Risks and Impacts to First Nation Health and the Mount Polley Mine Tailings Dam Failure

Abstract

In August 2014, the Mount Polley Mine tailings dam was breached, releasing millions of cubic metres of tailings water and tailings into Polley Lake, Quesnel Lake, and Hazeltine Creek in British Columbia (BC), Canada. To date, no assessment has identified the communities impacted by this event, nor how they were impacted, from a social or health perspective. This qualitative study uses a community-based participatory research approach to identify (1) First Nations impacted by this incident and (2) impacts to Aboriginal health experienced by these communities. To address these gaps in knowledge, the First Nations Health Authority funded the project team to complete the first two phases of a health impact assessment. This work draws attention to the strong links between First Nations, the land and resources, culture, and associated health outcomes. In considering the importance of Aboriginal health and culturally appropriate health pathways, the project team identified 4 key impacts: environmental dispossession, emotional stress, altered dietary patterns, and changes in physical activity. The similarity in impacts associated with the Mount Polley tailings dam failure for many First Nations in BC is best understood through an in-depth understanding of the importance of the Fraser River as a source of salmon for their communities. This work documents the unidentified and unfulfilled need to ameliorate the extent of emotional trauma prompted by real or perceived threat to salmon health, a threat exacerbated by a lack of reliable information from trusted sources in the aftermath of the breach. Relevant recommendations are also provided.

Keywords

First Nations, health impact assessment, Mount Polley Mine, Aboriginal health, Fraser River system, salmon

Authors

The authors are health impact assessment/social performance practitioners who work on behalf of First Nations and the First Nations Health Authority in British Columbia, Canada, and for other governments, institutes, and industry internationally. Dr. Shandro, Dr. Winkler, and Ms. Jokinen also hold university research positions focused on identifying, managing, and monitoring health impacts associated with the extractive sector.

Janis Shandro, PhD, corresponding author. 551 Tulip Avenue, Parksville, British Columbia, Canada. Arrowsmith Gold Inc., Parksville, BC, and the University of Victoria, Victoria, BC. Email: janis@arrowsmithgold.com, Phone: +1 (250) 951-6776.

Laura Jokinen, BA, MSc, Arrowsmith Gold Inc., Parksville, BC, and PhD candidate at the University of Victoria.

Alison Stockwell, BA, MASc, Arrowsmith Gold Inc., Parksville, BC.

Francesco Mazzei, BA, MBA, Arrowsmith Gold Inc., Parksville, BC.

Mirko S. Winkler, PhD, Swiss Tropical and Public Health Institute, Basel, Switzerland, and University of Basel, Switzerland.

Acknowledgements

The project team would like to sincerely acknowledge the time, energy, and dedication that First Nation chiefs, health and natural resource leaders, elders, and community members have invested in this work. The team would also like to express gratitude to community members, Band administration staff, and community-based coordinators who assisted the project team and provided logistical arrangements for scoping activities. Finally, the project team would like to acknowledge the First Nations Health Authority for financially supporting this work and filling a critical gap in British Columbia, Canada.

Introduction

British Columbia (BC) is one of Canada's most culturally diverse provinces. It is home to 198 First Nations speaking 32 First Nation languages (representing 60% of First Nation languages in Canada) with 59 dialects (First Peoples' Heritage, Language and Culture Council, 2010). For close to 9,000 years, many First Nations in BC have resided along the Fraser River system, the longest river in BC, which stretches 1,375 km across the province before reaching the Strait of Georgia near the city of Vancouver (Nguyen, Young, Hinch, & Cooke, 2016). For many First Nations, the Fraser River is regarded as an important location where they can engage in traditional activities, including salmon fishing, which is distinctively linked to culture, community, and health (First Nations Health Authority [FNHA], 2014; Reading & Wien, 2009). Salmon fishing, as a traditional activity, has been practiced for generations and provides the basis for a series of community gatherings that underpin community cohesion and reaffirm values. Fishing, fish processing, and preserving provide opportunities for shared activity, play an important role in maintaining a sense of identity, represent a physical manifestation of culture, and create opportunities for traditional knowledge to be passed from First Nation elders to youth (Chandler & Lalonde, 1998; Kant, Vertinsky, Zheng, & Smith, 2013). Furthermore, fishing and other traditional and self-sufficient food harvesting and hunting practices are nutritionally critical and economically benefit rural and remote communities by reducing reliance on often expensive and less nutritious, store-bought food (FNHA, 2009).

