Scoping Population Health in Impact Assessment (ScopHIA) Realist Review:

Identifying Best Practices for Equity in Scoping of Major Natural Resource and Large-Scale Infrastructure Projects

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EXECUTIVE SUMMARY

Background

Canada is an international leader in major natural resource and large-scale infrastructure projects, which substantially contribute to the domestic economy. Notwithstanding, major projects in rural and remote regions can pose significant challenges for population health equity, defined as the absence of avoidable differences in health determinants, status, and outcomes between geographic, socio-economic, or demographic communities and sub-populations. In these regions, a more equitable sharing of risks and benefits with Indigenous peoples and affected communities could help to address the ongoing legacy of colonialism, environmental injustice, and systemic oppression tied to histories of major project development.

Population health inequities can manifest through pathways like elevated risk perception and solastalgia; loss of language, social capital, cultural continuity, and subsistence practices; exposure to pollution and loss of ecosystem services; stress on community infrastructure and food and water security; increased socio-economic and political disparity within communities; increased incidence and prevalence of infectious and chronic diseases, mental illnesses, substance misuse, and addiction; and increases in crime and domestic, sexual, interpersonal, and structural violence. Consequently, public deliberations and decision-making about the impacts of projects should consider population health equity throughout the exploration, construction, operation, and closure periods.

Impact assessment is a legislated process in more than half of all countries in the world. Through public deliberation and decision-making about proposed major projects, impact assessments are generally mandated to identify and mitigate potential negative impacts to the biophysical environment. The recent development of a new federal system for impact assessments led by the Impact Assessment Agency of Canada (the Agency) has extended this mandate in the Canadian context to incorporate positive and negative impacts of projects on health, social, and economic conditions. In the new system, a 180-day planning phase has been introduced to engage with Indigenous peoples and affected communities on their issues of concern, in order to develop a more tailored impact assessment structure for each project. By providing increased opportunities for consultation, engagement, and input from the earliest stages, the planning phase can provide critical pathways to promote population health equity through impact assessments, which help to ensure projects make a net contribution to the public interest and sustainability.

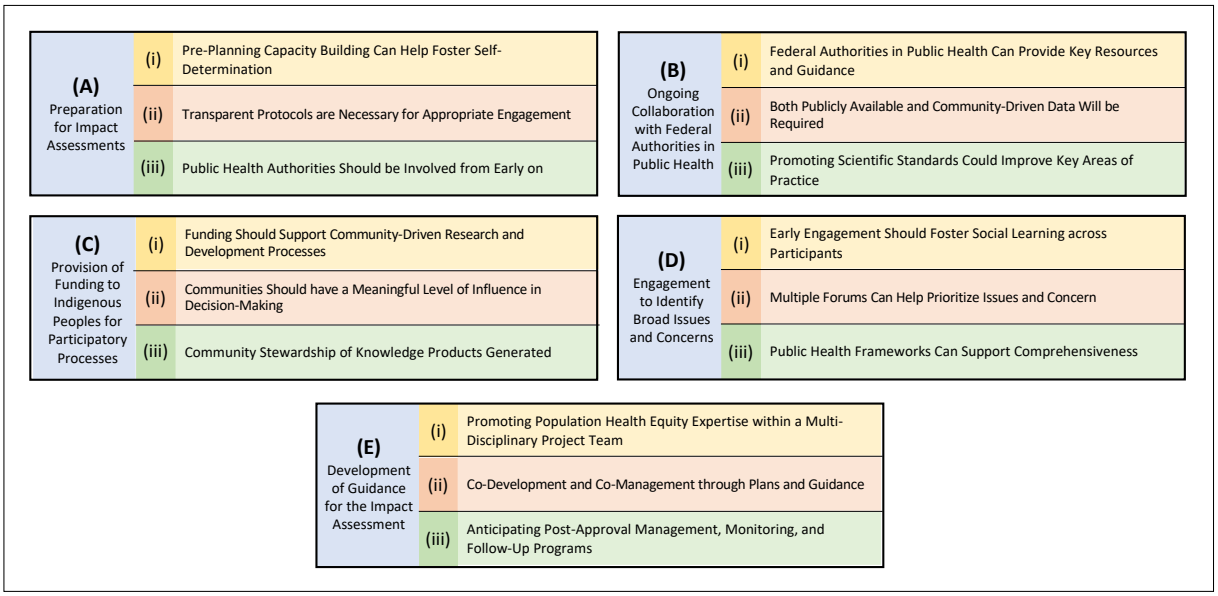
Objectives

The goal of this knowledge synthesis is to prioritize population health equity within federal impact assessment in Canada. Its objectives are to identify key points of leverage in the planning phase for achieving its goals through the implementation of evidence-based best practice and principles. Knowledge mobilization has the aim of promoting the uptake of findings from this research in impact assessment policy and health system practice; advocating for more public health research and practice to support population health equity in the context of major projects; and raising awareness of these issues among the Canadian public. During the research stages of the project, the research team conducted initial outreach through its professional networks and contacts with organizations and Indigenous leaders and knowledge holders. With completion of the research stage and submission of the final report, focus can now shift to strengthening partnerships and generating knowledge mobilization products to share and evaluate the uptake of research findings and results.

Methodology

Employing a methodologically rigorous realist review research process, documents were retrieved and screened through an iterative combination of systematically searching two key impact assessment journals, and purposively searching other journals and websites. A total of 185 peer-reviewed and grey literature sources underwent full data extraction, analysis, and synthesis, using a standardized procedure and template. Results include recommendations organized by main themes of findings across five key planning phase processes: (**A**) Preparations for Impact Assessments; (**B**) Ongoing Collaboration with Federal Authorities in Public Health; (**C**) Provision of Funding to Indigenous Peoples for Participatory Processes; (**D**) Engagement to Identify Broad Issues and Concerns; and (**E**) Development of Guidance for the Impact Assessment (**Figure 1**).

Figure 1: Planning Phase Processes and Main Themes of Findings in the Realist Review Knowledge Synthesis



Results and Key Messages

(A) Preparations for Impact Assessments: Integration with strategic and regional assessments, pre-planning capacity building, and transparency in processes of engagement emerged as consistent themes to support self-determination as a population health equity support for Indigenous peoples and affected communities. Early involvement of federal and local public health authorities was further indicated to support technical training and social learning across impact assessment participants working in areas affecting population health equity.

(B) Ongoing Collaboration with Federal Authorities in Public Health: Guidance was identified as a key mechanism for promoting scientific standards and encouraging the combined use of publicly available and community-driven data sources. Federal authorities like Health Canada, the Public Health Agency of Canada, and the Canadian Institutes of Health Research were shown to play important roles in developing advisory capacity, conducting knowledge translation, and funding research on population health equity in impact assessments.

(C) Provision of Funding to Indigenous Peoples for Participatory Processes: Funding holds the potential to support community-driven research and development processes for generating meaningful indicators, models, and thresholds for population health equity, and can facilitate community stewardship of data and information. Improved two-way communication about development projects, adequate resourcing of Indigenous governments and boundary organizations, and early consideration of mitigations and compensation were further identified to support Indigenous peoples and affected communities attaining meaningful levels of influence on decision-making in impact assessment.

(D) Engagement to Identify Broad Issues and Concerns: Facilitating social learning across multiple forums emerged as a key strategy for examining biases, reframing issues, building trust, sharing values, and fostering legitimacy in the process of impact assessment. Notably, comprehensive public health and community-led frameworks categorizing population health equity impacts were considered a key tool for appropriately engaging Indigenous peoples and affected communities, helping to generate discussion and organize responses in the planning phase.

(E) Development of Guidance for the Impact Assessment: Population health equity promotion at the end of the planning phase would involve ensuring sufficient expertise and community-based coordination on proponent teams; setting expectations for accountability, enforcement, and grievance mechanisms; and facilitation of co-development, co-management, and Indigenous-led assessments anticipating post-approval management, monitoring, and follow-up programs in impact assessment.

GOALS AND OBJECTIVES

The goal of the *Scoping Population Health in Impact Assessment (ScopHIA) Realist Review: Identifying Best Practices for Equity in Scoping of Major Natural Resource and Large-Scale Infrastructure Projects* knowledge synthesis is to prioritize population health equity within federal impact assessment in Canada. Its objectives are to identify key points of leverage during the new planning phase of impact assessments for achieving its goals through evidence-based best practices and principles. Notably, the new impact assessment system in Canada requires a public interest determination for major natural resource and large-scale infrastructure projects which implicates positive and negative effects on health, social, economic, and environmental conditions. Since the planning phase will provide structure and outline requirements for information and engagement in subsequent stages, its implementation can effectively establish the priority of population health equity considerations during an impact assessment. Accordingly, the ScopHIA knowledge synthesis aims to inform implementation of the planning phase across several key legislative provisions in the *Impact Assessment Act, 2019* (*IAA, 2019*), R.S.C. 2019, c. 28, s. 1:

- Proponents' *Initial Project Description* in Section 10;
- Opportunities for meaningful participation by the public in preparation for impact assessments in Section 11;
- Early consultations with affected jurisdictions and Indigenous groups in Section 12;
- Federal authorities' obligation to provide expert information and specialist knowledge to support impact assessment in Section 13(1);
- The *Summary of Issues* for concerns raised by Indigenous peoples, the public, or other jurisdictions in Section 14;
- Proponent's *Detailed Project Description* of how they intend to address concerns in Section 15;
- Guidelines for necessary studies and/or information required of proponents, and plans for public participation and cooperation with Indigenous peoples and the public in Section 18;
- Participant funding to support preparations for impact assessment of designated projects in Section 75(1)(a); and
- Provisions to conduct regional and strategic assessments that inform project-level assessments in Sections 92, 93(1), and 95(1)(a)(b).

Additionally, knowledge mobilization to share the findings of this research has the threefold aims of raising the profile of impact assessments as within the scope of practice, research, and policy work by Canadian public health professionals; conducting outreach with regional health units and environmental non-governmental organizations to support their participation during impact assessments; and providing information through print, broadcast, and social media channels to foster public awareness and support for promoting population health equity in impact assessments. By promoting implementation and innovation of the new extended mandate for impact assessment at the federal level in Canada, this research has the overall goal of generating, disseminating, diffusing, and exchanging knowledge to support population health equity for Indigenous peoples and affected communities.

The ScopHIA knowledge synthesis report begins with a background on population health equity in impact assessment of major natural resource and large-scale infrastructure projects in Canada. Methods for the realist review research process are then described, followed by a discussion of results organized by key themes. The report closes with a discussion of implications, and next steps for knowledge mobilization.

BACKGROUND

1.1 Major Natural Resource and Large-Scale Infrastructure Projects in Canada

Major natural resource and large-scale infrastructure projects comprise a significant component of the global economy. Worldwide, reserves of crude oil, bitumen, coal, petroleum products, natural gas, base and precious metals, minerals, biomass, and rare earth elements are extensively mined, drilled, dredged, quarried, and commodified on global markets. Canada is considered "the largest state actor in the global mining industry;"[1p.217] it is the fourth largest producer of natural gas, the seventh largest producer of petroleum, and houses more than half of all transnational mining headquarters, worldwide.[2] Domestically, more than 1,500,000 jobs can be attributed to the energy sector (crude oil, petroleum products, natural gas, uranium, and a small portion of renewables) and minerals mining (base metals, precious metals, minerals, rare earth elements, and biomass), contributing 16% of Canada's nominal gross domestic product.[3] From natural gas production in the Devonian shales of northeastern British Columbia to offshore petroleum drilling on the Grand Banks of Newfoundland,[4] Canadian major natural resource and large-scale infrastructure projects tend to be concentrated in relatively less developed, rural, and remote regions.[5] As a result, these industries are the largest private sector employer of Indigenous peoples, who are more likely to live in those regions, and support numerous Indigenous-owned offshoot companies.[3] Given the scale and complexity of this sector, major projects are a critical and contested site of conversations about sustainability in Canada.

Throughout their life-cycles (which may include exploration, development, operation, closure, and remediation), major natural resource and large-scale infrastructure projects can pose risks and benefits for population health equity.[6] Population health equity is linked to the concept of social justice in public health,[7] and refers to the outcome of efforts to reduce systemic inequities

> produced by social norms, policies and practices that result in the unfair distribution of and access to wealth, power and other social resources [which] prevents some individuals and populations from living in healthy environments or from accessing preventive services that minimise exposure to health hazards, treatments that mitigate the negative effects of those exposures or services designed to support people in living to their full health potential.[8p.807]

Major projects in Canada are typically located in the traditional territories of Indigenous peoples far from large population centres, where differential access to community infrastructure, food and water security, preventive services and treatments, and self-determination for governance have contributed to population health inequities in indicators like income, employment, and education.[9] Industrial activities have extensive effects on Indigenous peoples and affected communities in geographic proximity to projects, who experience the negative impacts of projects at disproportionate rates.[9] In these regions, there is a legacy of colonialism including residential schools and resettlement policies, resulting in inter-generational trauma that is not historically bounded.[10] Indeed, major projects proceeding without appropriate consultation can be considered a form of systemic oppression at the root of population health inequity experienced by Indigenous peoples in those regions, and "continued colonial action by the Government of Canada."[11p.117] Correspondingly, systematic review research indicates the maintenance, transfer, and revitalization of culture and decolonization are paramount for Indigenous peoples' health and well-being.[12]

The proponents of resource extraction and energy projects – who possess significant financial, technological, human, and other resources – argue that projects will provide much needed benefits in regions.[13] Examples include, but are not limited to employment, income, infrastructure, and opportunities for community education, health, and recreation.[13] However, many Indigenous peoples and affected communities throughout Canada have experienced negative impacts of projects as environmental injustice, defined as "disproportionate exposure to environmental hazards faced by communities with low socio-economic status and communities belonging to historically disadvantaged groups."[14p.305] Two such examples include 237,000 tonnes of yet-to-be remediated arsenic trioxide buried beneath Giant Mine outside of Yellowknife, Northwest Territories,[15] or evidence of declining and biophysically contaminated game and wildlife populations in oil sands regions of Alberta.[16] In rural and remote areas where land tends to be of particular import for livelihoods, the harvesting of food, and the continuation of cultural practices, these environmental impacts have heightened ramifications for Indigenous peoples and affected

communities. Thus, it is critical to consider projects through an environmental justice lens. Population health inequities can manifest through pathways like

- exposure to pollution and loss of ecosystem services;[1]
- elevated risk perception and solastalgia;
- abandonment of agricultural livelihoods and cultures;
- reductions in traditional subsistence land use (hunting, fishing, gathering for nutritional, medicinal, and cultural purposes);
- increased socio-economic and political disparity in communities; and
- decreased levels of physical activity and increased sedentarism.[18-21]

Moreover, rural and remote communities are particularly vulnerable to socio-cultural risks that include:

- physical injuries and accidental mortality;
- stress on community housing, recreational, health, food and water security, and educational infrastructure;
- loss of social capital, language, and cultural continuity;
- increased income disparity between genders and age cohorts;
- increased incidence of infectious and chronic diseases;
- increased prevalence of mental illnesses, substance misuse, and addiction; and
- increases in crime and domestic, sexual, interpersonal, and structural violence.[21,22]

Given these impacts, systematic review research demonstrates that if there is lack of a formal process to ensure that risks and benefits are equitably distributed, major natural resource and large-scale infrastructure projects do not enrich, but rather exacerbate the poverty of regions.[23]

Indigenous peoples in Canada have continuously sought self-determination and recognition of their rights, including through processes of reconciliation "to establish and maintain mutually respectful relationships between Canada's Indigenous and non-Indigenous peoples."[24p.119] Nevertheless, the social conditions and health of these Indigenous communities have been disproportionately disadvantaged through major projects.[25,26] The Canadian Constitution, treaties, legislative statutes, and common law require federal, provincial, and territorial governments of Canada to uphold the Duty to Consult and promote reconciliation between Canada and Indigenous peoples by appropriate engagement on development decisions. Indigenous peoples have pursued legal remedies where projects have disproportionately altered their access to land, water, and other resources, which has the potential to negatively impact Indigenous rights and title as protected under Canada's *Constitution Act, 1982*.[27] These legal activities have resulted in Supreme Court Judgments upholding and clarifying the Duty to Consult in Canada in the cases of *Haida Nation v. British Columbia*;[28] *Taku River Tlingit First Nation v. British Columbia*;[28] *Mikisew Cree First Nation v. Canada*;[30] *Beckman v. Little Salmon/Carmacks First Nation*;[31] and *Rio Tinto Alcan Inc. v. Carrier Sekani Tribal Council*.[32] Accordingly, emerging legal processes and institutions in Canada have been devised to uphold the Duty to Consult, and to consider the consequences to Indigenous rights or title, in assessing the impacts of major projects. Impact assessment (IA), or environmental impact assessment, is a key forum for upholding the Duty to Consult in Canada, with emerging potential to help promote population health equity for Indigenous peoples and affected communities.

1.2 Considering Population Health Equity within Impact Assessments

Over 100 countries have legislated impact assessments to ensure government oversight of major natural resource and large-scale infrastructure projects.[32] Impact assessment - or environmental (impact) assessment - can be traced back to the United States' highly influential 1970 National Environmental Policy Act (NEPA), which called

[1] Potential environmental impacts include displacement and resettlement; soil pollution, erosion, deforestation, and desertification; depletion, contamination, or eutrophication of rivers, streams, surface waters, and groundwaters; particulate emissions and acid deposition; degradation of ecosystems, habitat fragmentation, and biodiversity loss; increased frequency and severity of seismic activity; increased traffic, noise, lighting, and dust levels; and a spate of health hazards associated with the emerging effects of climate change.[17]

for developments to "stimulate the health and welfare of man."[34] Depending on the legislative basis and regulatory requirements, impact assessment usually consists of a structured, multi-stage process administered by a designated decision-making agency, lasting over a period from several months to several years.[35] IAs support efforts to improve population health equity by providing a public forum in which to articulate values, facilitate participation, and assemble evidence on the risk and benefits of development for affected individuals and communities. Development proposals that pose significant negative impacts and/or elevated levels of public concern are typically approved or rejected by the agencies coordinating IAs and/or political leadership, with conditions imposed upon approvals for industrial exploration, development, operation, closure, and remediation maintained through various forms of monitoring, follow-up, and enforcement.

