team involved. Whereas, ongoing monitoring activities were to be supported by local governmental staff, academic partners, community partner organizations, regional authorities, or private property owners. In situations where community health was to be monitored, responsibility frequently fell to local public health practitioners who collected required data through routine surveillance efforts.

Preliminary Outcomes—at the time of documentation, no HIA had yet completed any evaluation or monitoring activities. However, preliminary impacts of the HIA process were noted by some. Through piloting the use of the HIA, the Hoboken Stormwater Management and Colorado School-Based Health Centre HIAs were able to build local capacity for this health promotion tool. As well, East Aldine Town Centre Design HIA developed a built environment toolkit,

containing methods, tools, and resources, to guide others in their investigation of the connections between health and the built environment; in turn, contributing to advancement of HIA practice. Finally, findings from the Omaha Street Connections and Development Review Processes HIA were used to inform the prioritization of health in the implementation of similar street connections throughout the City.