On August 4, 2014, the first day salmon fisheries opened for First Nations along the Fraser River, the Mount Polley Mine tailings storage facility was breached and released 25 million cubic metres of mine waste into the Fraser River watershed (Petticrew et al., 2015). Following the spill, the BC government and the Mount Polley Mining Corporation released technical, environmental, and assessment reports describing pre-event infrastructure issues, post-event impacts to the receiving environments, and future pathways for re-permitting (BC Ministry

of Environment, n.d.; Morgenstern, Vick, & Van Zyl, 2015; Swan, Epps, & Miller, 2014). Notably lacking was a systematic, rigorous assessment that identified (a) First Nations who were impacted by this incident, and (b) impacts to Aboriginal health experienced by these communities. To address these gaps in knowledge, the First Nations Health Authority (FNHA) funded the project team to complete the first two phases of a health impact assessment (HIA), namely screening and scoping (World Health Organization [WHO], n.d.).

The International Finance Corporation (IFC) Performance Standards recognize that "project activities, equipment, and infrastructure can increase community exposure to risks and impacts" and requires companies to "avoid or minimize the impacts and risks to community health, safety, and security that may arise from project-related activities, with particular attention to vulnerable groups" (IFC, 2012, p. 1). In addition, "depending on the type of environmental and social impact, clients may be required to assess the potential impacts to the health of a community through a process known as a 'Health Impact Assessment (HIA).' This may include reviews of existing health statistics, and evaluation of potential impacts of the project on the health and safety of the affected community" (IFC, n.d., para. 3).

A HIA is a systematic approach that uses mixed-methods research designs to assess health risks and impacts associated with a project, program, or policy. The assessment comprises five distinct phases (i.e., screening, scoping, analysis, reporting, and monitoring) and considers environmental, social, and culturally appropriate determinants of health (BC Ministry of Environment, 2014; WHO, n.d.). First, the screening phase establishes the health relevance of the project, program, or policy of concern. Second, the scoping phase identifies health issues and public concerns and defines the terms of reference of the assessment. Third, the analysis phase involves an in-depth analysis of associated health impacts using evidence from secondary and/or primary sources. Fourth, the reporting phase seeks to mitigate negative and enhance positive health impacts by providing recommendations that are prioritized based on risk assessment. Fifth, the monitoring phase monitors implementation and evaluates impacts (WHO, n.d.). Broad stakeholder involvement throughout the assessment phases is an essential feature of HIAs (Winkler et al., 2013).

This paper describes findings from the Mount Polley Mine HIA screening and scoping phases, with focus on health risks and impacts to First Nations associated with this disaster. Specifically, the screening and scoping phases of the HIA had the following objectives: (1) review available environmental, industry, and community health data; (2) identify potentially impacted communities; (3) identify probable community-level impacts on determinants of health linked to the Mount Polley Mine tailing dam breach; (4) undertake a gap analysis based on existing literature to highlight existing data and identify additional evidence required for the full HIA; and (5) identify interim measures to reduce ongoing health impacts and risks for affected First Nations.

Methods

The research model for this HIA is rooted in community-based participatory research, which aims to equalize power differences within the research process, build trust between researchers and communities, and foster a sense of ownership for participating communities (Hacker, 2013). The project adhered to Canada's federal Tri-Council Policy Statement for research involving Aboriginal Peoples of Canada (CIHR, NSERC, & SSHRC, 2014) and applied OCAP[1] data principles (Schnarch, 2004). To meet the objectives of the assessment, community-based coordinators worked in collaboration with the project team and provided logistical arrangements for scoping phase activities.

Review and Synthesis of Available Data

The project team reviewed and organized available data on the Mount Polley Mine tailings dam failure prior to the screening and scoping phases. These data included community demographic and health information for First Nations (e.g., Aboriginal Affairs and Northern Development Canada community data), project-related documents for the Mount Polley Mine tailings dam breach (e.g., environmental reports, academic studies, press releases), and water and fish sampling studies. This information underpinned the development of key-informant interviews that were conducted during the screening and scoping phases and contributed to the identification of data gaps.