Historically, legislated impact assessments have tended to emphasize environmental impacts instead of population health equity impacts.[36] Nevertheless, there has been widespread and longstanding interest among both impact assessment and public health practitioners to consider the effects of major projects on health, social, and economic factors, based on strong demand from interested and affected communities.[37] In their systematic review of health impact assessment frameworks, Hebert et al. (2012) report that 29 out of 45 guidelines (64%) presented by international agencies, professional associations, and national and regional health units discussed mandatory consideration of health within impact assessment legislation.[38] This strategy dates back to the World Health Organization (WHO)'s (1982) World Health Assembly endorsement of integrating health into environmental impact assessments, which expressed:

> WHO's total commitment to work with Member States, national and international agencies and financial institutions to incorporate the necessary preventive measures into development projects to minimize the risks to the health of populations and the environment.[39p.13]

At the national level, policy development to mandate the consideration of health (and social and economic determinants of population health) in impact assessment is currently underway in dozens of countries.[37] In the United States, the first health impact assessment conducted under the auspices of NEPA occurred in 2007, triggered by concerns of the Iñupiat community in the North Slope Borough of Alaska that oil development would negatively impact their health, culture, and way of life.[40] Other key examples include establishing a constitutional basis for health impact assessment in Thailand,[41] and requirements for the incorporation of health into strategic environmental assessments in the European Union under *European Directive 2001/42/EC*, the *Protocol on Strategic Environmental Assessment*, and the *Convention on Environmental Impact Assessment in a Transboundary Context*.[42]

Within the Canadian context, the origins of a population health equity mandate in impact assessments can be traced to the Mackenzie Valley Pipeline Inquiry (or Berger Inquiry), which first captured the national imagination as a precursor to federal impact assessment from 1974 to 1977.[43] As leader of the Berger Inquiry, Justice Thomas Berger traveled tens of thousands of kilometers to visit thirty-five communities, speaking with over one thousand community members in eight languages (with translators) about a proposed natural gas pipeline across the western Arctic. Still considered the gold standard for meaningful consultation with Indigenous communities, community concerns about impacts to permafrost, wildlife, and self-determination led to a ten-year moratorium on any pipeline until key conservation areas could be established and land claims resolved.[44] Notably, the Berger Inquiry recognized systemic inequities underlying the predicted impacts of a pipeline, disproportionately borne by Indigenous peoples and affected communities across the North, and rejected any development on that basis. Following the Berger Inquiry, federal procedures for the Environmental Assessment and Review Process Guidelines were established through an Order in Council in 1984.[45] The *Canadian Environmental Assessment Act, 1992*[46] subsequently passed as primary legislation in 1992, and was revised twenty years later as the *Canadian Environmental Assessment Act, 2012*.[47] Over forty years since the Berger Inquiry, the strongest mandate to consider population health equity in IAs has just recently emerged in Canada, as federal legislation for a new Canadian impact assessment system.

The *Impact Assessment Act, 2019 (IAA, 2019)*[48] received Royal Assent on June 21, 2019 and came into force on August 28, 2019 to repeal and replace the *Canadian Environmental Assessment Act, 2012*.[47] Impact assessment legislation has typically been framed in language that recognizes the importance of preserving and promoting health in relation to major projects. Notably, *IAA, 2019* is among the first federal statutes in the world to provide a direct mandate to consider the positive or negative effects of changing health and socio-economic conditions resulting from projects, directly implicating population health equity promotion. The Expert Panel for the Review of

Environmental Assessment Processes' report *Building Common Ground: A New Vision for Impact Assessment in Canada* documented fourteen months of national consultations in preparation for drafting the new legislation, recommending the shift in terminology from *environmental assessment* to the more general term of *impact assessment*:

> A matter that was heard resoundingly from Canadians was the need for an EA [environmental assessment] process to move beyond the bio-physical environment to encompass all impacts, both positive and negative, likely to result from a project … social issues, economic opportunities, health impacts and cultural concerns should be considered.[49]

Despite the Expert Panel's recommendation that impact assessments broadly consider factors supportive of population health equity, *IAA, 2019* was highly controversial for expanding the mandate of IAs in this way, especially to industry groups who criticized the legislation for its additional requirements, as having the potential to "cripple sectors already grappling with low commodity prices and constrained pipeline capacity."[50] Environmental groups cautiously praised the *Impact Assessment Act, 2019* for establishing a more transparent public interest determination to evaluate major projects. The public interest determination stipulated that Indigenous rights, contribution to sustainability, and international climate change obligations were required factors to consider in decision-making.[51] The response from Indigenous peoples was more mixed, with some groups mobilizing opposition to the legislation,[52] and others lobbying the federal government to implement it.[53] Following the highly contentious passage of *IAA, 2019*, the implementation of its mandate for population health equity presents an opportunity to bridge these diverse interests in promoting environmental, health, social, and economic sustainability though major natural resource and large-scale infrastructure projects in Canada.

1.3 A New Mandate for Population Health Equity in Canada

The *Impact Assessment Act, 2019*,[48] the Physical Activities Regulations (the Project List)[54] and the Information and Management of Time Limits Regulations[55] set out new purposes, objectives, procedures, and timelines for federal impact assessments in Canada. It is important to examine how key features of the legislation might support greater consideration of population health equity relative to major projects. As a federal statute, *IAA, 2019* applies to the "construction, operation, decommissioning and abandonment"[54s.2(1)] of a limited set of developments falling under national jurisdiction, which are referred to as *designated projects*.[2] The statute falls under the authority of the Ministry of Environment and Climate Change Canada, and establishes the Impact Assessment Agency of Canada (or the Agency, and formerly the Canadian Environmental Assessment Agency) to conduct impact assessments and coordinate with several key participants within the process (**Figure 2**).

There are five legislated phases under *IAA, 2019*, including the planning phase, the impact statement phase, the impact assessment phase, the decision-making phase, and the post-decision phase, which must adhere to set timelines and milestones detailed in the Information and Management of Time Limit Regulations (**Figure 3**).[55] In addition, *IAA, 2019* provides a legislative basis for integrating IAs with strategic and/or regional assessments, which can help determine broader population health equity objectives and goals within jurisdictions, geographic areas, industrial sectors, or policy spheres.

Under *IAA, 2019*, all designated projects[3] undergo the planning phase, following which the Agency will coordinate subsequent phases of the impact assessment, or otherwise the Minister of Environment and Climate Change Canada will refer the designated project to a review panel.[55s.1,ss.66(1)] Review panels follow the same phases subsequent to planning as other impact assessments, but are afforded longer timelines accounting for more

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[2] *Designated projects* include major natural resource and large-scale infrastructure projects in national parks and protected areas; projects for military defence; mines and metal mills; nuclear facilities for power, storage, and disposal; extraction of oil, gas and fossil fuels; long distance electrical transmission lines and pipelines; large hydroelectric, in-stream tidal, or tidal renewable energy generation facilities; transportation projects; hazardous waste management, and water projects like dams, locks, or canals.[53]

[3] The *Impact Assessment Act* can also apply to non-designated projects at the discretion of the Minister of Environment and Climate Change Canada, according to criteria set out in Section 9 of the legislation.[48s.9]

complex scenarios, and are conducted by parties designated on a project-by-project basis.[4] Increasing transparency and public accessibility of information under *IAA, 2019*, the Canadian Impact Assessment Agency Registry serves as a searchable online repository for all of the documentation generated during impact assessments and review panels.[5]

Figure 2: Key Participants for Impact Assessments conducted under the *Impact Assessment Act, 2019*

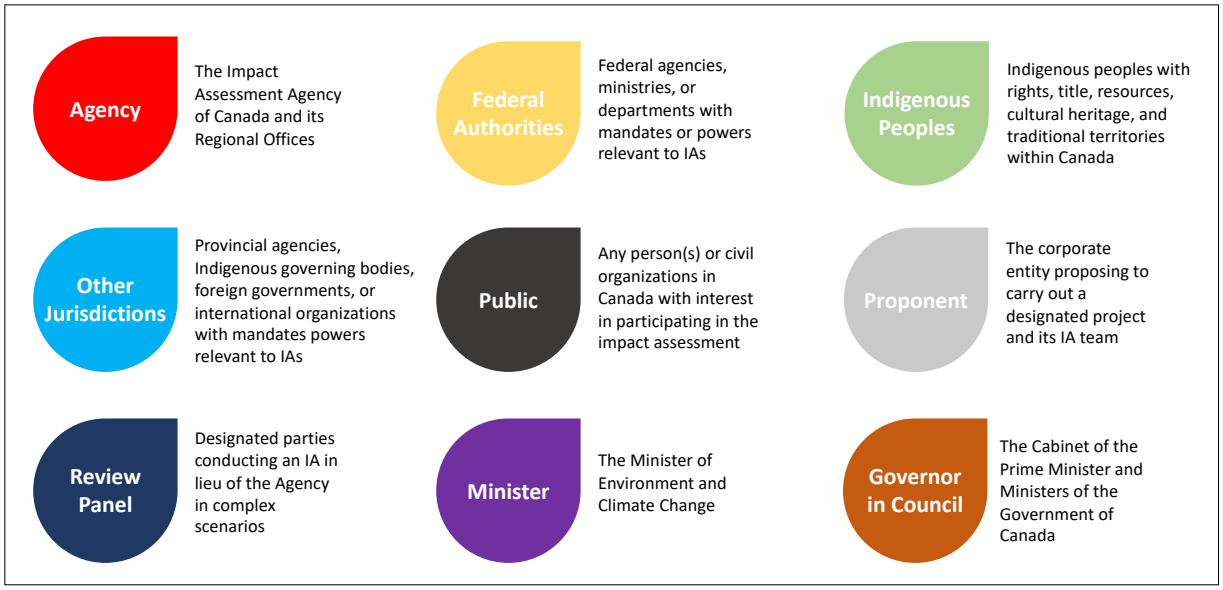
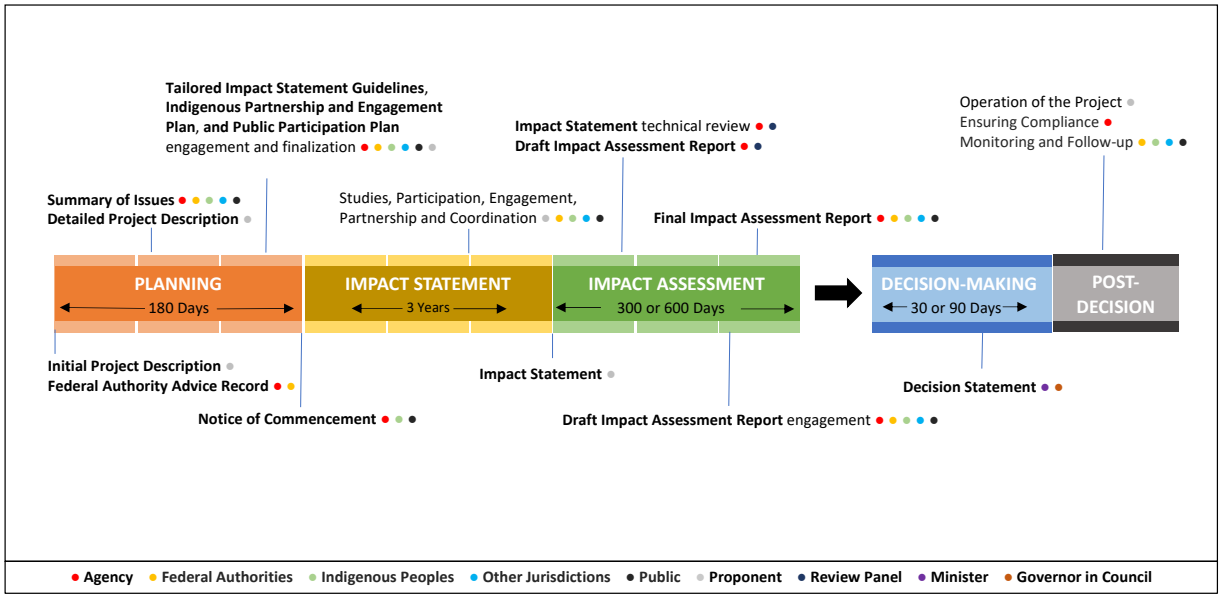


Figure 3: Five Legislated Phases for Impact Assessments under the *Impact Assessment Act, 2019*



The planning phase consists of 180 days prior to determining whether a designated project will require an

[4] Review panels are employed in the most complex inter-jurisdictional scenarios for impact assessment; for instance, projects regulated by the Canada Energy Regulator and Canadian Nuclear Safety Commission.[47s.43; ss.51(2)(3)]

[5] The Canadian Impact Assessment Agency Registry is currently located at https://ceaa-acee.gc.ca/050/evaluations.

impact assessment or review panel. During this phase, the Agency coordinates with the major project proponent, federal authorities, other jurisdictions, Indigenous peoples, and the general public to identify broad issues and concerns. Further, the Agency must conduct engagement and consultations on the structure and requirements for the subsequent impact statement and impact assessment phases. This structure will be formally set out in the *Tailored Impact Statement Guidelines* and other key documents developed by the Agency, stating the requirements for studies and further engagement to be conducted by proponents. At the conclusion of the planning phase, the Agency will determine whether a project requires IA or a review panel, marking the beginning of the impact statement phase.

During the impact statement phase for IAs, proponents are accorded a three-year window to complete studies, participation, engagement, partnership, and coordination with federal authorities, other jurisdictions, Indigenous peoples, and the public laid out during the planning phase.[6] All of the information gathered by proponents must be documented in the *Impact Statement Report*, which proponents submit to the Agency. Following the impact statement phase, the Agency will conduct a technical review of the *Impact Statement*, and prepares a draft *Impact Assessment Report* in the impact assessment phase (not to be confused with the more general term *impact assessment* applied to this overall process).

The *Impact Assessment Report* must summarize how the Agency conducted the impact assessment process; considered information and analysis provided by proponents; met the requirements of federal authorities and other jurisdictions; incorporated the perspectives of Indigenous peoples and the public; and assessed identified potential impacts alongside proposed mitigation measures. The Agency will conduct further engagement and consultations on this draft to finalize the *Impact Assessment Report*, containing its recommendation on whether to approve or reject a project, as well as any conditions for approval. This final *Impact Assessment Report* will then be provided to the Minister of Environment and Climate Change Canada and/or Governor in Council (the federal Cabinet) to support the decision-making phase. During the decision-making phase, the Minister and/or Governor in Council must make a transparent and informed public interest determination documented in the *Decision Statement*, which will include the public interest determination; rationale for the decision; enforceable conditions placed upon the project; an expiry date for the decision (to ensure proponents begin projects within reasonable time frames); and a description of the project (to ensure no major changes can be made). The post-decision phase extends over the life-cycle of the project, with proponents operating the project, the Agency ensuring compliance, and federal authorities, other jurisdictions, Indigenous peoples, and affected communities potentially involved in monitoring and follow-up.

The *Impact Assessment Act, 2019*, the Project List, and the Information and Management of Time Limits Regulations prohibit proponents from undertaking any designated projects requiring IA unless they comply with conditions set out in the *Decision Statement*. At the same time, the Minister and Governor in Council are prohibited from issuing *Decision Statements* that permit designated projects to be carried out unless they have transparently determined projects are in the public interest. There are two streams for evaluation of potential impacts under this new legislation: Section 63, which sets out all of the factors to be considered for the public interest determination in the decision-making phase (**Table 1**); and Section 22, which sets out all of the factors which are to be considered in the impact statement and impact assessment phases (**Table 2**).

Table 1: Factors for the Public Interest Determination under Section 63 of the *Impact Assessment Act, 2019*

	Factors Listed in Section 63 of the Impact Assessment Act
1	Poses adverse effects under federal jurisdiction
2	Poses adverse effects that hinder Canada's ability to meet its environmental and/or climate change obligations
3	Poses adverse effects that impinge on Indigenous groups or the rights of Indigenous peoples
4	Implements mitigation measures as deemed appropriate
5	Contributes to sustainability

[6] Under the Act, these timelines can be extended by the Impact Assessment Agency of Canada via authorization from the Minister of Environment and Climate Change Canada, by proponents' request.[47]

The considerations for impact assessments (Section 22) differ from considerations for the public interest determination (Section 63), since decision-making under *IAA, 2019* must be legally limited to matters within federal jurisdiction.[48] Although the factors for decision-making in Section 63 are narrower than those in Section 22, the positive emphasis of the public interest determination represents a significant departure from decision-making under the *Canadian Environmental Assessment Act, 2012*, which considered if projects posed "significant adverse environmental effects … whether those effects are justified in the circumstances."[47s.52(2)] In contrast, Section 63 of the Act extends decision-making to consider whether projects pose adverse impacts under federal jurisdiction; impede Canada in its international environmental and climate change commitments; adversely impact Indigenous groups, rights, title, or cultural considerations; and contribute to sustainability. *Sustainability* is defined in the Act as "the ability to protect the environment, contribute to the social and economic well-being of the people of Canada and preserve their health in a manner that benefits present and future generations."[48s.2]

In addition to decision-making, *IAA, 2019* extends the impact statement and impact assessment phase mandates to consider population health equity across many of the factors set out in Section 22. These factors includes positive and negative impacts on health, social and economic conditions; environmental changes and impacts on Indigenous groups, rights, title, and cultural considerations; intersectional sex, identity factors, and gender-based analysis plus (GBA+ as it is referred to in *IAA, 2019*); and consideration for Indigenous and community knowledge. Importantly, the planning phase of IAs can support Indigenous peoples and affected communities to decisively shape how population health equity will factor into both the proponent's and Agency's activities, as well as the Minister's or Governor in Council's public interest determination, by providing increased opportunities for consultation, engagement, and input from the earlier stages.