Screening Phase

Between September and November 2015, the project team contacted First Nations to participate in the screening phase of the Mount Polley Mine HIA. The purpose of the screening phase was to identify potentially impacted First Nations in the region and identify community-level impacts related to the tailings dam breach. The following criteria were used to purposefully select communities to participate in the project:

1. The First Nation is located in close proximity to the Mount Polley Mine site and/or is situated along the Quesnel or Fraser River;
2. The First Nation's traditional land was directly impacted by the tailings breach;
3. The First Nation was recommended to participate by the FNHA and FNHA community engagement coordinators; and
4. The First Nation was recommended by another Nation. First Nation leaders recommended other Nations, resulting in a snowball effect which involved "identifying respondents who are then used to refer researchers on to other respondents" (Atkinson & Flint, 2001). For example, during interviews, participants recommended the project team contact a specific First Nation for additional information.

[1] Standing for ownership, control, access, and possession, OCAP® is a registered trademark of the First Nations Information Governance Centre (FNIGC; www.fnigc.ca).

By accessing publicly available online sources (e.g., community websites, documents, and registries) and information provided by FNHA, the project team contacted First Nation chiefs, health directors, band council members, and health representatives via telephone to request their participation in the project.

A screening instrument was developed to identify communities potentially impacted by the Mount Polley Mine tailings breach. This instrument involved a short set of closed-ended questions related to potential impacts of the event (e.g., impacts to personal fishing practices, commercial fisheries, traditional land use). The research team administered the screening instrument via telephone with a designated First Nation representative.

In total, 47 communities were contacted by the project (46 First Nations; one non-First Nation community) and 24 responded (23 First Nations; one non-First Nation community). After receiving project-related information, only one First Nation did not self-identify as experiencing impacts following the tailings dam failure.

Scoping Phase

The aim of the scoping phase was to organize diverse, often fragmentary, evidence into a coherent framework to enable the research team to identify potential health risks and impacts related to the tailings dam breach. Risks and impacts specific to each community are reported. The scoping phase involved a gap analysis of available data and a site visit, which included key-informant interviews, focus groups, observation, and situational analyses. A subsequent gap analysis determined the needs for further baseline data collection.

The Mount Polley Mine HIA scoping phase focused on the communities that were directly impacted by the Mount Polley Mine breach (i.e., as identified during the screening phase or through direct knowledge of impacts).

Site Visit

The fieldwork consisted of interviews with key informants focusing on the health impacts/risks associated with the Mount Polley Mine tailings dam failure and their effects on individuals and on the community. To provide additional insight into sociocultural aspects and to support local capacity development, community-based coordinators assisted with the research, facilitating site visits (i.e., organizing and facilitating key-informant interviews and group discussions), gathering locally available data, and reviewing project findings.

During the site visit, the team held semi-structured interviews using a grounded theory approach (Corbin & Strauss, 2008) with purposefully selected key informants from the health and natural resource sectors. Informants selected were directly involved in health service provision or natural resource monitoring for their communities. Interviews were approximately one hour in length, and detailed field and observation notes were taken. Participants were asked to provide their perspective on community- and individual-level health impacts linked to the Mount Polley Mine tailings dam failure.

The team also participated in Nation assembly meetings, chiefs' meetings, chief and band council meetings, and lunches with elders, and it facilitated a community forum.

The following 16 First Nations participated in the Mount Polley Mine HIA scoping phase:

- Lhtako Dené Nation
- Lillooet Tribal Council: N'Quatqua First Nation, Sekw'el'wás, T'ít'q'et First Nation, Tsal'álh, Xaxli'p, Xwísten
- Stswecem'c Xgat'tem First Nation
- T'exelc (Williams Lake Indian Band)
- Tŝilhqot'in National Government: ʔEsdilagh First Nation, Tl'etinqox Government, Tl'esqox of the Tsilhqot'in, Tŝideldel, Xeni Gwet'in First Nation, Yunesit'in Government
- Xatśūll First Nation (Soda Creek Indian Band)

Validation of Research Findings

In line with Knowledge Translation approaches, an iterative process supported the confirmation of research findings. Knowledge Translation is defined as a "dynamic and iterative process that includes synthesis, dissemination, exchange and ethically sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system" (Canadian Institutes of Health Research, 2016, Introduction). First, as per Knowledge Translation and grounded theory approaches, member checks occurred in real time (during interviews). Once the findings had been synthesized and reported on, each First Nation received a draft version of the report and a short summary, and had an in-person presentation of findings by the research lead. The presentations varied and were developed to meet the needs of each specific First Nation (e.g., they included bidirectional sharing of research findings at elders' luncheons, formal community meetings, chief and council meetings, one-on-one meetings with key informants, and presentations at large community events). A similar approach was used to share findings with FNHA. In addition, a highly qualified professor and Canada Research Chair in rural health at the University of Victoria completed peer review, along with a senior social performance international expert (holding 15+ years' experience on extractive sector and community issues). The work was finalized after reviewing findings and recommendations with participant communities and peer reviewers.

Results

Screening Phase Findings

Community-specific findings identified as part of the screening phase fieldwork are presented in Table 1. Results from the screening phase highlight the geographical extent of impacts experienced by First Nations as a result of the Mount Polley Mine tailings dam failure (Figure 1). For example, Spuzzum First Nation, located 425 km South from the mine site, and

DOI:10.18357/ijih122201717786

Tl'azt'en Nation located 426 km Northwest from the mine site, reported community-level impacts from the Mount Polley Mine tailings dam breach. The majority of communities reported impacts to personal fishing practices, increases in emotional stress, and increased administration burden.

Table 1

Reported Impacts/Key Issues Related to the Mount Polley Mine Tailings Dam Failure Experienced by Communities Who Participated in the Screening Phase of the Project

Community	Traditional territory directly impacted	Decrease in individual fishing practices	Impacts on commercial fisheries	Emotional stress	Increased administration burden
Boston Bar First Nation					
ʔEsdilagh First Nation		X	X	X	X
Lhtako Dené Nation	X	X		X	X
Nak'azdli Whut'en		X		X	X
N'Quatqua First Nation		X		X	X
Sekw'el'wás		X		X	X
Simpcw First Nation		X		X	X
Skatin		X		X	X
Spuzzum First Nation		X		X	X
Stswecem'c Xgat'tem First Nation		X		X	X
T'eqt'aqtn'mux (Kanaka Bar Indian Band)		X		X	X
T'exelc (Williams Lake Indian Band)	X	X		X	X
T'ít'q'et First Nation		X		X	X
Tl'azt'en Nation		X		X	X
Tl'esqox of the Tsilhqot'in		X	X	X	X
Tl'etinqox Government		X	X	X	X
TsaĹálh		X		X	X
Tŝideldel		X	X	X	X
Xatśūll First Nation (Soda Creek Indian Band)	X	X		X	X
Xaxli'p		X		X	X
Xeni Gwet'in First Nation		X	X	X	X
Xwísten		X		X	X
Yunesit'in Government		X	X	X	X