Table 2: Factors to be Considered during Impact Assessments under Section 22 of the *Impact Assessment Act, 2019*

	Factors Listed in Section 22 of the Impact Assessment Act
1	Changing environment, health, social, and economic conditions and positive or negative consequences
2	Mitigation measures that are technically and economically feasible to prevent adverse effects
3	Impacts on indigenous groups and rights of Indigenous peoples
4	Purpose and need for the project
5	Alternative means of carrying out the project
6	Alternatives to the project
7	Indigenous knowledge provided with respect to the project
8	Contribution of the project to sustainability
9	Effect of the project on Canada's ability to meet its environment obligations and climate change commitments
10	Environmental changes caused by the project
11	Requirements of the follow-up programs for the project
12	Indigenous cultural considerations with respect to the project
13	Community knowledge provided with respect to the project
14	Comments received from the public
15	Comments received from other jurisdictions
16	Any relevant strategic or regional assessment
17	Any assessments conducted on behalf of an Indigenous governing body
18	Any study or plan conducted or prepared by a jurisdiction or Indigenous governing body
19	Intersectional sex and gender-based analysis plus (GBA+) of identity factors
20	Other relevant matters

1.4 Population Health Equity and the Planning Phase

The legislated 180-day planning phase for impact assessments and review panels conducted under the *IAA, 2019*[48s.10-15] can provide additional timelines to support population health equity for Indigenous peoples and affected communities. As per the previous legislation, proponents were required to submit a complete description of projects at the earliest stages.[47s.8(1)] The absence of a planning phase incentivized proponents to finalize their proposals prior to impact assessments, which effectively precluded the meaningful incorporation of many environmental, health, social, economic, or other concerns.[56] In the new federal impact assessment system, the planning phase operationalizes procedures for Indigenous peoples and affected communities to participate in consultations and engagement early on, and to contribute input on key aspects of proposals for designated projects. Thus, the planning phase holds significant potential for activities helping ensure the risks and benefits of projects are distributed to promote social and environmental justice. In this way, IAs can be characterized by "transparency, accountability, and having a wide scope [as] crucial to achieving the promise of 'tangible results' from large projects,"[57p.1464] as a recognized requirement of procedures to promote population health equity.

Prior to the planning phase (in the pre-planning phase), a great deal of preparatory work is conducted by the Impact Assessment Agency of Canada through its headquarters in Ottawa and six Regional Offices in Vancouver (Pacific and Yukon Office), Edmonton (Prairie and Northern Regional Office), Toronto (Ontario Office), Québec City (Québec Office), Halifax (Atlantic Office), and St. John's (Newfoundland and Labrador Office).[58] Depending where a designated project is proposed, one of the Regional Offices will serve as a first point of contact for proponents, ensuring they are aware of the standard of evidence and level of engagement required. The office also serves as the main contact for coordinating the planning phase, impact statement phase, and impact assessment phase for proposals. Regional Offices can provide proponents with information about IA procedures and requirements with implications for population health equity, making connections between proponents and federal authorities with implicated mandates. Through its Regional Offices, the Agency will communicate with other jurisdictions having legal responsibilities for impact assessment during pre-planning (including the provinces, territories, and Indigenous governments established by treaties or land claims) to begin to determine how the various responsible parties will coordinate. Regional Offices are also involved in the new mandate for strategic assessments of federal policies in relation to IAs, and regional assessments of cumulative impacts under *IAIA, 2019*.[48] Although the Act provides limited detail on how strategic and regional assessments are to be conducted,[59] the Expert Panel for the Review of Environmental Assessment Processes suggested these could "facilitate involvement by the public and Indigenous Groups, ensuring that the views received are considered,"[49p.52] and then be *tiered* so that strategic and regional assessment decisions inform project-level IA:

> Strategic IA will provide clarity on how federal policies can be effectively considered in regional and project IA. Regional IA will provide clarity on thresholds and objectives on matters of federal interest in a region and will inform and streamline project IA. Therefore, a tiered approach should be implemented whereby strategic and regional IAs provide the policy and planning foundations for improved and efficient project IAs.[49p.22]

Importantly, the Regional Offices will implement much of the Agency's responsibility for the Duty to Consult with Indigenous peoples across their geographic jurisdictions. Since Regional Offices are involved in strategic and regional assessments, and coordinate multiple impact assessments within jurisdictions, this Duty to Consult extends beyond the scope of single projects to building strong relationships that facilitate trust and meaningful consultation in engagement and partnership with Indigenous peoples and affected communities.

The Impact Assessment Agency of Canada has developed service standards for procedures to be conducted over the course of the 180-day planning phase,[58] meeting the requirement laid out in the Information and Management of Time Limits Regulations (**Figure 4**).[55] The service standards for the planning phase and the associated documentation generated through these procedures provides a preliminary outline for understanding how population health equity considerations might be integrated within early stages of impact assessments (**Figure 5**).

Figure 4: Service Standards for Population Health Equity Considerations During the Planning Phase

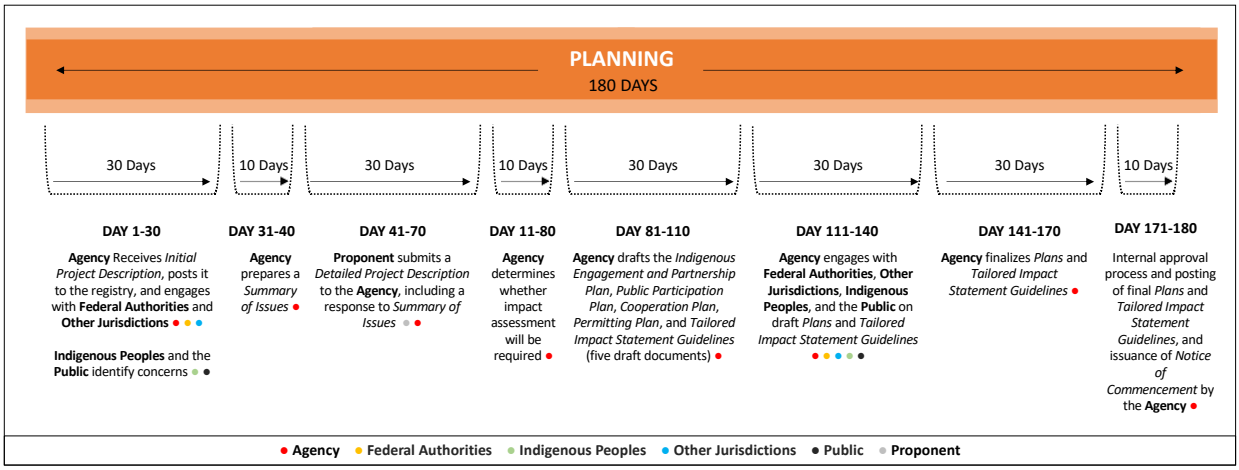
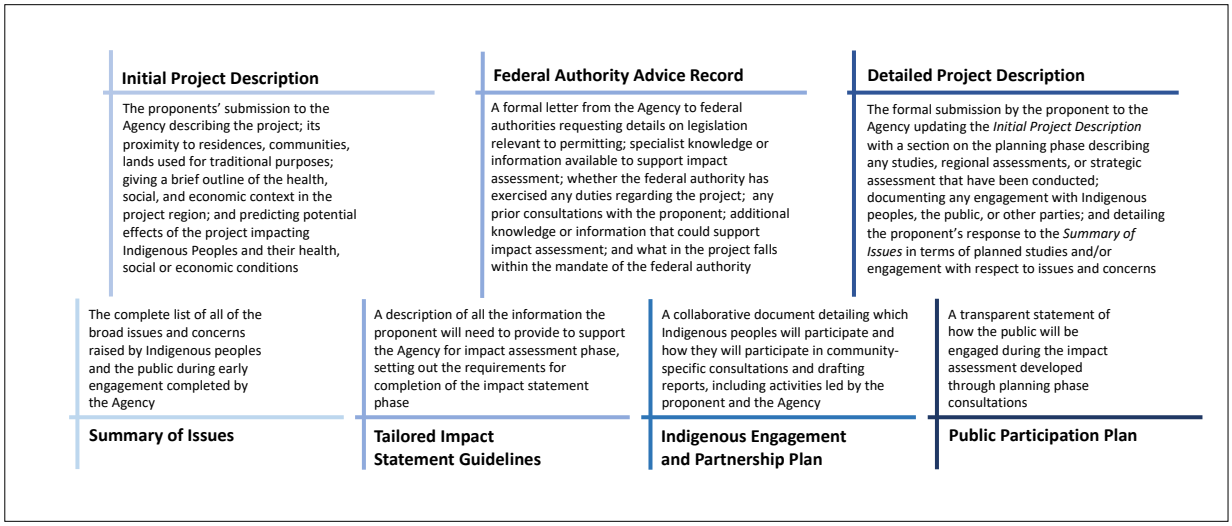


Figure 5: Documentation for Population Health Equity Considerations During the Planning Phase



Under the *IAA, 2019*, the planning phase is officially underway once a proponent submits the *Initial Project Description* for a proposed major project to the Agency. The *Initial Project Description* consists of general information about a designated project, including information relevant to population health equity like proximity to settlements; characterization of baseline health, social, and economic conditions; and predicted impacts to the baseline for Indigenous peoples and affected communities.[58] Once the Agency receives the *Initial Project Description*, it sends a *Federal Authority Advice Record* request to federal authorities with implicated mandates. The *Federal Authority Advice Record* requests details about the federal authorities' mandates to contribute to IAs under *IAA, 2019* or other applicable legislation, and whether federal authorities have specialist (or otherwise relevant) knowledge or information on designated project proposals.

Once the Agency receives, accepts, and posts the *Initial Project Description* to the *Canadian Impact Assessment Registry*, funding of $5000 becomes available to Indigenous peoples to support their engagement in reviewing the *Initial Project Description*. The Agency will then proceed to conduct early engagement procedures for thirty days, ten days after which it will deliver a compilation of the broad issues and concerns raised during early engagement as the *Summary of Issues*.[48s.12,14(1)] In response to the *Summary of Issues*, the proponent will then have thirty days to modify their initial proposal (the *Initial Project Description*) to submit a *Detailed Project Description*.

The *Detailed Project Description* should describe engagement and consultations during the planning phase; incorporate relevant guidance from strategic or regional assessments; and detail further studies or engagement that will be undertaken in response to issues and concerns raised in the *Summary of Issues*.[48s.15(1)]

Once the Agency receives, accepts, and posts the *Detailed Project Description*, it has a ten-day window to determine whether a designated project will proceed to impact assessment past the planning phase. If that is the case, the Agency will then have thirty days to prepare three draft documents particularly relevant to population health equity: the *Tailored Impact Statement Guidelines*, the *Indigenous Engagement and Partnership Plan*, and the *Public Participation Plan*.[58;7] The *Tailored Impact Statement Guidelines* provide a description of information and engagement required from the proponent in the impact statement phase to support the Agency during the impact assessment phase. The *Indigenous Engagement and Partnership Plan* will detail appropriate structures of engagement in partnership with Indigenous peoples during community-specific activities led by the Agency or proponent, based on consultations and input received during the planning phase. Similarly, the *Public Participation Plan* will detail how the public can participate throughout the impact assessment. At this point, additional funding of $5000 becomes available to Indigenous peoples to support their engagement in reviewing the *Tailored Impact Statement Guidelines*, *Indigenous Engagement and Partnership Plan*, and *Public Participation Plan*. Over the next thirty days, the Agency will engage and consult with Indigenous peoples, the public, federal authorities, and other jurisdictions in order to finalize these documents, publicly posting them on the *Canadian Impact Assessment Registry* along with a *Notice of Commencement* for IA of the proposed major project.

METHODS

3.1 Realist Review as a Method for Knowledge Synthesis

Through a scientifically rigorous realist review-informed process, the ScopHIA knowledge synthesis has assembled research, practice, and policy evidence to identify the best practices and principles for promoting population health equity during the planning phase for impact assessments under the *Impact Assessment Act, 2019*.[48] Realist reviews are an emerging method of knowledge synthesis used to examine complex interventions in the social, policy, or services context.[60,61] On a practical level, realist review can be considered a "policy-friendly"[62p.1] form of research, since it provides explanation of "what works for whom, in what circumstances, in what respects, and how,"[63p.23] with the explicit aim of developing recommendations and strategies to inform implementation and innovation. Interchangeable with the term realist synthesis, a realist review will

> begin by eliciting from the literature the main ideas that went into the making of a class of interventions (the program [or intervention] theory) ... [t]he pertinence and effectiveness of each constituent idea is then tested using relevant evidence (qualitative, quantitative, comparative, administrative and so on) from the primary literature on that class of programs.[62p.2]

Compared with systematic reviews as another form of knowledge synthesis, realist review will "tackle[] the program [or intervention] theory rather than the primary study as the unit of analysis."[63] In the same way that primary research begins with hypotheses, realist reviewers formulate research questions and articulate intervention theories as context-mechanism-outcome configurations (or CMOs) combining the context, mechanism, and outcomes of interventions as a single unit of analysis. The objective is to "develop[] clear hypothesis about how, and for who, and to what extent, and in what contexts"[62p.2] the CMOs *work*, iteratively seeking out evidence about "casual mechanisms (M) and the conditions (C) under which they are activated to produce specific outcomes (O)."[62p.2] Jagosh (2019) describes the development and utilization of CMOs as follows:

> The process involved in developing candidate theories [CMOs] can be varied, depending on the nature of the research question. For example, formalized theories in the published literature that provide adequate explanatory power can be used and adapted, along with if–then statements or hypothetical CMO configurations. Middle-range theories that explain causation at a more abstract level can also hypothesize

7 In addition, the Agency will prepare the *Impact Assessment Cooperation Plan* detailing coordination with other jurisdictions, and the *Permitting Plan* to capture additional permitting requirements outside the impact assessment forum.[58]

> the trajectory of anticipated programmatic success over time.[64p.367]

The CMO configurations can be used to organize data extraction from the peer-reviewed and grey literatures. Then, assembled evidence is analyzed for causal relationships as to how an intervention "alters context (for example, by making new resources available), which then triggers mechanism(s), which produce both intended and unintended outcomes."[62p.2] As such, the role of the realist reviewers is

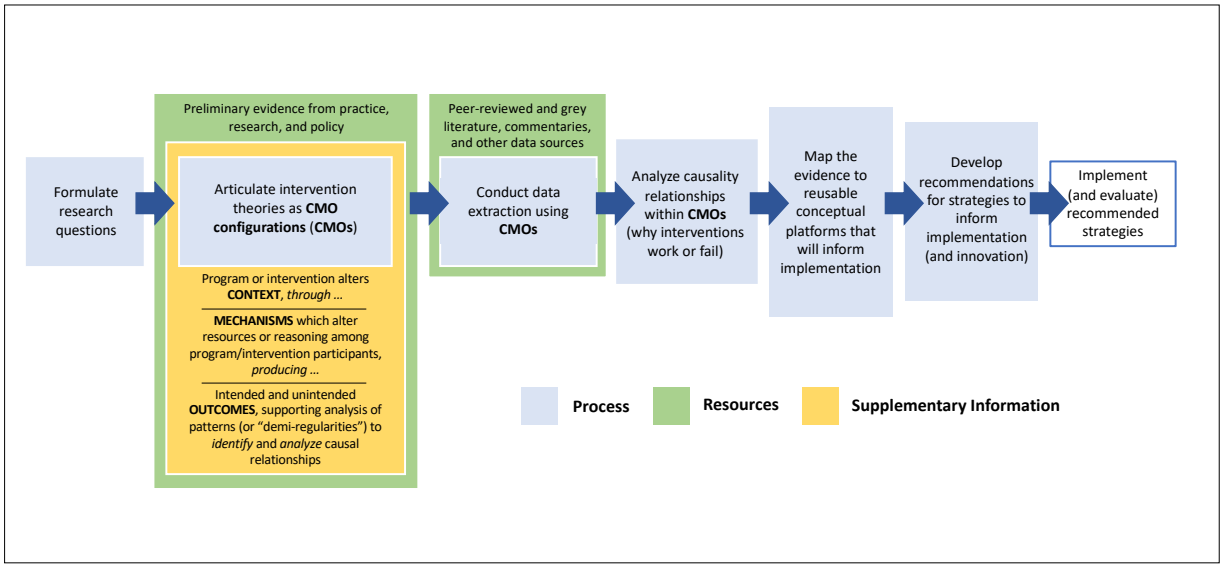
> to discover those contexts (C+) that have produced solid and successful outcomes (O+) from those contexts (C-) that have induced failure (O-) [as] evidence on positive and negative CMO configurations … ensuing policy advice will be to seek out the former and avoid the latter.[65p.345]

Pawson (2013) states realist review leads to the accumulation of "reusable conceptual platforms"[61p.92] that can inform implementation and innovation, which Jagosh (2019) likens to the "architectural blueprints of programs,"[64p.368] providing a firm evidentiary basis for "where to target resources [and] how to maximise impact."[60p.1]

Although realist review is a relatively recent form of knowledge synthesis originating in Pawson and Tilly's (1998) seminal work *Realistic Evaluation*,[66] several relevant studies have been conducted. Pawson and Manzano-Santaella (2012) report the publication of over a hundred realist evaluations, and over twenty realist reviews, with some of the widest applications to be found in the health sciences.[67] Recent work on population health equity includes Wong et al.'s (2011) research identifying threats to legislation for improving public health;[68] Willis et al.'s (2014) study of organizational capacity for health literacy campaigns;[69] O'Campo et al.'s (2015) examination of unemployment insurance effects on poverty and health;[70] and Willis et al.'s (2016) research on scaling up complex interventions.[71] Examples of realist research conducted on impact assessments include Simos et al.'s (2015) realist evaluation of ten case studies of health impact assessments from the WHO European Healthy Cities Network,[72] and Tyler et al.'s (2019) realist synthesis looking at the use of academic evidence in equity-focused impact assessments.[73] Through this realist review and evaluation research about how complex interventions work, evidence can be integrated, and knowledge built up over time, thus supporting both implementation and further innovation.