DOI:10.18357/ijih122201717786

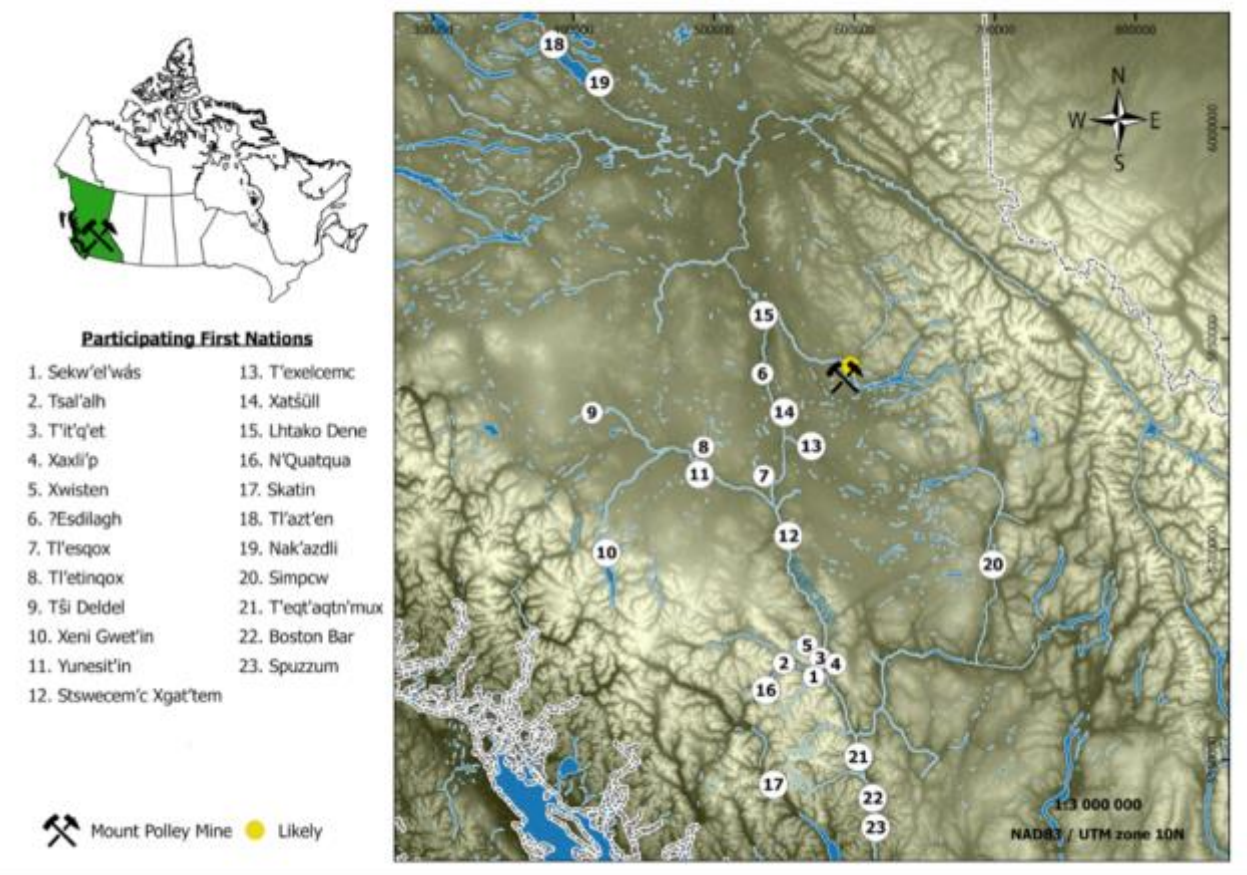

Figure 1. **A map of participating First Nations and the Mount Polley Mine.** All First Nations were identified as impacted with the exception of 22. Communities 1–23 `are those that participated in the screening process. Communities 1–16 are those that were involved in scoping phase activities. The Mount Polley Mine site is identified as the pickaxe symbol, and the community of Likely is identified by the yellow dot. This map demonstrates the geographical extent of impacts experienced by First Nations.

Traditional fishing areas were avoided by some communities, due to their concern about contamination of the Fraser River system. It was reported that members of these communities travelled greater distances to catch fish for the season. In other communities, such as T'eqt'aqtn'mux, leadership proactively encouraged members to fish following the Mount Polley Mine tailings breach. Despite the concerns regarding the safety of consuming fish from the Fraser River, the impacts to community health would be too great if members were unable to catch and consume fish.

Results from the screening phase also highlighted the extent of post-breach emotional stress at the community level. For instance, the Nak'azdli Whut'en (near Fort St. James) described an intense emotional response following the tailings dam failure. Health service providers noticed increases in anger, sadness, fear, and confusion among band members. The uncertainty surrounding the event and the potential irreversible impacts to the environment were described as deeply concerning.

DOI:10.18357/ijih122201717786

Another impact reported was increased inter-community tension, in particular the actions, motivations, decisions, and/or mitigation measures of one First Nation being questioned and critiqued by another.

The screening instrument provided preliminary data indicating potential community-level impacts related to the Mount Polley tailings dam breach, and it highlighted that the geographical extent of impacts experienced by First Nations throughout BC was much larger than what was being addressed by the mining company and provincial government. The only Nation that did not report impacts was Boston Bar. This phase helped establish more detailed scoping phase interview questions.