The ScopHIA knowledge synthesis presents scientifically rigorous realist review-informed analysis investigating processes and procedures within the planning phase of the new Canadian impact assessment system as mechanisms to support population health equity for Indigenous peoples and affected communities. Realist review can be considered more of a theoretical orientation than a prescribed set of procedures for conducting knowledge synthesis, although the literature does specify certain methodological and reporting requirements.[74] This realist review-informed research broadly adhered to the *Realist and Meta-narrative Evidence Synthesis: Evolving Standards (RAMESES) I* publication standards.[62] These standards can be summarized as a step-wise and iterative process of formulating the research question; articulating the intervention theories, conducting data extraction, and analyzing and synthesizing causal relationships using CMOs; mapping the evidence to reusable conceptual platforms to inform implementation; and developing recommendations for implementation and innovation (**Figure 6**).

Figure 6: The Step-Wise and Iterative Process of Realist Review for the ScopHIA Knowledge Synthesis



3.2 Developing a Framework for Realist Review

The ScopHIA knowledge synthesis was conducted with attention and adherence to the seven reporting requirements outlined by the *RAMESES I* publication standards for realist review, as the following:

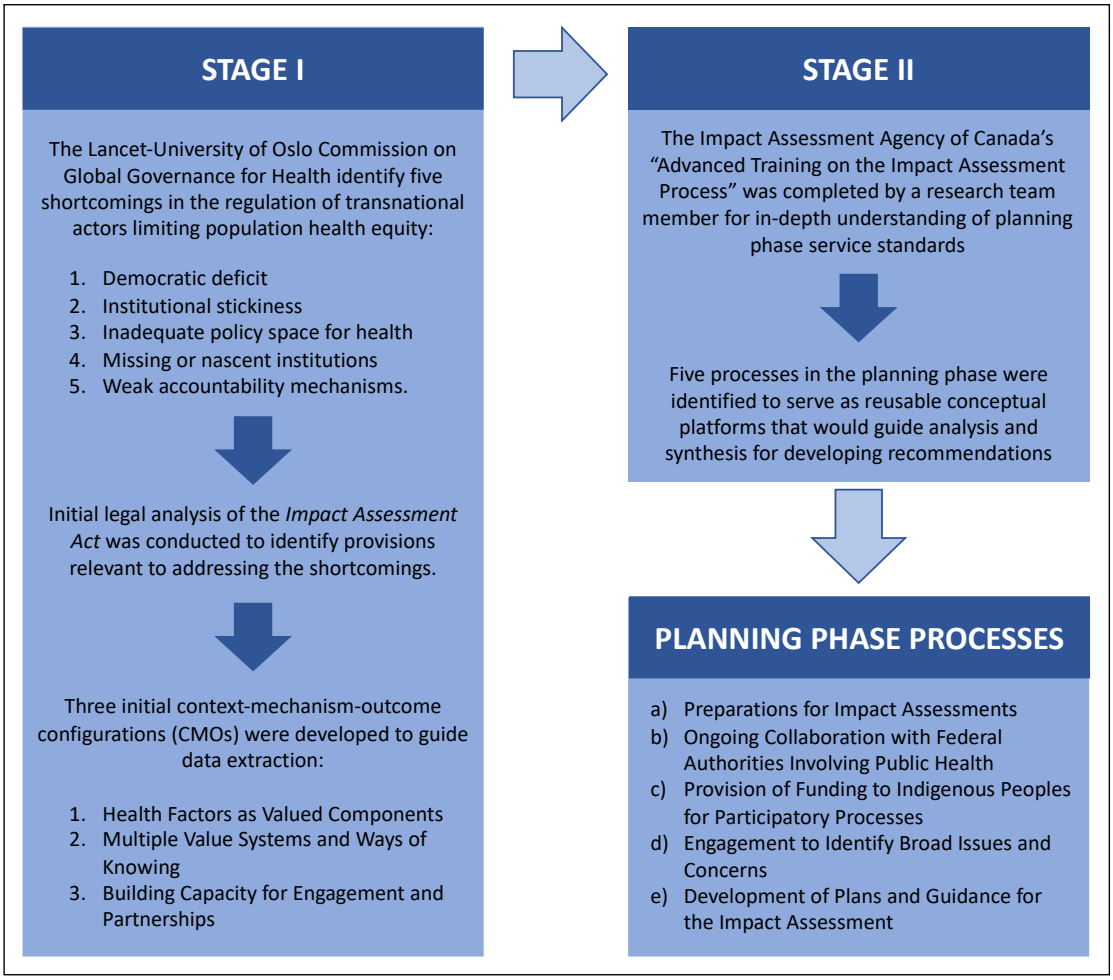
1) Preliminary Scoping and Development of the Context-Mechanism-Outcome Configurations;
2) Description of the Iterative Searching Process;
3) Explanation for the Selection and Appraisal of Documents;
4) Statement of the Document Characteristics and a Document Flow Diagram;
5) Justification for the Selection of Data for Extraction;
6) Description of the Analysis and Synthesis Process; and
7) Outline of Any Changes in the Review Process.[62]

The research team members who conducted data extraction and analysis and synthesis for the realist review and drafted the report consisted of Jennifer Ann Brown (Research Supervisor), Hyejun Kim (Research Assistant), and Kelsey Schober (Research Assistant). Candace Nykiforuk (Principal Investigator) provided oversight to the research and knowledge mobilization processes, as well as scientific review for the report. Melissa Gorman (Knowledge User Collaborator) provided oversight to the research topic selection, as well as scientific review for the report; and Joe Vipond (Knowledge User Collaborator) provided direction to the media engagement and advocacy strategy for knowledge mobilization. Biographic information for each of the research team members stating relevant training and qualifications for the ScopHIA knowledge synthesis is provided in **Appendix A**.

3.2.1 Preliminary Scoping and Development of the Context-Mechanism-Outcome Configurations

Preliminary scoping of the literature in realist review involves careful but informal scanning of key sources in the topic area. This preliminary scoping is needed to support the development of context-mechanism outcome configurations (CMOs) to guide document searching, retrieval, screening, and data extraction. The ScopHIA knowledge synthesis drew upon knowledge and expertise within the research team and its understanding of the peer-reviewed and grey literatures. It consisted of two stages, summarized in **Figure 7** and described in detail below.

Figure 7: Preliminary Scoping and Development of the Context-Mechanism-Outcome Configurations (CMOs)

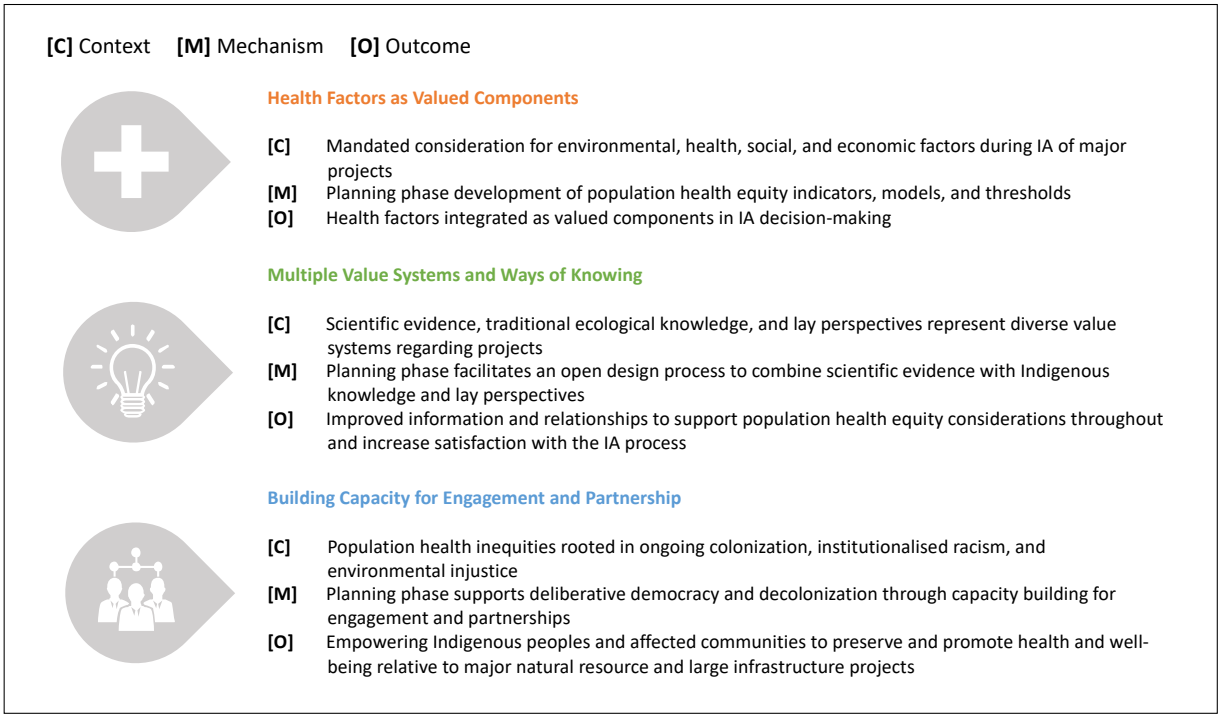


Stage I involved legal analysis of the *Impact Assessment Act*[48] to identify provisions relevant to five institutional shortcomings in the regulation of transnational actors (such as proponents of major projects) identified by the *Lancet-University of Oslo Commission on Global Governance for Health* as limiting the promotion of population health equity.[75] According to McGetrick et al.'s (2019) analysis, each of these five identified shortcomings can be defined in relation to impact assessment in the following way:

> *Democratic deficit* refers to insufficient participation by under-represented stakeholders like "civil society, health experts, and marginalised groups"[75p.631] … *Weak accountability mechanisms* refers to a lack of transparency and inability to enforce regulation of powerful actors … *Institutional stickiness* refers to regulatory processes maintaining entrenched power relations, inflexibility, and resistance to reform … *Inadequate policy space for health* refers to a lack of intersectoral collaboration between industries and public health authorities … [and] *Missing or nascent institutions* refers to a lack of intersectoral instruments and institutions for promoting population health.[76p.2-3]

From this legal analysis, three CMOs were developed to guide data extraction across the peer-reviewed and grey literature sources. Described as (i) Health Factors as Valued Components; (ii) Multiple Value Systems and Ways of Knowing; and (iii) Building Capacity for Engagement and Partnerships, these three CMOs were devised so that research team members conducting data extraction would capture all of the information relating to any and all of these themes within each source, generating a highly detailed and comprehensive data set for the ScopHIA knowledge synthesis. **Figure 8** provides an overview of each CMO.

Figure 8: The Context-Mechanism-Outcome Configurations (CMOs) Developed to Facilitate Data Extraction



In **Stage II** of preliminary scoping, a member of the research team completed the Impact Assessment Agency of Canada's "Advanced Training on the Impact Assessment Process" program for in-depth understanding of planning phase service standards. Through this training and drawing upon knowledge and expertise within the research team, five planning phase processes were identified to serve as "reusable conceptual platforms"[61p.92] to guide analysis and synthesis of evidence from data extraction:

a) Preparations for Impact Assessments;
b) Ongoing Collaboration with Federal Authorities in Public Health;
c) Provision of Funding to Indigenous Peoples for Participatory Processes;
d) Engagement to Identify Broad Issues and Concerns; and
e) Development of Plans and Guidance for the Impact Assessment

Results for the ScopHIA knowledge synthesis have been organized as key points under each planning phase process as "reusable conceptual platforms."[61p.92] This allowed for the development of recommendations to support implementation and innovation for evidence-based best practices and principles, thus leveraging the theoretical orientation of realist review to understand "works for whom, in what circumstances, in what respects, and how."[63p.21]

3.2.2 Description of the Iterative Searching Process

The iterative searching process to identify peer-reviewed and grey literature for data extraction proceeded in two streams, incorporating both the systematic and purposive retrieval of documentary sources. Using the Scopus database maintained by Elsevier, articles containing the words "health" and/or "scoping" in the title, abstract, key words, or text from the ten-year period from 2010 to 2019 inclusive were retrieved for *Environmental Impact Assessment Review* and *Impact Assessment and Project Appraisal,* as the two foremost international research journals in the field of impact assessment. Concurrently, additional peer-reviewed and grey literature for any year of

publication were purposively identified and retrieved iteratively through multiple channels. These channels were based on knowledge and expertise within the research team to identify key references, examination of citations within the sources undergoing data extraction, and/or targeted key word searching on specific topics and ideas within planning phase processes emerging at later stages of the realist review analysis and synthesis.[8]

3.2.3 Explanation for the Selection and Appraisal of Documents

Documents retrieved from *Environmental Impact Assessment Review*, *Impact Assessment and Project Appraisal*, other peer-reviewed journals, and the grey literature were initially screened for inclusion at the time of their retrieval by assessing their relevance to the new Canadian impact assessment system for major projects. This initial screening occurred across any or all of the data extraction CMOs (see **Figure 8**) and consisted of title, abstract, and keyword review. The documents were then further appraised for full data extraction if they had relevance to any of the planning phase processes for analysis and synthesis, namely: a) Preparations for Impact Assessments; b) Ongoing Collaboration with Federal Authorities in Public Health; c) Provision of Funding to Indigenous Peoples for Participatory Processes; d) Engagement to Identify Broad Issues and Concerns; and e) Development of Plans and Guidance for the Impact Assessment. Given these criteria for selection and appraisal, the resulting data set was large and comprehensive, providing an extensive basis of evidence for the realist review.

3.2.4 Statement of the Document Characteristics and a Document Flow Diagram

The systematic search retrieved 515 documents and the purposive search retrieved 71 documents, for 586 documents in total. There were 66 out of 321 documents retrieved from *Environmental Impact Assessment Review* that passed initial screening, and 62 documents underwent full data extraction. For *Impact Assessment and Project Appraisal*, 62 out of 194 documents passed initial screening, and 58 underwent full data extraction. All 71 documents identified through purposive searching passed initial screening, and 65 underwent full data extraction. Therefore, 199 documents out of the 586 total documents passed initial screening, and 185 underwent full data extraction for the realist review report, with 14 documents excluded as not having substantial relevance to the five planning phase processes developed for analysis and synthesis (**Figure 9**).

In addition to documents retrieved from *Environmental Impact Assessment Review* and *Impact Assessment and Project Appraisal*, other source journals for documents that underwent full data extraction included *European Journal of Operational Research* (three documents), *Environmental Health Perspectives* (two documents), *International Journal of Circumpolar Health* (two documents), *Journal of Environmental Assessment Policy and Management* (two documents), and *The Extractive Industries and Society* (two documents). Journals that contributed a single document to the data extraction included *Challenges*, *EcoHealth*, *EMBO Reports*, *Environmental Geochemistry and Health*, *Environmental Practice*, *Environmental Science & Policy*, *Human Ecology*, *Pimatisiwin: A Journal of Aboriginal and Indigenous Community Health*, *Science of the Total Environment*, and *World Development*.

Grey literature documents that underwent full data extraction included materials produced by the Arctic Council (from two working groups, the Sustainable Development Working Group [SDWG] and Conservation of Arctic Flora and Fauna [CAFF]), the Firelight Group, the First Nations Major Projects Coalition, the Government of the Northwest Territories, the International Petroleum Industry Environmental Conservation Association (IPIECA) and the International Association of Oil and Gas Producers (IOGP), the National Collaborating Centre for Environmental Health, the Ngā Pae o te Māramatanga Maori Centre of Research Excellence, the State of Alaska Health Impact Assessment (HIA) Program, and the World Health Organization.

To distinguish these documents as having undergone full data extraction for analysis and synthesis, each realist review document in the ScopHIA knowledge synthesis is cited by the first letter of its author numbered alphabetically (**Table 3**), with a full reference list for all 185 documents provided in **Appendix B**.

[8] Targeted key word searching on specific topics and ideas within planning phase processes emerging at later stages of analysis and synthesis were conducted using the Scopus and Google Scholar databases, Google search engine, and relevant websites.