Table 2

Reported Scoping Phase Impacts/Key Issues Related to the Mount Polley Mine Tailings Dam Failure Experienced

Key issue or impact	Community					
	Lillooet Tribal Council Nations	**Lhtako Dené Nation**	**Stswecem'c Xgat'tem First Nation**	**T'exelc**	**Xatśūll First Nation**	**Tŝilhqot'in National Government Communities**
Failure to receive information in timely manner about the Mount Polley tailings dam breach from the responsible parties or from government representatives	X	X	X	X	X	X
Distrust in received information on Mount Polley Mine breach	X	X	X	X	X	X
Increased administrative burden experienced by leadership and staff in attempts to understand the situation around Mount Polley	X	X	X	X	X	X
Decreased/discontinued traditional land use activities	X	X	X	X	X	X
Decreased/discontinued personal fishing practices	X	X	X	X	X	X
Decreased/discontinued commercial fishing resulting in loss of revenue						X
Emotional stress	X	X	X	X	X	X
Increased intra-community tension	X	X	X	X	X	X
Increased inter-community tension		X		X	X	X

Three First Nations—Xatśūll, T'exelc (Williams Lake Band), and Lhtako Dené First Nation—suffered direct impacts that were immediate and are ongoing. Through the process of environmental dispossession, access to sacred land and territory, traditional food sources, and medicine has been lost. These three First Nations are experiencing impacts involving a wider range of potential pathways that can influence community health. In addition to environmental dispossession, the following impacts were also reported by all participating First Nations (except Boston Bar):

- **Continued emotional stress in relation to the Mount Polley incident.** The level of emotional stress is linked to the severity of potential impacts and risks perceived by the community and the level of uncertainty and lack of trust in the information provided. Emotional stress was also felt by community leadership in relation to the increased administrative burden resulting from the tailings dam failure. This increased burden was placed on community leadership who reported substantial workloads in attempts to garner credible, trustworthy information related to the event, environmental assessment results, efforts for remediation, and the safety of salmon and the Fraser River system.
- **Altered dietary patterns and reduced physical activity as a result of a Decrease in fishing practice and cultural practices.** Commercial fishing activities were also affected, resulting in reduced community income and employment opportunity. Decreased fishing activities, as well as practice of fish-related cultural traditions, has had a negative impact on the physical activity of affected communities, which is directly associated with their health status.

This project highlights the extent of emotional trauma prompted by real or perceived threat to salmon health that has been exacerbated by a lack of reliable information from trusted sources in the aftermath of the breach. These factors led affected First Nations to cease or significantly reduce salmon fishing during 2014, and for some, this issue remains. This repression of culture holds significant implications for health and well-being. In Canada, it is well recognized that cultural/emotional trauma has contributed to physical, psychological, economic, and political disadvantage for Aboriginal people.

Limitations

Limitations of this project include the time between the event and screening/scoping phase activities in addition to the commitment (financial) to next phases. The work was commissioned by FNHA as both industry and the provincial government failed to implement a social or health impact assessment as part of the response to the tailings dam failure. Unfortunately, by the time the HIA was initiated, one year had passed. Therefore, the impacts captured by this project may not be comprehensive and only represent a snapshot in time. Resources to complete this work remain uncommitted at the time of writing. Recommended required next steps for this HIA are under recommendations, below.

Discussion

Environmental Dispossession and Health Risks

Richmond & Ross (2009) describe environmental dispossession as a critical pathway for negative health outcomes experienced by Aboriginal people. They define environmental dispossession as the "processes by which aboriginal people's access to the resources in their traditional environments are reduced" (p. 403). According to Cunsolo Willox et al. (2013), First Nation people's "identity, conceptions of the self, and mental wellness are directly and intimately linked to the environment, and to the ability to hunt, trap, fish, forage, and travel on the land and continue to practice cultural traditions related to being 'on the land'" (p. 260). On one hand, positive health outcomes (e.g., improved diet, exercise, increased self-esteem, improved mental health) have been reported when individuals engaged in land-based activities (Jokinen et al., 2015; Shandro et al., 2014). On the other hand, a wide range of negative health outcomes have been found to be associated with changes in the environment. When Aboriginal access to land is restricted, studies report increases in mental-health stressors, family stress, substance use, suicidal ideation, and prevalence of cardiovascular disease (Cunsolo Willox et al., 2013; Dillard, Smith, Ferucci, & Lanier, 2012; Gibson & Klinck, 2005).

Through an iterative process, the foundational finding from this work draws attention to the strong links between First Nations, the land and resources, culture, and associated health outcomes. For the most directly impacted communities, the Mount Polley tailings dam failure has physically restricted First Nations from accessing their traditional territory. All of the affected First Nations lost or experienced (and in some cases, continue to experience) restricted access to traditional resources that are central to their conceptions of self and their ability to travel on the land and continue to practice cultural traditions.

The environmental dispossession model suggests that the overall sum of the individual clusters of impacts described in the preceding sections—psychological stress, changes in diet, and reduced physical activity—is likely to underestimate the overall impacts on health. For First Nations, especially those living in rural and remote areas, the consumption of traditional food is directly linked to positive health outcomes. Not only is traditional food a fundamental source of nutrients, the collection of traditional food also provides social and cultural benefits for individuals, families, and communities (Kishigami, 2010). In contrast, limited access to the physical environment such as that resulting from the Mount Polley Mine tailings spill leads to decreased personal knowledge/skills related to food harvesting, reduces consumption of traditional food, leads to more individuals relying on store-bought food or government-sponsored food programs, and reduces social cohesion and cultural benefits for communities. In addition, when accessing food through non-traditional sources, the risk of cardiovascular disease increases due to unhealthy food being incorporated into diets more often (Richmond & Ross, 2009). Consideration of the environmental dispossession pathway as a potential source of health impacts and risks may suggest additional holistic issues to address.

Salmon and the Health of the Fraser River: Critical Determinants of Health for Many BC First Nations

First Nations who participated in this research reported overwhelmingly negative impacts on fishing practices and access to traditional food sources (i.e., salmon) following the Mount Polley Mine tailings dam breach. Researchers had posited that this would influence community health primarily through changes to dietary patterns; however, in the course of the research it became clear that there are broader consequences that require consideration. Project findings indicate the central role that salmon fishing plays in a wide variety of determinants of health ranging from physical activity to social cohesion, learning and sharing cultural identity, and a wide range of factors affecting emotional health. Inclusion of the environmental dispossession pathway as one that is critical to preventing health impacts points to the particular importance of this array of drivers to the overall health of First Nations.

The environmental dispossession pathway also highlights the importance of a holistic understanding of the environment, including regional water systems, for First Nations if they are to improve their health status to one that is more aligned with the broader Canadian status. International standards recognize the importance of ecosystem health and ecosystem services (e.g., the production of food and water) as key factors to consider in relation to projects and their potential impacts on and risks to community health and safety. According to the IFC (2012), the "project's direct impacts on priority ecosystem services may result in adverse health and safety risks and impacts to Affected Communities" (p. 2). Project proponents must identify and avoid potential risks/impacts. When unavoidable, mitigation measures based on best practice are to be implemented (IFC, 2012).

Over the course of the research, First Nations repeatedly expressed concerns over the health of the Fraser River system in general and its salmon in particular, in the context of cumulative impacts from multiple sources (e.g., tailings dam breaches and the direct discharge of tailings waste through permit approval, point source discharges, organic pollutants, fish farming impacts, etc.). Based on the principle of intuitive toxicology (the process by which lay people rely on their senses to detect unsafe water, food, or air, and distrust information from experts that contradicts their experience), First Nations observe negative changes in salmon populations and salmon health and distrust information provided by experts claiming that all is well (Neil, Malmfors, & Slovic, 1994). These concerns lead to a sense of environmental dispossession, an important determinant of Aboriginal health (Cunsolo Willox et al., 2013).