Table 3: List of Citations for Documents Undergoing Full Data Extraction in the ScopHIA Knowledge Synthesis

A1 Aalhus 2020
A2 Aashukan Declaration 2017
A3 Allais & Gobert 2019
A4 Anderson et al. 2013

B1 Bacelar-Nicolau et al. 2018
B2 Baldwin 2015
B3 Baldwin & Rawstorne 2019
B4 Baumgart et al. 2018
B5 Bhatia et al. 2009
B6 Bhatia & Seto 2011
B7 Bhatia & Wernham 2008
B8 Boerchers et al. 2018
B9 Bond et al. 2013
B10 Bond et al. 2014
B11 Bond et al. 2018a
B12 Bond et al. 2018b
B13 Bonnell 2020
B14 Borgert et al. 2019
B15 Borioni et al. 2017
B16 Bourcier et al. 2015
B17 Brauer 2018
B18 Brueckner et al. 2014
B19 Bullock et al. 2019
B20 Buse et al. 2018
B21 Buse et al. 2019
B22 Byambaa et al. 2014

C1 Cameron et al. 2011
C2 Canter & Ross 2014
C3 Cashmore & Richmond 2013
C4 Chanchitpricha & Bond 2018
C5 Claudio et al. 2018
C6 Climent-Gil et al. 2018
C7 Conservation of Arctic Flora & Fauna 2019
C8 Coutinho et al. 2019

D1 Dare et al. 2014
D2 Day et al. 2019
D3 den Broeder et al., 2016
D4 den Broeder et al., 2017
D5 Doelle & Sinclair 2019
D6 Domínguez-Gómez 2016

E1 Ehrlich & Ross 2015
E2 Equator Principles 2020

F1 Fehr et al. 2016
F2 FNIGC 2014
F3 First Nations Major Project Coalition 2019a
F4 First Nations Major Project Coalition 2019b
F5 Freeman 2019

G1 Gaber & Overacker 2012
G2 Gamu et al 2015
G3 Gibson 2017
G4 Gibson & Klinck 2004
G5 Glasson & Cozens 2011
G6 Government of the NWT 2019
G7 Green et al. 2019
G8 Grieg & Duinker 2011

H1 Hackett et al. 2018
H2 Haigh et al. 2012
H3 Hanna & Noble 2012
H4 Hanna & Vanclay 2013
H5 Hanna et al. 2014
H6 Hanna et al. 2016
H7 Hansen et al. 2019
H8 Hansen & Wood 2016
H9 Harris & Haigh 2015
H10 Harris & Spickett 2011
H11 Harris & Viliani 2018
H12 Harris-Roxas & Harris 2013
H13 Harris-Roxas & Harris 2011
H14 Harris-Roxas et al. 2012
H15 Health Canada 2015
H16 Hebert et al. 2012
H17 Heiner et al. 2019
H18 Hserc et al. 2018

I1 IPIECA 2016

J1 Johnston et al. 2019
J2 Jones et al. 2014
J3 Joseph et al. 2015
J4 Joseph et al. 2017

K1 Kågström 2016
K2 Kågström et al. 2013
K3 Kågström & Richardson 2015
K4 Kantamaturapoj et al. 2018
K5 Kemp & Vanclay 2013
K6 Khan et al. 2020
K7 Kirchoff & Tsuji 2014
K8 Know et al. 2010
K9 Kwiatkowski 2009
K10 Kwiatkowski 2011

L1 Larkin et al. 2018
L2 Larsen 2018
L3 Leifsen et al. 2017
L4 Leuenberger et al. 2019
L5 Leung et al. 2015
L6 Linzalone et al. 2019
L7 Loomis & Dziedzic 2018
L8 Loxton et al. 2013
L9 Lyhne & Kørnøv 2013

M1 Mahboubi et al. 2015
M2 McCaig 2005
M3 McCallum et al. 2017
M4 McCallum et al. 2015
M5 McGetrick et al. 2017
M6 McGetrick et al. 2015
M7 McKay & Johnson 2017
M8 Meuleman 2015
M9 Midgley et al. 2018
M10 Morgan 2017
M11 Morgan 2012
M12 Morgan 2011
M13 Morgan & Fa'aui 2018
M14 Morrison-Saunders & Pope 2013
M15 Muir 2018
M16 Mulvihill 2003
M17 Mulvihill & Baker 2001
M18 Mulvihill & Jacobs 1998

N1 Negev 2012
N2 Negev et al. 2013
N3 Nkyekyer & Dannenberg 2019
N4 Noble & Birk 2011
N5 Noble & Bronson 2005
N6 Noble & Bronson 2006
N7 Noble et al. 2019

O1 Odparlik & Köppel 2013
O2 Office Chief Medical Office of Health 2012
O3 Office of the Wet'suwet'en
O4 O'Faircheallaigh 2010
O5 Olagunju & Gunn 2015
O6 Orenstein et al. 2010
O7 Orenstein et al. 2019

P1 Parkes et al. 2019
P2 Parlee 2015
P3 Parsons & Moffat 2014
P4 Partidario & Sheate 2013
P5 Pavlyuk et al. 2017
P6 Pennock & Ura 2011
P7 Peterson & Kosatsky 2017
P8 Petrova & Marinova 2015
P9 Pfeiffer et al 2017
P10 Pfeiffer et al 2010
P11 Pollack et al. 2015
P12 Pope et al. 2013
P13 Porter 2014
P14 Pouliot & Godbout 2014
P15 Prystay et al. 2014

R1 Rehu & Morgan 2012
R2 Reschny et al. 2018
R3 Retief et al. 2014
R4 Retief et al. 2013
R5 Riley et al. 2019

S1 Sánchez & Mitchell 2017
S2 Sarkar et al. 2019
S3 Schirmer et al. 2011
S4 Schuchter et al. 2014
S5 Schuchter et al. 2015
S6 Sinclair & Diduck 2017
S7 Sinclair et al. 2018
S8 Sinclair et al. 2012
S9 Snell & Cowell 2006
S10 Snyder et al. 2012
S11 Spickett et al. 2012
S12 State of Alaska HIA Program 2015
S13 Storey 2016
S14 SDWG Arctic Council 2019

T1 Tamburrini et al. 2011
T2 Therivel 2019
T3 Tobias &Richmond 2014
T4 Tsuji et al. 2011

U1 Udofia et al. 2016
U2 Udofia et al. 2017
U3 UNDRIP 2017

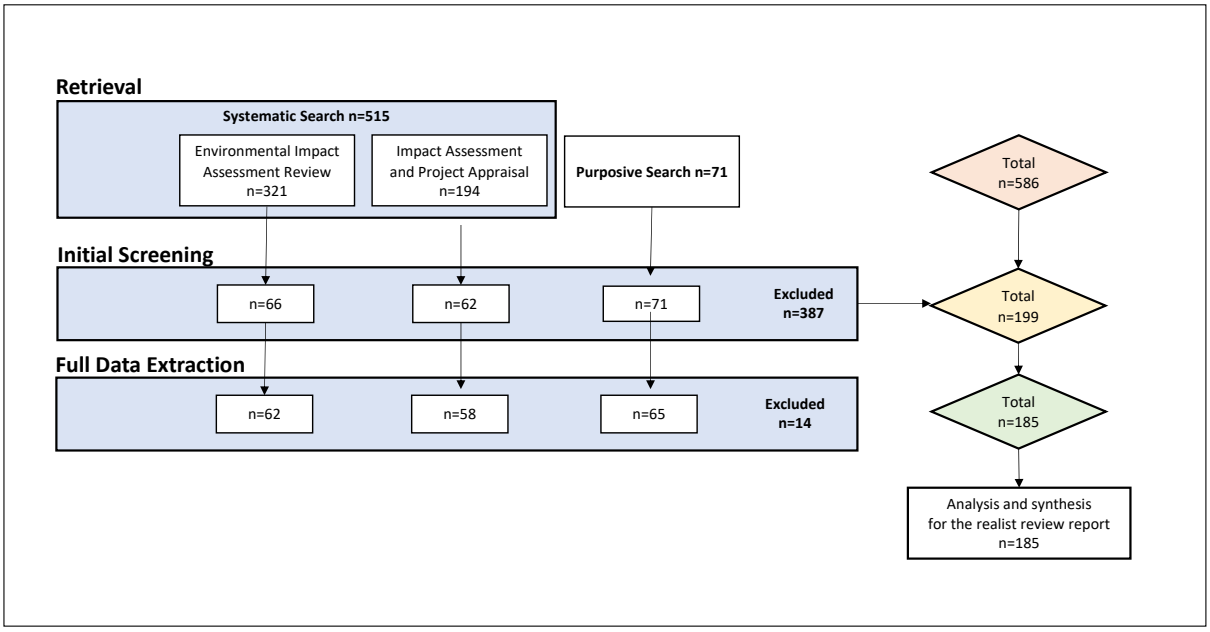
V1 Vanclay 2019
V2 Vanclay et al. 2013

W1 Walker 2010
W2 Wernham 2007
W3 Wessels et al. 2015
W4 Wewstman & Joly 2019
W5 Westwood & Orenstein 2016
W6 Whitelaw et al. 2009
W7 Winkler et al. 2019
W8 Winkler et al. 2012
W9 Wong & Ho 2015
W10 World Health Organization 1999

Y1 Yap 2016
Y2 Yearworth & White 2018

Z1 Zhang et al. 2018

Figure 9: The ScopHIA Knowledge Synthesis Document Flow Diagram



3.2.5 Justification for the Selection of Data for Extraction

Each of the 185 documents that underwent full data extraction were reviewed in entirety by a Research Assistant, using the three CMOs to identify every instance of evidence in each document relevant to the realist review. Each instance was copied from the source documents and indexed into a data extraction template according to a specific set of criteria (**Table 4**). Specifically, the Research Assistant directly quoted its full text or image, assigned it to one of the three CMOs, assessed whether it identified positive or negative outcomes, stated whether it provided applied or conceptual insights, indicated any important cited or otherwise relevant follow-up references, and clarified their rationale for the extraction and/or additional notes for consideration during analysis and synthesis.

Table 4: Data Extraction Template for Documents in the ScopHIA Knowledge Synthesis

Context-Mechanism-Outcome Configuration	A statement of which CMO was implicated for the instance of evidence
Positive or Negative	A statement whether the instance of evidence identified positive or negative outcomes supporting analysis and synthesis for recommended best practices and principles, or potential pitfalls to be avoided
Quote#	A number assigned incrementally to each instance of evidence providing its identifier within the data extraction process
Direct Quote (…)	The full text of the instance of evidence from a document parsed as a single entry in the data extraction process
Page	The page number(s) for locating the direct quote within the document
Applied / Conceptual / [Other] Evidence	A statement whether the instance of evidence represented applied, conceptual, or other insights for analysis and synthesis
Follow-Up Reference?	Identification of any references cited in the document, or provided by the research team member conducting data extraction relating to the instance of evidence for consideration in initial screening for inclusion
Notes	Clarification for the rationale in data extraction of the instance of evidence by the research team member and/or any additional notes for consideration during analysis and synthesis

3.2.6 Description of the Analysis and Synthesis Process

Following data extraction for the 185 documents, the Research Supervisor reviewed each template to assign the instances of evidence where applicable to one or more of the planning phase processes: a) Preparations for Impact Assessments; b) Ongoing Collaboration with Federal Authorities in Public Health; c) Provision of Funding to Indigenous Peoples for Participatory Processes; d) Engagement to Identify Broad Issues and Concerns; and e) Development of Plans and Guidance for the Impact Assessment. At the same time, the Research Supervisor provided any additional notes clarifying this assignment or responding to initial data extraction by the Research Assistant, to which the Research Assistant responded as necessary (**Table 5**).

Table 5: Analysis and Synthesis Template for Documents in the ScopHIA Knowledge Synthesis

Planning Phase Process	A statement of which planning phase process(es) the instance of evidence would be applied
Additional Notes	Any additional clarification or responses to the initial notes by the Research Assistants from the Research Supervisor
Response	Any follow-up response from the Research Assistants to the Research Supervisor

Once each instance of evidence had been assigned, all of the text or images copied in the data extraction template was compiled into a single document for each of the planning phase processes. Using Scrivener version 3.1.5 word processing software (which has extensive capabilities for complex compiling and mark-up of text and images) the instances of evidence were grouped, summarized, and linked within each planning phase process. This categorization step permitted the analysis and synthesis of causality relationships, as well as development of a narrative for recommended strategies to inform implementation and innovation.

In Sections 4.1.1 through 4.5.3 of the results section, findings for the ScopHIA knowledge synthesis are presented by planning phase processes, organized by sub-themes providing key insights for evidence-based best practices and principles to support population health equity under Canada's new impact assessment system.

3.2.7 Outline of Any Changes in the Review Process

Although it was originally intended that there would be a formal protocol for the process of realist review developed prior to undertaking the research process for the ScopHIA knowledge synthesis, the timelines for completion of the project precluded formalization of research activities in the published literature prior to report submission. Instead, the research team will aim to publish the realist review protocol, as a precursor to further developing the materials in the report for peer-reviewed publication. Candidate journals for the publication of the realist review protocol include *BMJ Open*, *Implementation Science*, and *Systematic Reviews*.

RESULTS

The ScopHIA knowledge synthesis results are organized by *dark blue headings* describing the five planning phase processes, with *grey headings* presenting three key themes emerging under each process. These themes organize recommendations from the realist review for strategies to inform implementation and innovation through evidence-based best practices and principles.

All in-text references with alphanumeric citations in the results refer to documents that underwent full data extraction for the realist review, as described in the methods. These alphanumeric citations are listed in abbreviated format in **Table 3**, and are fully referenced in **Appendix B**.

4.1 Preparations for Impact Assessments

4.1.1 Pre-Planning Capacity Building Can Help Foster Self-Determination

The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (2007) principle of free, prior and informed consent (FPIC) has been recognized as a touchstone for upholding Indigenous peoples' "customs, traditions and land tenure systems,"[U3p.19] and as the basis for meaningful consultation in impact assessments.[A2,F4,G3,H4,H5,L3,U1,U3] Notably, FPIC principles define Indigenous peoples' self-determination as the "right to determine and develop priorities and strategies for the development or use of their lands or territories and other resources."[U3p.23,F4,H4,M5]

As major natural resource and large-scale infrastructure projects can be "rights-limiting and culturally significant"[W4p.235,B8] for Indigenous peoples, some sources contend that "appropriate tiering"[B13p.53] of strategic and regional assessments is needed, prior to the start of the planning phase.[H5,K7,S7,U1] Strategic and regional assessments can support shared understandings of Indigenous rights, title, resources, cultural heritage, and territories in project-level IAs.[F4,G3] As Noble et al. (2019) and others point out, strategic and regional assessments that address population health equity[B8,H11,L1,M15,W1] as a higher-level goal could broadly indicate "how to ensure a fair distribution of impacts, benefits, risks and uncertainties."[N7p.348] Conducting strategic and regional assessments incorporating Indigenous self-determination and population health equity prior to the planning phases for designated projects could thus provide foundational analyses throughout project-level IAs.[C2,J4,N7,O5,P1,P10,S13]

In parallel with strategic and regional assessments, several sources argue the importance of ongoing capacity building programs to support self-determination and engagement across all phases of IAs.[B7,B19,H13,M7,M15,O6,P9,P10,U2] As Bullock et al. (2019) note, however,

> [r]ights alone are not enough for Indigenous communities to reap the benefits of natural resource development. Diverse institutions are needed to support informal and formal relationships and processes. Moreover, capacity to become involved, indicated by the presence and development of several forms of capital, is essential.[B19p.90]

Several authors have recognized that IAs are moving beyond procedural check-lists to evaluate whether and how statutory authorities like the Agency can foster legitimacy, fairness, and social learning[B12,G7,J1,J3,L7,P4] by sharing "values [and] collaborative processes."[M12p.11] Providing space for Indigenous leadership in pre-planning capacity building for Indigenous peoples and affected communities can support this emerging mandate.[B19,M15,O6,P9,U1] For example, the Wet'suwet'en First Nation in British Columbia has demonstrated the capacity to establish a natural resources management office mandated by its hereditary leadership to coordinate with proponents in meeting requirements for acceptable development.[B19,O3] Organizations like the First Nations Major Project Coalition have produced tools such as the *Community Readiness Assessment* questionnaire to characterize capacity building requirements for elected and/or hereditary institutions to participate in project IAs.[F3] Capacity building must help foster self-determination to support population health equity; arguably, a lack of recognition for the self-determination of the Wet'suwet'en First Nation on a major pipeline project (despite its high capacity for participation in IAs) is the root of its national protest movement. Thus, fostering self-determination and capacity building from the pre-planning stage is critical to ensure legitimate and fair processes in impact assessments.[F3,F4,G3]

4.1.2 Transparent Protocols are Necessary for Appropriate Engagement

Choices made by the Agency and proponents about early engagement with Indigenous peoples and affected communities have implications throughout IAs, with potential repercussions for population health equity over the short-term, medium-term, and long-term.[F4,L2,M1,N5,S7,W2] The potential for unequal power relations during the pre-planning stage and planning phases for impact assessments could prevent sharing of evidence and information, and preclude meaningful consideration for multiple value systems and ways of knowing (for example, worldviews and epistemologies based in sharing Indigenous knowledge between generations).[B10,C3,J2,L2,M15,N1,S8,S9,W2] In the absence of

transparent protocols, perceived preferential engagement for some groups over others can exacerbate unequal power relations with proponents, and potentially preclude consideration of transboundary impacts.[A3,B6,M9,M13,O5,S2,S14,W1] Given the necessity for transparency in appropriate engagement with Indigenous peoples and affected communities, the State of Alaska HIA Program (2015) offers one possible set of criteria, namely: geographic proximity to projects; predicted changes in water sources; possibility for accidental release of contaminants; likelihood of population influx or relocation; regions for workforce recruitment; activity locations or potential for change in subsistence resources; changing transportation infrastructure; changing economic conditions; existing high burden of psychosocial distress, disease, or other health disparities; and existing high exposure to environmental hazards.[S12p.26] Strategic and regional assessments could provide further direction for appropriate engagement in project-level IAs.[B13,K7,S7,T5]

To illustrate the need for transparent protocols in terms of transboundary impacts to affected communities, Whitelaw et al. (2009) and Tsuji et al. (2011) relate how a planning phase unfolded during the early stages of IA for a proposed diamond mine in Québec, resulting in preferential engagement with certain Indigenous organizations over others.[T4,W6] Arguably, this planning phase neglected to acknowledge that "stewardship responsibilities"[T4p.44] and "significant cultural value"[T4p.44] are typically shared between communities,[B21] such that changes in relationships between communities can impact "Indigenous cultural continuity"[F4p.23] and generate local conflicts.[T4,W6] Through strategic and regional assessments and capacity building in the pre-planning stage, the Agency should develop transparent protocols for appropriate engagement that increasingly incorporates these broader considerations as they emerge from engagement with Indigenous peoples and affected communities on an ongoing basis.[C5,C7,F4,G3,L3,M10,U3,V2,W4]

The principles of UNDRIP (2007) and many authors assert the value of extending representativeness for population health equity to identify a wide range of participants in IAs, including "Indigenous Elders, women, youth, children and persons with disabilities,"[U3p.17] as well as on the basis of educational, socio-economic, occupational, and lifestyle criteria.[B19,G3,G6,J2,N2,N5,W6] To recognize their priority for population health equity considerations, Snyder et al. (2012) suggest denoting the various demographics as likely to be advantaged, marginally disadvantaged, or greatly disadvantaged by designated projects,[S10] which can support greater attention to the voices of those in the community beyond simply the leadership, or other prominent interests. Gender-based analysis plus (GBA+ in *IAA, 2019*) is another possible tool to help determine vulnerable subgroups and identify appropriate mitigation and accommodation measures.[G2,G3,H14,I1] Cameron et al. (2011) and others argue that diversity in engagement empowers "local people to become informed, active decision makers in bringing about the changes required for better health."[C1p.434,G3,M9,M13,N2,O2] For Indigenous peoples, identifying sub-populations to participate in IAs requires substantial coordination and consultation with "representative institutions"[U3p.23] to determine how these participants want to be engaged on a project-to-project basis, and with respect "customs, traditions, rules, and legal systems."[U3p.26]

As a wide-ranging recommendation, the Sustainable Development Working Group of the Arctic Council (2019), Tsuji et al. (2011), and others suggest the Agency, proponents, and other authorities must transparently and publicly document all methods, assumptions, and processes for engaging Indigenous peoples, affected communities, and sub-populations, anticipating that social learning will be critical to the evolving legitimacy of IAs.[G3,O4,S1,S8,S9,S14,T4,U1] These transparent protocols are required during the pre-planning phases, in addition to creation of the *Indigenous Engagement and Partnership Plan* and *Public Participation Plan* in later stages of the planning phase.

4.1.3 Public Health Authorities Should be Involved from Early on

The importance of developing structures for intersectional collaboration between impact assessment and public health authorities has been emphasized by many sources.[B9,C7,C4,F5,H9,H11,L6,L7,M1,M2,M12,P7,P1,P9,S1,S11,W7] According to Doelle and Sinclair (2019), "[i]t will be up to the Agency, informed by the early planning phase, to provide appropriate direction on this allocation of responsibility"[D5p.4] between impact assessment practitioners and public health authorities working at the federal level. This will be formalized on a project-by-project basis by the *Federal Authority Advice Record* requesting specialist knowledge or other information to support population health equity in IAs. Developing working relationships between the Agency and local public health authorities or regional health

units can be another way that the pre-planning stages can help support population health equity for Indigenous peoples and affected communities.[F5,P10]

Greater collaboration between the Agency and public health authorities at both federal and local levels can support shared understandings and more comprehensive perspectives on impacts, as well as produce more realistically actionable population health equity recommendations to proponents.[B4,B7,B16,C4,C5,H10,H12,K10,N1,N3,N5,N7,S10,W10] As one illustration for collaboration in the pre-planning stage, medical officers of health, environmental health officers, public health inspectors, and IA specialists located within regional health units could provide expertise in collaboration with federal authorities for more comprehensive and acceptable outlines of the health, social, and economic context submitted as part of proponents' *Initial Project Descriptions*.[B1,B9,F5,H8,H15, J1,N5, O2,P1,P7,P10,S12] In developing such baseline profiles, the Sustainable Development Working Group of the Arctic Council (2019) advises proponents to "[s]tart building a relationship with [Indigenous peoples and] affected communities at the earliest possible stage."[S14p.22] Jones et al. (2014) and others[F4,G3,H4,S6] emphasize that

> engagement with Indigenous populations be built upon trust through acknowledging historical experiences with research and health issues; recognizing Indigenous sovereignty; understanding Indigenous diversity and its implications; planning for extended timelines; interpreting data within the cultural context; and utilizing Indigenous ways of knowledge.[J2p.6]

Many public health authorities at all levels have worked to advance population health equity for Indigenous peoples over many decades, and can support proponents in areas such as vocabulary, concepts, and methodologies;[P9] providing information on regional health services and surveillance systems;[I1] offering guidance on established procedures for health impact assessment;[H16,N2,W10] advising on participatory forms of engagement and research;[B5,K10] and helping identify suitable indicators, models, and thresholds for baselines, predictions, and monitoring.[M4,S12] Although timing and resources present perennial challenges,[B7,F5,H10] strong working relationships between the Agency and public health authorities are critical to promoting population health equity throughout IAs.[F5,P10]

Beyond the clinical and epidemiological capacity located in regional health units, some authors suggest extending structures for intersectoral collaboration to local stakeholders in education, social services, transportation, planning, and community organizations.[F5,G6,G8,H10,O2,P10] Sinclair and Diduck (2017) and others point out that establishing standing structures for intersectoral collaboration such as committees, working groups, or other networking forums could generate additional support for Indigenous peoples and affected communities.[B7,F4,M8,N1,S6,S14] This would provide opportunities to strengthen multi-level governance and furnishing easier access to officials and experts with a mandate to support population health equity in IAs.

4.2 Ongoing Collaboration with Federal Authorities in Public Health

4.2.1 Federal Authorities in Public Health Can Provide Key Resources and Guidance

Many authors describe the positive role for federal authorities in public health to provide guidance and advancement to the field of impact assessments.[F5,M2,P10,T1] According to the World Health Organization's (1999) *Gothenburg Consensus on Health Impact Assessment*, democracy, equity, sustainable development, and ethical use of evidence are four key values;[W10] researchers working for the World Health Organization (2010) further state that the basic procedures of health impact assessments will

> generate an overview of existing health issues (baseline), an indication of the probable health issues associated with the [project] (future potential changes in health outcomes) and what interventions will be needed to address them.[P10p.26]

In addition to providing an overview of the procedures for considering population health equity within broader IAs, guidance can identify potential indicators, models, and thresholds to be employed appropriately with communities,[B1,C2,G2,M1] recommend methodological approaches,[B6,L4,M1,M4,N5,P6,P7] clarify significance determinations,[B15,E1,H8,O6] guide the assessment and communication of uncertainty,[B6,D2,I1,N2,P5,S11] and present key principles and practices for more effective community engagement.[D1,D5,J1,H14,M9,P3,S4,S12]

Health Canada, the Public Health Agency of Canada, and the Canadian Institutes of Health Research (CIHR) hold key leadership roles in providing guidance and advancing the field, especially with an expansion of Health Canada's advisory mandate for IAs conducted under *IAA, 2019*.[B9,F5] Under the *Canadian Environmental Assessment Act, 2012*, Health Canada (2015) provided advice to the IA system in the form of specialist and expert knowledge in methods such as human health risk assessment;[B21,H15,I1,L1,M3,M4,R5] scientific review for proponents' project-specific documentation, predictions, and modelling;[G7,G8,N5,R2] information on health impacts mediated through potential contamination of country foods, air and water quality, noise and radiological impacts, and electric and magnetic fields;[A1,B4,B7,B20,C7,G3,H1,I1,J4,K10,L1,M4,M12, M15,N3,N5,P7,T3,W2,W7,Y1] as well as advisory assistance to other responsible authorities for analyzing impacts on potential and established Indigenous and treaty rights.[B19,B20,E2,F4,G3,H1,H17,J3,K5,K7,L2, L3,M6,M7,M15,P2, P7,P15,S5,S7,U1,U3,V2]

Through the Public Health Agency of Canada, the six National Collaborating Centres for Public Health have developed many relevant knowledge products and resources, including the recent *Health Impact Assessment (HIA) Knowledge and Needs Scan* that engaged with Canadian public health professionals to identify gaps and provide recommendations to develop structures, and increase capacity, for IAs within regional health units.[F5] In addition, CIHR as a federal funding agency for population health equity should continue to increase support for applied public health and implementation science research for IAs,[A3,D6,L1,L4,P2] with the aim of meeting an identified need for more research on major national resource and large-scale infrastructure projects in Canada.[B7,G8,P9]

4.2.2 Both Publicly Available and Community-Driven Data will be Required

Federal authority guidance for IAs considering population health equity should advise careful consideration of factors that extend beyond the major project footprint.[A1,B4,C5,G3,J1,M1,P9,S12] Authors have identified many factors affecting population health equity in affected communities: ecosystem degradation, household income and economic changes, demographic shifts, political developments, so-called *boom and bust* effects on community accessibility and transportation, overcrowding and unsanitary living conditions, stress on basic infrastructure and community facilities, changes in the built environment, lack of capacity for health and social services, increases in behavioural risk factors like unsafe sexual practices and substance use, domestic violence and crime, worksite and transportation injuries, toxic exposures, and food insecurity.[A1,B7,B20,G2,G4,G5,H1,J1,K2,M5,O2,P8,P10,R5,S4, S12,S13,W4]

Clinical health impacts associated with projects identified through scoping research have included increasing incidence and prevalence of cancers, chronic diseases, obesity and overweight, mental illness, cardiovascular diseases, and respiratory conditions.[A1,S4] In examining these impacts, numerous peer-reviewed and grey literature sources indicate a pressing need to consider environmental justice and levels of social vulnerability to impacts that guidance should address,[A1,B4,B7,B16,B21,C6,I1,K2,O2,S4,S10,S12,W1,W9] including differential impacts to groups such as women, children and youth, the elderly, people with disabilities, the poor, unemployed or illiterate, gender minorities, cultural and/or ethnic minorities, and Indigenous peoples.[A1,G4,H10,L4,M4,P10,U3] The nature of impacts to clinical health and broader socio-ecological environments factors will vary across projects. Thus, relevant factors should be integrated into baselines for impact assessments in close collaboration with Indigenous peoples and affected communities.

In a report prepared by Pfeiffer et al. (2010) for the World Health Organization—reflective of work by other researchers[B20,B22,H1,K2,M2]—the authors note that failure to acquire adequate baseline data reflecting Indigenous peoples' and affected communities' priorities can be a principal failing of health impact assessments in relation to major projects.[P10,S4] Federal authority guidance should address ways to develop adequate baselines to support population health equity considerations during IAs, using both publicly available and community-driven data sources.

To support the development of federal authority guidance in this respect, Buse et al. (2018) and others have recommended a "parallel streams"[B20p.27] approach, combining community-driven selection of indicators, models, and thresholds with both public surveillance and primary data collection at a local level.[B14,F4,M8,P1,P4,V1] Appropriate consideration of Indigenous knowledge as part of community-driven processes should be an important ethical imperative in this work.[G3,V2] The parallel streams approach aligns with many authors' view that scientific and Indigenous knowledge must be "treated as separate and complementary knowledge system[s]."[H5,M17,M18,R1,S14]

Moreover, respectful inclusion of community-driven data sources can help to avoid "culturally biased assumptions about landscape and livelihood" [W4p.239,K10] that can unfortunately undervalue risks to land-based practices in relation to economic benefits, as part of later processes in IAs.[B20] Importantly, a parallel streams approach can support "co-production of knowledge"[P14p.833] and "community verification"[G3p.41] by which Indigenous peoples and affected communities lead the development and validation of meaningful, socially-derived indicators, models, and thresholds.[G3,H1,J4,S10]

4.2.3 Promoting Scientific Standards Could Improve Key Areas of Practice

Federal authorities in public health can promote population health equity across multiple impact assessments to achieve continuous improvement under *IAIA, 2019*, by helping to develop and promote scientific standards that facilitate what Hackett et al. (2018) and others consider to be "a common, coordinating framework to ensure consistency and transferability of data or information from one project to the next."[H1p.420,B1, B6,B15,B21,M12] In addition to recommending that IAs identify potential indicators, models, and thresholds through the parallel streams approach,[B14,B20,F4,P4,V1] scientific standards are currently needed to validate diversity in methodological approaches, characterize significance determinations, communicate uncertainty, and promote community engagement strategies.[B1,C2,G2,H8, M4,N5,P5,S4]

Methodological diversity is a hallmark for considering population health equity in impact assessments,[B7,B14, C5,G1,G3,H2,M1,M2,M4,P8,S5,W10] although quantitative approaches are far more frequently employed than qualitative ones.[R2] According to Fehr et al. (2016) and others, quantitative methods should be contextualized by "causation, external validity, heterogeneous effects, and secular trends."[F1p.179-180,M4] Qualitative methods commonly used in assessing population health equity impacts are drawn from the social sciences, and can include literature reviews, surveys, interviews, focus groups, ethnographies, case studies, participatory mapping, narrative- and arts-based approaches, administrative data analysis, network analyses, and cohort studies, typically designed with repeat measures for follow-up.[B2,B20,G1,G2,I1,Y2] Given differing purposes and standards for rigour in the use of mixed-methods, federal authorities in public health can iteratively identify and catalogue quantitative and qualitative approaches with respect to commonly encountered population health equity issues in IAs, highlighting approaches with high acceptability and confidence for Indigenous peoples and affected communities.[F4,K6,M7,M16,P1]

For determining significance, multiple authors have suggested factors for which Orenstein et al. (2019) have elaborated levels for predicting impacts. These include nature (beneficial, adverse, mixed), community importance (low, moderate, high), magnitude (negligible, low, moderate, high), duration (immediate, short-term, medium-term, long-term, permanent), geographic extent (footprint, local, regional, beyond regional), likelihood (unlikely, possible, likely), reversibility (fully reversible, partially reversible, irreversible), affected population (evenly distributed, disproportionate), and confidence (low, moderate, likely).[B5, E1,L9,M3,O6,S12] In partnership and through engagement with Indigenous peoples and affected communities, federal public health authorities can advance standards for assessing significance to facilitate comparison with emerging scientific consensus and socially-defined thresholds, while supporting "precaution-oriented values for the protection of health."[B4p.65,M4,P12]

In addition, many authors point to a need for public health system guidance on addressing, reporting, and communicating uncertainty during IAs.[B12,D2,G8,H2,H14,L5,M3,M15,P5,P14,R3] As Negev et al. (2013) and others indicate, a key approach in cases of scientific uncertainty is to apply the precautionary principle, which can have high acceptability for Indigenous peoples who value generational timescales even despite differences between scientific generalization and locally-situated Indigenous knowledge.[F3,N2,N7,S6] Federal authorities can emphasize the need for participatory and collaborative solutions in response to uncertainty, recognizing that precautionary approaches are generally considered to be common ground.[B15,D2,N1]

4.3 Provision of Funding to Indigenous Peoples for Participatory Processes

4.3.1 Funding Should Support Community-Driven Research and Development Processes

The Aashukan Declaration (2017) (developed through Indigenous peoples' leadership in forums hosted by the International Association for Impact Assessment) states that enhancement for the well-being of Indigenous peoples facing major natural resource and large-scale infrastructure projects must be "based on their own definitions and criteria,"[A2n.p.] which is echoed by many authors in both the policy[F4,G3,G4,H4,S14,U3] and research spheres.[B12,H17,L2,T3,W6]

Accordingly, fulfilling rights for access to financial and technical assistance[U3] in reviewing planning phase documents like the *Initial Project Description* and *Tailored Impact Statement Guidelines* "can cross over usefully to other applications"[M16p.48] for Indigenous peoples, since the space accorded to develop these definitions and criteria may serve to strengthen self-determination in affected communities.[B19,F3,H4,H16,H17,I1,L2,M15,P4,S8,U3] The Agency should thus be prepared to support Indigenous peoples to leverage planning phase funding "to advance the aspirations of the participant communities,"[M13p.987] by focusing review efforts on identifying and promoting "factors necessary for the creation and maintenance of health."[B4p.59]

There are several examples of how Indigenous peoples' review of planning phase documents could translate into community-driven research and development processes to generate "Indigenous health indicators or cultural service studies."[G3p.45,J2,S14,U1,U3,W6] As an illustration of these kinds of products, the *First Nations Perspective on Health and Wellness* provides a framework for Indigenous well-being as

> [s]triving to be in balance, within self (Body, Mind, Spirit and Emotion), with others (Family & Community), with the Spirit World, and with the land (nature). If there is an imbalance in any of these areas there is stress on our overall system. In time this stress causes illness and it can be physical illness, mental/ emotional illness (such as depression), or spiritual illness.[A1p.10]

In a further example, Gibson & Klinck (2004) proposed a set of indicators for Indigenous community resilience in northern Canadian communities that incorporates economic factors (income, employment, community finances, and long-term security); demographic change (mobility, migration, and crime); perceived resilience (social capital and community relations); and governance (institutional and community leadership).[G4p.121] Similarly, Parlee (2015) co-developed a model of health and well-being with the Lutsel K'e Dene First Nation, working with the community to develop indicators like "intergenerational knowledge sharing; family cohesion; volunteerism; civic participation; social interaction and communication; demonstration of traditional values; and participation in cultural events."[P2p.423] Morgan and Fa'aui (2018) describe their framework for *mauri* sustainability[9] as having the four constituent dimension of eco-system *mauri*, *hapū* (cultural) *mauri*, community *mauri*, and *whānau* (family) *mauri*,[M13p.987] redefining thresholds for risks and benefits of proposed projects to further reflect the worldviews of Indigenous peoples and affected communities.[R1] As Gibson (2017) for the Firelight Group and others describe "traditional knowledge and use studies [as] the prevalent Indigenous counter-mapping method,"[G3p.14] it can be another tool to potentially circumvent hegemonic technical discourses during IAs.[M6,M13]

These research products or new tools developed through on-going community-driven research and development processes can be used to support requirements for engagement and studies laid out in the *Tailored Impact Statement Guidelines*, *Indigenous Engagement and Partnership Plan*, or *Public Participation Plan*. As such, funding to review planning phase documents could be linked to broader community-driven research and development processes (which could be funded separately through programs like the Agency's Indigenous Capacity Support Program).[58] This would facilitate the operationalization of definitions and criteria to enhance the well-being of Indigenous peoples, helping to ensure "culture is alive and enlivened in the research process."[G3p.36,U1]

[9] The Māori word "mauri" can be translated as "life force or life supporting capacity."[M13p.984]

4.3.2 Communities Should have a Meaningful Level of Influence in Decision-Making

Population health equity for Indigenous peoples participating in impact assessments requires self-determination and meaningful levels of influence over decision-making.[B19,H4,L2,M5,M6,O4,V1] Generally, authors in the knowledge synthesis did not argue that FPIC principles[U3] should be employed to permit communities to veto developments,[D5,H5,L1,L2] although this argument can certainly be made. Instead, a meaningful level of influence in decision-making in terms of FPIC was set out as empowering Indigenous peoples "to fully comprehend the implications of the project"[V1p.3] including "[i]nformation on whether and how the [p]roject will contribute a net benefit to Nation-building … and 'distributional equity' between Indigenous and non-Indigenous sub-populations."[F4p.35] Importantly, Larsen (2018) and others note that even in jurisdictions with considerable institutional capacity to empower Indigenous peoples in this way, population health equity can be "undermined by unequal capacities between communities and developers and lack of proper recognition of Indigenous political and customary institutions,"[L2p.216,P4,W4] causing communities and allied organizations to resort to litigating or protesting developments.[B7,B11,F4,H4,K6,K7,M5,M8,P10,W1] In light of these argument and evidence, it is imperative that IAs equalize decision-making capacity between the Agency, proponents, Indigenous peoples, and affected communities.

In the planning phases, meaningful levels of influence over decision-making require information needs to be met. These include: culturally appropriate language translation; an appropriate reflection of community needs and aspirations in the *Tailored Impact Statement Guidelines*, *Indigenous Engagement and Partnership Plan*, and *Public Participation Plan*; and early consideration of potential mitigation and/or compensation measures that are negotiated as acceptable to Indigenous peoples and affected communities.[B19,C7,D5,G3,K10,M18,R1,R5,S8,S14,U3] According to the First Nations Major Project Coalition (2019), appropriate compensation measures in the absence of available mitigations for population health equity could include "capacity building programs, cultural protection/continuity programs, habitat restoration, education, training, employment and procurement opportunities, infrastructure, and financial considerations."[F4p.36] This list of measures could be expanded, potentially through funding support provided to Indigenous peoples during the planning phase.[B2,C5,E2,F4,G2,H7,J3,W1,Y1] Although accommodation measures are more typically considered in later stages of IAs, opening these conversation during the planning phase will help determine which measures are acceptable (and which are not) at an earlier point in the process.

Indigenous governments[S14] and boundary organizations that translate information between policy actors and communities (such as the First Nations Major Project Coalition,[F4] Kimberly Land Council,[G3] Maniilaq Association,[S14] or Makivik Corporation,[M18] and others) can help facilitate meaningful levels of influence for Indigenous peoples and affected communities at various points during the planning phase, as Mulvihill and Jacobs (1998) illustrate for a planning phase exercise in northern Québec:

> The Makivik Corporation undertook its own interpretive exercise, taking oral interventions and other inputs, then distilling these into more guideline-ready form. Their submission was an exhaustive summary of the concerns [and] a number of recommendations.[M18p.361]

Meaningful levels of influence can also be facilitated through Indigenous-led assessments, or as part of co-developed processes where Indigenous peoples and affected communities contribute to drafting, reviewing, and/or approving relevant sections within the *Impact Assessment Report* produced in the impact assessment phase.[G3,S14]

4.3.3 Community Stewardship of Knowledge Products Generated

Community stewardship of knowledge products generated in community-driven research and development processes is required for self-determination, and thus population health equity, as recognized by the First Nations Information Governance Committee principles of ownership, control, access, and possession (OCAP®).[F2p.4,G3,M6] While OCAP® principles refer specifically to the context of First Nations in Canada, respecting Indigenous knowledge as locally situated and belonging to the communities in which it is expressed has been reinforced by the UNDRIP (2007) and the Sustainable Development Working Group of the Arctic Council (2019), the latter of whom states:

> Indigenous knowledge-based studies cannot be held as proprietary by project proponents or authorities, but they require consideration around intellectual property rights.[S14p.22,U3]

According to guidelines for *Ethical Professional Practice in Impact Assessment Principles for Ethical Research Involving Humans,*[V2] prior to engaging in the development of Indigenous knowledge data and information products "plans should be agreed for managing use of, and access to, research results."[V2p.248] Buse et al. (2018) further specify that agreements, plans, and protocols for considering Indigenous community data and information in IAs should

> recognize original data collection efforts; clarify data ownership, management, maintenance and use; [and] protect privacy and confidentiality.[B20p.23]

Many authors maintain that Indigenous governments, boundary organizations, and knowledge holders must be empowered to lead appropriate consideration and stewardship of Indigenous knowledge within IAs.[H5,M6,M15,M18,S14,T3] Moreover, free, prior and informed consent principles require that plans concluded with Indigenous peoples must be developed in accordance with Indigenous peoples' own institutions and structures, upholding "the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions,"[U3p.22,F4] as well as requirements for confidentiality.[H17,M6,V2] Gibson (2017) for the Firelight Group describes how Indigenous peoples must retain control of research and development processes throughout data collection, analysis, and interpretation stages, reflecting their own needs and aspirations throughout,[C7,G3,M18] and producing

> community led studies, which allow stories and knowledge to be shared in the settings they are always shared in, between the generations. When Elders and hunters are able to teach young people about their stories and histories out on the land, in community controlled studies, they are actively living their culture. Traditional knowledge is carefully characterized, but not at all in isolation [and it] cannot be reduced to data points that can be used to understand a concept.[G3p.37]

Community stewardship of knowledge products generated during the planning phase—and any other data and information products involving Indigenous peoples during IAs—can help promote population health equity by supporting the development of appropriate indicators, models, and thresholds for IA; strengthening institutions and structures for data and information stewardship in communities; and preventing development of mistrust and conflict with proponents.[G3,K10,M6,P1,P7,S14]

4.4 Engagement to Identify Broad Issues and Concerns

4.4.1 Early Engagement Should Foster Social Learning across Participants

Social learning as changing knowledge, attitudes, and behavior through group observations, interactions, and two-way communication was identified as an important goal for early engagement and partnership with Indigenous peoples and affected communities during IAs.[D3,H8,H11,H12,M11,P4,S1,W6,Y2] Through social learning, IA participants can "work together, sharing information to identify effective, socially acceptable strategies to mitigate impacts and identify opportunities"[O4p.21] by examining biases, reframing issues, building trust, sharing values, and fostering legitimacy in the process.[N2,M9,P4]

During early engagement, social learning about a proposed project can be enhanced through sharing, interpreting, and reconsidering information in clear and understandable terms, resulting in plain language summaries translatable into Indigenous languages.[B4,B19,D3,F5,J2,K10,M5,N1,N7,P1,P4,S1,S8,S14,T3] To support this work, the Agency and non-Indigenous IA participants should formally or informally undertake education and training in cultural sensitivity, enabling appropriate acknowledgement and respect for Indigenous ontologies (theories of reality) and epistemologies (theories of knowledge).[B12,J1,J2,M15,O4,P4,S14]

Importantly, social learning during early engagement for population health equity should be uniquely situated by the circumstances, cultural dynamics, and leadership structures of Indigenous peoples and affected communities.[D1,H8,L3,M17,N1] Supporting social leaning between Indigenous and non-Indigenous participants in early engagement processes, Jones et al. (2014) present the requirement for

> the difficult conversation addressing the impacts of assimilation policies, systemic racism and the impacts on community health and individual wellbeing is necessary and should be sensitively conducted.[J2p.5]

In terms of population health equity, Tobias and Richmond (2014) and others note the negative impacts of ongoing and persistent "environmental dispossession"[T3p.26] for Indigenous peoples, while sustaining a strong connection to the land has been associated with "increased self-esteem, cultural pride and overall improved physical health."[T3p.26,H17,J2,K10,M6,M15] To understand the local context for Indigenous peoples and affected communities, Mulvihill & Jacobs (1998) recommend that every party to an IA

> become literate in imagery, methodology, and epistemology beyond its own frame of reference [as] a full participant in the learning process, rather than a player in an adversarial game.[M18p.360]

Without social learning, Muir (2018) and others caution, the "cultural systems, institutions, subsistence economy and the traditional laws and practices"[M15p.195] that nourish Indigenous peoples' relationship with the environment can be "further eroded through conventional [impact assessment] processes."[M15p.195,G4,L1] As such, all parties to IAs have a responsibility to promote population health equity through their commitment to social learning.

4.4.2 Multiple Forums Can Help Prioritize Issues and Concerns

Several authors indicate that employing multiple techniques and forums during early engagement with Indigenous peoples and affected communities can help ensure a wide variety of perspectives on population health equity are considered during the planning phase.[H5,I1,K6,K7,M7,P3,U2,W7] Various techniques and forums have been proposed for early engagement, including setting up community advisory groups, opening project field offices, hiring community coordinators, scheduling community meetings, facilitating sharing circles, holding public hearings, conducting surveys and interviews, holding community fairs, providing field trips, opening information hotlines, offering webinars and teleconferences, and soliciting comments through a public registry website.[H3,J2,M4,M11,P4,S1,S6,W2] For events, the State of Alaska HIA Program (2015) notes that authorities like the Agency and proponents should

> make attendance as convenient and enjoyable for the community as possible; as such, providing food, door prizes, and childcare can enhance attendance.[S12p.29]

Morgan & Fa'aui (2018) and others note the value in conducting early engagement according to existing cultural protocols for meetings within Indigenous communities;[F4,G3,J2,M13,M17] with O'Faircheallaigh (2010) suggesting that

> Indigenous Elders travel with officials to their traditional lands and expose them to environmental and cultural knowledge by demonstrating traditional life styles and practices.[O4p.21]

Across these and other techniques and forums with various advantages and disadvantages, authors consider ethical engagement practices, plain language information, visual simplification of concepts, and translation into Indigenous languages to be key practices.[B20,M9,N1,S12,S14,V2] While technological methods can support broader access to engagement processes during the planning phase,[Y2] Hanna & Noble (2012) note that, assuming there is access to the technology, resources on a public registry website need to be intelligible and searchable to Indigenous peoples and affected communities:

> It is one thing to have information available in the form of a registry; it is another to have it available in a language, format, and style that are easily understood by diverse audiences.[H3p.225]

Rigid daytime scheduling during the work week and compressed timeframes for early engagement can frequently be problematic.[G8,M15,M17,S8,S14] The seasonality of land-based activities and community events can determine the scale of participation for Indigenous peoples and affected communities, by conflicting with service delivery standards in the planning phase for IAs.[M3,S12]

As Baldwin and Rawstorne (2019) and others note "[w]hat for one community is experienced as a lower or less important risk with manageable effects may be experienced as catastrophic and intolerable in another."[B3p.385, B2,L8,N1,W2] Risk perceptions and emotional reactions about major projects among Indigenous peoples and affected communities presents an immediate population health equity impact,[B2,I1,L8,O2,R3,V1,W4] which should be documented in the *Summary of Issues* and addressed by proponents in their *Detailed Project Descriptions*. To support this work, Borgert et al. (2019) have proposed conducting materiality analyses of issues and concerns to identify and prioritize "the most 'material' issues for the organization to address."[B14p.40] This could be leveraged to support population

health equity by highlighting the materiality of issues and concerns presented by Indigenous peoples and affected communities during early engagement.[B3,D3,D6]

4.4.3 Public Health Frameworks Can Support Comprehensiveness

According to Pfeiffer et al. (2010) for the WHO, data and information used for baseline profiles, predicted impacts, and mitigations "need to provide a complete picture of what is happening in a given population"[P10p.37] for more comprehensive consideration of population health equity in impact assessments. During the planning phases, public health authorities can support efforts by the Agency to summarize issues and concerns raised by Indigenous peoples and affected communities in early engagement forums by providing guidance and expertise on the use of appropriate disciplinary frameworks.[B1,B21,M3,P1,P6,P7,R5] Public health frameworks can support early engagement with Indigenous peoples and affected communities by empowering coordinating agencies to ask "the right questions"[B8p.89] in order to identify broad issues and concerns, and avoid unnecessarily limiting the scope of IAs.[M7,M17,P6,S12] For example, in the appropriate context, early engagement might use the *mauri* framework for sustainability to ensure that issues and concerns were considered across all four of its dimensions of eco-system, cultural, community, and family well-being.[M13]

While noting alongside Pope et al. (2013) and others to avoid "excessive use of checklists, protocols, guidance or standards"[P12p.7] that prevent "sufficient depth to tackle adequately the complexity of the issues involved,"[D6p.114,H8,S9] frameworks can improve comprehensiveness for population health equity by ensuring a full suite of factors are considered, thus enabling a more complete *Summary of Issues* that can begin to link to parallel streams of indicators, models, and thresholds used throughout IAs.[B14,B20,G3,H1,J4,P1,P4,S10]

As an example of a public health framework, the State of Alaska HIA Program's (2015) Health Effect Categories could help support the generation of a *Summary of Issues* from early engagement across eight areas: "social determinants of health … accidents and injuries … exposure to potentially hazardous materials … food, nutrition, and subsistence activity … infectious disease … water and sanitation … non-communicable and chronic diseases … [and] health services infrastructure and capacity."[S12p.20-22] The State of Alaska HIA Program provides extensive public health system authority guidance and resources for operationalizing the Health Effect Categories framework to link major projects to health determinants and health outcomes,[S12,W2] with case studies and information supporting efforts to "gather data, execute fieldwork, review literature, prepare documents, and respond to comments."[A4p3] Alternately, Pennock & Ura (2011) have proposed an alternative salutogenic framework for health impact assessment based on their novel application of the Gross National Happiness index, employing the categories of "time use, living standards, governance, psychological wellbeing, community vitality, culture, health, education and ecology."[P6p.62]

Selection of an appropriate framework can occur through established and/or emerging structures for intersectoral collaboration between IA and public health authorities, and be informed and guided by regional and strategic assessments.[B9,C4,C7,F5,H9,H11,L6,L7,P7, P9,S1,S11] Ongoing capacity building and community-driven research and development processes can further support the use and development of appropriate measures for ensuring an equitable distribution of the risks and benefits of major projects.[F4,K7,N7,U1]

4.5 Development of Plans and Guidance for the Impact Assessment

4.5.1 Promoting Population Health Equity Expertise within a Multi-Disciplinary Project Team

Many authors have recognized the importance of proponents assembling an appropriately qualified multi-disciplinary team of consultants responsible for assessing population health equity in the impact statement phase of IAs,[B14,B16,L9] with expertise in public engagement and assessment methodologies[K3,Z1] and a strong foundation in reflective and ethical practice.[D2,H2,H9,J1,K1,P14,R4,V2,W1,W10] Other disciplinary experts such as sociologists, anthropologists, community development specialists, and others also can make exceptional contributions to population health equity while working as consultants for IAs.[B2,G3,H5,P7,W9] Further, authors suggest direct representation from Indigenous

peoples and affected communities serving as community coordinators within multi-disciplinary proponent teams,[H5,O6] with integration and accountability between health, community, and other technical membership as a key strategy for promoting population health equity perspectives.[K3,S5,W9]

Consideration for population health equity in impact assessment is still an emerging scope of practice for many Canadian consultants and public health professionals,[F5] which has been developing through a community of practice for on-the-job training, professional education, experiential learning, research and evaluation, organizational accreditation, professional certification, professional codes of conduct, and some university coursework.[B22,F5,K3,P4,P10,P11,S1,S5,W4] Policy and standards have been developed through international organizations, professional associations, public health agencies, knowledge translation centres, regional health units, university programs, and funding agencies.[A4,F5,J1,K6,P11,S4,S12,V3,W10] According to Kågström (2016) and other authors, incentives which motivate consultants to consider population health equity during IAs include regulatory requirements, enhanced professional identity and reputation, and a sense of ownership in producing quality impact statements.[B7,B14,K1,K3,L7,P15,R4,S9] The Agency and proponents can recognize population health equity expertise within the multi-disciplinary project team by promoting the involvement of consultants in the community of practice, adherence to policy and standards, and professional motivation within the IA context.

4.5.2 Co-Development and Co-Management through Plans and Guidance

The Sustainable Development Working Group of the Arctic Council (2019) presents co-development and co-management as key strategies to promote equitable sharing of risks and benefits in impact assessments, defined as when

> the Indigenous party assesses the impacts of the proposed project alongside the governmental agency in the EIA process. Ideally, the co-management process is based either on a legislated framework or a signed agreement between the Indigenous party and government enabling joint decision-making, thus meeting the goals and aspirations of Indigenous parties.[S14p.50]

According to the First Nations Major Project Coalition (2019), co-development and co-management can support processes for obtaining free, prior and informed consent by providing Indigenous peoples and affected communities with a meaningful level of influence over decision-making.[B19,D5,F4,H4,O4,V1] Co-development and co-management processes can support population health equity by addressing unequal power relations, encouraging participation and engagement, facilitating generation and sharing of evidence, and fostering meaningful consideration for Indigenous value systems and ways of knowing during IAs.[B10,C3,J2,L2,M15,N1,N2,S8,S9,W2]

Co-development and co-management procedures should employ data and information management plans ethically founded in community stewardship of knowledge products generated,[B20,F2,V2] building upon community-driven research and development processes for identifying population health equity indicators, models, and thresholds,[G3p.45,J2,S14] and leveraging on-going capacity building programs from the pre-planning and planning phases.[B7,B19,H13,M7,M15,P9,P10,U1] Development of the *Indigenous Partnership and Engagement Plan*, *Public Participation Plan*, and *Tailored Impact Statement Guidance* can formalize co-development and co-management, providing a clear basis and set of expectations for all IA participants.

4.5.3 Anticipating Post-Approval Management, Monitoring, and Follow-Up Programs

Studies required under the *Tailored Impact Statement Guidelines* can support population health equity during IAs by anticipating data and information that will contribute to post-approval management, monitoring, and follow-up. Co-developed and co-managed protocols[F4,S14] for "health management plans or integrated environmental management plans"[P10p.40] led by Indigenous peoples and affected communities can incorporate "identified thresholds of acceptable change [and] effective protection"[P10p.20] within community-based programs for data collection and analysis, monitoring the performance and compliance of major projects.[F4] Community-based programs in post-approval management, monitoring, and follow up have potential to contribute to adaptive management;[B6] according to McKay and Johnson (2017), these programs

> can play a role in a broader environmental assessment process by satisfying community engagement, explicitly including TK [traditional or Indigenous knowledge], and providing near-continuous information that documents environmental change … communities can use [community-based programs] to build community capacity to better inform decision makers of the interests and concerns of local people [and] may create opportunities to work towards establishing a joint decision-making process.[M7p.17]

Community-based management, monitoring, and follow-up programs can improve communication with proponents, build capacity to collect data and conduct analyses, provide opportunities for meaningful employment, foster land-based practices and transmission of Indigenous knowledge, and provide early warnings of potential impacts.[C4,M6,M7,M12,W9] Work to develop baselines, participatory structures, and other processes for these community-based programs should proceed from the planning phase through the impact statement, impact assessment, decision-making, and post-decision phases to ensure programs will be functioning and available when required.

Hanna et al. (2014) and others note that follow-up "accountability, enforcement and grievance mechanisms must be strengthened"[H5p.65] in post-approval stages, so that proponents are incentivized to meet the expectations of contributing to the public interest for population health equity in good faith.[B16,J1,P10] In addition to project-based management, monitoring, and follow-up, Mulvihill and Baker (2001) call for "process development"[M17p.383] to integrate evidence from IAs into broader institutional learning to support population health equity for Indigenous peoples and affected communities. As Heiner et al. (2019) indicate

> few unified conceptual frameworks exist to guide the standardized integration of biodiversity and social/cultural values into environmental impact assessments or development proposals, despite Indigenous people owning or having legal title to a large portion of the world's lands and water.[H17p.2]

Integration of emerging standards for indicators, models, thresholds, data collection protocols, and data sharing as requirements within the *Tailored Impact Statement Guidelines* can help support process development and contribute to transferable learning systems for population health equity.[B15,G8,H1] Authors like McGetrick et al. (2015) and Olagunju & Gunn (2015) have argued that regional data repositories could further help ensure that project-scale changes are integrated within analyses of cumulative impacts;[M4,O5] notably, these systems should be devised in ways that adhere to community stewardship of knowledge products generated, and uphold FPIC.[F2] With these institutional supports, community-based programs for data collection and analysis can become a key mechanism to support population health equity outcomes beyond impact assessments.

IMPLICATIONS

Through a process of realist review with data extraction from 185 peer reviewed and grey literature documents, the ScopHIA knowledge synthesis has developed a series of recommended strategies for evidence-based best practices and principles to support population health equity in the planning phase of impact assessments for major natural resource and large-scale infrastructure projects. The recommended strategies are organized around five planning processes described in the following paragraphs:

a) Preparations for Impact Assessments;
b) Ongoing Collaboration with Federal Authorities in Public Health;
c) Provision of Funding to Indigenous Peoples for Participatory Processes;
d) Engagement to Identify Broad Issues and Concerns; and
e) Development of Plans and Guidance for the Impact Assessment.

From this work, a number of implications emerged for implementation and further research. Acknowledging that the needs, interests, and aspirations of Indigenous peoples and affected communities must be prioritized in efforts to achieve population health equity, the implications from the ScopHIA knowledge synthesis are distributed across the Agency, public health authorities at the federal and local levels, and various IA participants.

In the process of preparation for impact assessments, several opportunities were identified to further support population health equity. Research and policy development are needed to understand the socio-ecological geographies and jurisdictional mandates for appropriate tiering of strategic and regional impact assessments to

ensure these higher-level processes can inform project-level IAs. Tools developed by boundary organizations to assess the need for capacity building programs[10] can help determine resources and timelines required for Indigenous peoples' and affected communities' participation in IAs. The methods and assumptions that the Agency employs to identify and engage Indigenous peoples, affected communities, and vulnerable sub-groups should be transparently documented to facilitate analysis of the distribution of risks and benefits for projects. Research and policy development on intersectoral collaboration between IA and public health systems could facilitate a shared understanding of population health equity; access to information and guidance to support actionable recommendations; and improved clarity for proponents, consultants, and agencies when undertaking this work. While there are certainly questions of jurisdictions between federal and provincial health systems, proponents could coordinate with public health authorities in preparing an outline of the local health, social, and economic context in the *Initial Project Description* for projects, while building relationships with Indigenous peoples and affected communities that will support community-driven research and development processes.

In the process of ongoing collaboration with federal authorities in public health, there were a number of roles and responsibilities for promoting population health equity evidenced in the literature. Federal authorities in public health can promote scientific standards by clarifying methodological approaches, supporting significance determinations, facilitating communication of uncertainty, and recommending community engagement strategies in IA practice. Key authorities at the federal level include Health Canada, the Public Health Agency of Canada, and the Canadian Institutes of Health Research, who can support population health equity through direct involvement in IAs, conducting knowledge mobilization to build capacity in the public health workforce, and funding research to support population health equity considerations in impact assessment of major projects. Across these roles and responsibilities, federal public health authorities can advocate for the parallel streams approach to assessing health impacts, which combines community-driven selection of indicators, models, and thresholds and with publicly available health services, public health surveillance, and other relevant forms of data. At all levels, public health system authorities can promote population health equity by recognizing and promoting the importance of Indigenous knowledge and precautionary approaches, while emphasizing the need for participatory and collaborative solutions in IAs. Many of these roles can be developed and implemented through processes initiated through the *Federal Authority Advice Record* in the planning phase.

In the provision of funding to Indigenous peoples for participatory processes, several themes emerged in the literature related to free, prior and informed consent (FPIC). Indigenous peoples should be supported in their self-determination to characterize risks and benefits of projects for themselves, providing a foundation for further community-driven processes to develop indicators, models, and thresholds for use in IAs. Ensuring Indigenous peoples and affected communities attain a meaningful level of influence over decision-making by their own definition requires culturally-appropriate communication and consideration of local needs and aspirations in the overall IA process design. Moreover, conversations about acceptable measures for mitigation and/or compensation should begin early on. Many of these functions can be performed by Indigenous governments, boundary organizations, and knowledge holders, but require adequate resourcing and integration throughout the IA process. Any products of community-driven research and development or other processes involving Indigenous peoples and affected communities—including data, articulation of Indigenous knowledge, or other forms of community-specific information—must be governed by community stewardship, and cannot be held as the property of project proponents. Involving public health system authorities to support community-driven processes can build trust, demonstrate respect, and build understanding of Indigenous knowledge systems, which will ultimately support population health equity through the IA process.

In the process of engagement to identify broad issues and concerns, the literature emphasized preparations and procedures to foster social learning and two-way communication across IA participants. There is a need to ensure that non-Indigenous participants undertake cultural sensitivity education and training (formal or informal) to ensure appropriate acknowledgement, respect, and incorporation of Indigenous ontologies and epistemologies throughout IAs and beyond. In the process of conducting community engagement across multiple forums, coordinating agencies and the proponent should ensure supports and incentives for attendance and participation are available to Indigenous peoples and affected communities (including appropriate scheduling to avoid seasonal

[10] The First Nations Major Project Coalition's *Community Readiness Assessment* in one example of such a tool.

activities, community events, and workdays) in culturally appropriate plain language information formats that include Indigenous and other minority language translations. Engagement with Indigenous Elders and other knowledge holders should employ appropriate cultural protocols and flexibly accommodate the forms that knowledge will take. Technological forms of engagement like the use of a public registry website should be optimized to make the resource accessible, intelligible, and searchable by Indigenous peoples and affected communities, in addition to increasing the reach of engagement to the broader public. At the same time, the *Summary of Issues* raised in early engagement forums should reflect that risk perceptions of major projects constitutes an immediate impact for Indigenous peoples and affected communities. Proponents can employ materiality analysis to support population health equity by prioritizing the issues raised during early engagement. Public health system authority guidance on the use of disciplinary frameworks to capture issues and concerns raised in early engagement forums can support more comprehensive treatment in terms of population health equity, facilitated through structures for intersectoral collaboration established during the pre-planning phases, and the provision of funding to Indigenous peoples to support community-driven research and development processes.

In the development of guidance for impact assessment, the planning phase can contribute to population health equity by helping to ensure the IA process is designed to provide Indigenous peoples and affected communities with a forum to articulate and receive responses to their concerns. One of the key backstops to achieving this is for proponents to assemble their project teams with multi-faceted expertise to consider population health equity in IAs, spanning social sciences as well as public health disciplinary backgrounds, and with a foundation in reflective and ethical practice. Since population health equity in IA is an emerging mandate for the Agency within Canada's new impact assessment system, guidance for practitioners can be taken from work undertaken by regional health units, public health authorities, professional associations, international organizations, universities, and funding agencies to provide education, training, and professional certification. Importantly, proponents and their project teams should include community coordinators to further support a meaningful two-way flow of communication. Motivation for consultants who work on population health equity aspects of IAs include regulatory requirements, professional reputation, and producing quality impact statements. Given unequal power relations between proponents and Indigenous peoples and affected communities, co-development and co-management processes are needed to develop stronger trust-based relationships, encourage participation and engagement, facilitate generation and sharing of evidence, fostering meaningful consideration for Indigenous value systems and ways of knowing, and supporting free, prior and informed consent. These co-development processes need to employ data and information stewardship plans formalized through the *Indigenous Partnership and Engagement Plan* and *Public Participation Plan* to provide a clear basis and set of expectations for all IA participants. Importantly, studies conducted under the *Tailored Impact Statement Guidelines* should be devised to make use of earlier work completed during community-driven research and development processes, and contribute to planned future community-based management, monitoring, and follow-up programs. Health management plans and integrated environmental management plans should be co-led by Indigenous peoples and affected communities, and employ appropriate and acceptable indicators, models, and thresholds linked to public health authority frameworks and models. Accountability and grievance mechanisms will also be important to ensure compliance for designated projects, and regional data repositories can support analyses of cumulative impacts and population health equity.

CONCLUSIONS

Canada is an international leader in major natural resource and large-scale infrastructure projects, which substantially contribute to the domestic economy. Extensive negative impacts of developments have been documented, disproportionately affecting Indigenous peoples and marginalized populations, with the potential to exacerbate population health inequities in rural and remote regions. Impact assessment has emerged as a legislated process in many countries, providing a forum for public deliberation and decision-making on the environmental impacts of major projects. Canada's new impact assessment system further extends this mandate to implicate population health equity with respect to Indigenous peoples and affected communities, introducing a new 180-day planning phase to identify issues, and develop structures, for a more equitable review process. The ScopHIA knowledge synthesis employed realist review methods to extract, analyze, and synthesize information about

evidence-based best practices and principles to promote population health equity within the planning phase. There were several notable themes within the knowledge synthesis across each of the five planning phase processes.

In the process of preparation for impact assessments, self-determination and early engagement with public health authorities are key. Guidance on scientific standards and the need to incorporate both publicly available and community-driven data are critical contributions for federal authorities in public health. Funding for Indigenous peoples during the planning phase should support community-driven research and development processes that empower communities to define and characterize risks and benefits with respect to their own worldviews, with community stewardship of knowledge generated by processes, and associated perspectives on development attaining meaningful level of influence in decision-making. Engagement to identify broad issues and concerns should foster social learning between IA participants and be conducted across multiple forums in a way that is acceptable to Indigenous peoples and affected communities, using public health frameworks to ensure comprehensiveness where possible. Guidelines and plans should anticipate post-approval management, monitoring, and follow-up programs, be implemented by multi-disciplinary proponent teams with population health equity expertise, and formalize processes for co-development and co-management during impact assessments.

KNOWLEDGE MOBILIZATION

The ScopHIA research team developed a knowledge mobilization strategy for this knowledge synthesis with the goals of promoting the uptake of findings in impact assessment policy and health system practice; advocating for more impact assessment research and practice in the field of public health; and raising the profile of population health equity in impact assessment with the Canadian public. During the research phases of the project, this strategy was initiated by conducting outreach through the professional networks of research team members, with the objective of engaging regional, national, and international collaborators in impact assessments and public health. With the submission of this final report, knowledge mobilization can now shift to the generation of knowledge products in partnership with these collaborators, aiming to achieve the goals stated above.

To promote the uptake of findings in impact assessment policy and health system practice, the research team will participate in the Social Sciences and Humanities Council of Canada and Impact Assessment Agency of Canada's knowledge mobilization forum for the "Informing Best Practices for Environmental and Impact Assessments" Knowledge Synthesis Grants competition, scheduled to occur in the fall of 2020 in Ottawa, Ontario, Canada. Participation in this forum will provide the opportunity to present the ScopHIA knowledge synthesis directly to policy makers at the Agency. Our invited knowledge user participating in the forum is an impact assessment specialist employed with a regional health unit, who is well positioned to help facilitate knowledge mobilization for our work in health system practice. Furthermore, knowledge mobilization for this knowledge synthesis will work to communicate findings directly to impact assessment specialists working at Health Canada, facilitated by the professional networks of research team members. In addition, a research team member recently participated in a Best Brains Exchange on "Mental Health Outcomes in Impact Assessment" hosted by the Canadian Institutes of Health Research and Impact Assessment Agency of Canada in February, 2020 in Ottawa, establishing an important contact for knowledge mobilization of this knowledge synthesis with CIHR, as a federal public health funding agency.

Another round of outreach is underway, with two Canadian national public health organization in the early stages of engagement to support ongoing and future work. These organizations are the Canadian Public Health Association (CPHA), and the National Collaborating Centre for Environmental Health (one of six National Collaborating Centres with a mandate for knowledge mobilization under the authority of the Public Health Agency of Canada).[11] An initial contact has been made with the CPHA Policy Development Committee, which can facilitate one of three activities regarding initiatives brought forward from the CPHA membership, namely an endorsement (lending the CPHA name to support to an issue or initiative); a position (issuance of a stand-alone statement by the CPHA); or a policy (a commitment of CPHA action and resources). With the generation of knowledge products, the research team will seek appropriate endorsement from the CPHA, moving forward. Contact with the National

[11] The Canadian Public Health Association CPHA website is located at https://www.cpha.ca/, and the National Collaborating Centre for Environment Health website is located at http://www.ncceh.ca/.

Collaborating Centre for Environment Health has produced an ongoing dialogue, with the aim of identifying further opportunities and synergies to partner and conduct knowledge mobilization together.

Other not-for-profit organizations with which the research team has conducted outreach include the Canadian Association of Physicians for the Environment (CAPE), the Alberta Environmental Network (AEN), and the International Association for Impact Assessment (IAIA).[12] The research team aims to engage with CAPE's expertise in advocacy and outreach to develop a press release, social media postings, and opinion editorials submitted to local news outlets in Alberta, as well as seeking opportunities to support CAPE using the ScopHIA knowledge synthesis in its own provincial and national advocacy. Although outreach with AEN is in the very early stages, the research team hopes to develop workshop materials that will support the AEN environmental non-governmental organization members to bring a population health equity lens for participation in impact assessments. Further, outreach will target the IAIA as a leading organization for impact assessment professionals, through conference presentations and networking with expert practitioners in Canada and internationally.

Finally, the research team will respectfully engage with the Elders and Knowledge Keepers program at the School of Public Health, University of Alberta[13] to develop knowledge mobilization strategies appropriate for engaging with Indigenous peoples and affected communities to share the ScopHIA knowledge synthesis. This engagement is currently in the early stages. Through thoughtful integration of learning from this engagement into all knowledge mobilization activities, and through outreach and potential co-development of materials with Indigenous-led organizations partnering with the research team, efforts to generate, disseminate, diffuse, and exchange this realist review research will focus on activities to promote and support Indigenous peoples' and affected communities' self-determined population health equity considerations for impact assessments conducted under Canada's new impact assessment system.

[12] The Canadian Association of Physicians for the Environment CAPE website is located at https://cape.ca/, the Alberta Environmental Network AEN website is located at https://www.aenweb.ca/, and the International Association for Impact Assessment IAIA website is located at https://www.iaia.org/.

[13] The Elders and Knowledge Keepers program at School of Public Health, University of Alberta website is https://www.ualberta.ca/public-health/about/indigenous-reconciliation-initiatives/elders-knowledge-keepers-and-adjuncts.html

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APPENDIX A

Jennifer Ann Brown is a doctoral candidate at the University of Alberta, holding both a Frederick Banting and Charles Best Doctoral Research Award, and Alberta Innovates Graduate Studentship in Health Innovation for her work on population health equity in impact assessments. Jennifer Ann completed a Masters in Global Health thesis with ArcticNet, funded through Polar Knowledge Canada's Northern Scientific Training Program. She has presented her work in forums such as the International Congress on Circumpolar Health, Arctic Science Summit Week, and the International Association for Impact Assessment, with publications in *Social Science & Medicine*, *Environmental Science & Policy, Health Communication*, *Critical Public Health*, and *Preventive Medicine Reports*.

Melissa Gorman is a graduate of the University of Alberta with a Masters of Public Health in environmental and occupational health. Since 2014, she has participated in the review of major natural resource and large-scale infrastructure projects, and therefore has first-hand experience working in the realm of environmental/impact assessment in Canada. Prior to her experience in impact assessment, Melissa conducted ecological risk assessments of petroleum substances. Melissa has a particular interest in the area of health impact assessment.

Hyejun Kim is a Masters of Public Health student with a research background in physiology and endocrinology of diabetes and obesity. She has extensive volunteer experience with the Indigenous and Global Health Research Group (IGHRG) at University of Alberta, supporting culturally appropriate, participatory community health research with Indigenous communities in both Northern and urban contexts. A member of the Golden Key Honour Society, and Institute of Integrative Health (IHI) learner passionate about circumpolar health and Northern environments, Hyejun has travelled to eight Inuit communities in Kivalliq and Baffin regions of Nunavut to deliver Science, Technology, Engineering, and Mathematics (STEM) instructional camps and activities to underrepresented, underserved Inuit youth.

Kelsey Schober is a Masters of Political Science student at the University of Alberta researching structural incentives for resource extraction in the Arctic through a lens of climate change and transition, supported by a Fulbright U.S. Student Research Grant. A previous recipient of the Thomas J. Watson Fellowship and the Mat-Su Health Foundation Scholarship, she has contributed to an Arctic Council Report on mainstreaming biodiversity in Arctic mining, written for *ArcticToday* and the Center for American Progress, and acted as the Youth Delegate to the Gender Equality in the Arctic initiative of the Arctic Council, as well as a Youth Leader for the State of Alaska's Climate Action Leadership Team. Kelsey is originally from Sutton, Alaska.

Joe Vipond is a Clinical Assistant Professor at the University of Calgary Cumming School of Medicine, President-Elect of President Elect of Canadian Association of Physicians for the Environment (CAPE), and an emergency room physician who served key roles in CAPE's historical Coal Phase-Out campaigns for Canada and Alberta. A leader in environmental advocacy, Joe conducts frequent public outreach through keynotes, lectures, workshops, and seminars to medical colleagues, associations, and organizations across Canada, as well as through media interviews, opinion editorials, and community forums.

Candace I. J. Nykiforuk is a Core Committee member of Alberta Health Services' Population, Public and Indigenous Health Strategic Clinical Network, CIHR/PHAC/Alberta Innovates Applied Public Health Chair in Public Policy & Community Environments (2014-2019), and Professor and Director of the Centre for Healthy Communities in the School of Public Health at University of Alberta. She is a member of the College of New Scholars, Artists and Scientists of the Royal Society of Canada (2016-2023), and leads several multi-jurisdictional collaborations on healthy public policy research, with extensive experience engaging target research users to co-create impactful research products.

APPENDIX B

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