Communities are losing not only access to the environment, but also the traditional practices associated with catching, preserving, and consuming salmon that the environment hosts. Given the complexity of the relationship between First Nations in BC and salmon, the project team concludes that the loss of salmon, or the continued distrust in the health of salmon in the Fraser River system, will result in devastating cultural impacts to First Nations across BC. Therefore, we recommend that FNHA consider promoting an understanding of salmon health as a key determinant of First Nation health for BC communities and find ways to advocate for studies and mitigation actions that will protect the river ecosystem and identify the causes of the

observed impacts on salmon populations and health. While studies to date have focused on the immediate safety of salmon for eating and often focus on whether contaminant levels exceed legally recognized threshold levels, the First Nations have a more nuanced understanding of their environment and ask questions about the impacts on spawn and juvenile fish of hatching and growing in lakes lined by tailings sediment, and the potential impacts of this on the return rate after three years at sea. They also recognize that levels of toxins that have no significant immediate impact on human health may make fish more susceptible to illness, or simply make them less resilient to surviving through their life cycle. Together these factors point to an urgent need to protect the health of the Fraser River system in an integrated manner, as the health of the river, of its salmon, and of BC First Nations are intrinsically linked, and are perceived by many First Nation people interviewed to be at risk.

Recommendations

The next step in completing the HIA process is the collection and participatory analysis of data specific to the impacted First Nations that are identified in Table 1 above. In view of the data gaps identified, this will require primary data collection in the affected First Nations, as well as an assessment and analysis of the data that are available through the routine health information system.

Additional data collection will aim to:

- add to and amend information at a local level to fully describe the current status of health determinants and outcomes in affected communities. Researchers will also include analysis of retrospective components in the data collection, to support the modelling of health impacts and associated management/mitigation measures; and
- establish a solid health, environmental, and sociocultural baseline as part of an overarching surveillance and response mechanism to identify potential long-term impacts and monitor change over time. First Nations participating in the study viewed this as particularly important in light of the fact that the Mount Polley Mine is currently operating again and has recently received approval for tailings water discharge into Quesnel Lake.

In addition to contributing to the design of the full HIA, the screening and scoping phase work identified ongoing health impacts and risks for First Nations that could be significantly reduced through targeted interventions. Chronic emotional stress is known to be detrimental to health, and strategies could be implemented in the short term to reduce the drivers of stress and to mitigate its symptoms and physiological impacts. These include the following:

- **Improve access to counselling and cultural healing processes.** One approach to reducing stress would be to ensure access to counselling for affected community members and to develop and implement a culturally appropriate healing process.

- **Improve access to trusted information on a range of issues.** Finding appropriate channels for providing information that can be trusted by impacted First Nations and working with them to develop data to address their concerns could alleviate the uncertainty and distrust. Community-based participatory processes could be considered. The FNHA appears to be in a strong position to facilitate the identification and delivery of trusted information.
- **Address ongoing constraints to accessing traditional diets and medicine.** It will take time to restore trust in the safety of consuming traditional food or to identify prudent alternatives that take into consideration the unique concerns of First Nations. In the interim, maintaining health levels depends on replacing the losses in salmon and other foods/medicines with equivalent sources that communities trust to be safe.
- **Initiate a grievance and compensation process for use by affected individuals and communities.** Developing a grievance process acceptable to the affected First Nations would provide a channel to seek redress from the Mount Polley Mining Corporation. In the interest of limiting ongoing and further damage, an interim compensation fund could be established by the company to address the priorities identified in this report.

Another recommendation is to provide advocacy support to Lhtako Dené, as evidence contained in this report places their traditional territory within the Mount Polley Mine tailings breach area. It is recommended that they have access to meetings in Likely (or elsewhere) at no cost to determine appropriate actions for the BC Ministry of Environment and Mount Polley Mining Corporation.

Finally, we have identified a series of policy recommendations (Shandro, Winkler, Jokinen, & Stockwell, 2016) based on the research and on experiences working with Indigenous communities and with international mining companies worldwide. The most important of these recommendations is for the FNHA to play an advocacy role in explaining the critical importance of salmon fishing in a wide variety of determinants of First Nation health, ranging from physical exercise to social cohesion, building and sharing cultural identity, and a wide range of factors affecting emotional health. More holistically these could be seen as a range of factors leading to a sense of environmental and cultural belonging (the opposite of environmental dispossession).

The project team recommends that FNHA advocate for studies and mitigation actions that will protect the river ecosystem and identify the causes of the observed impacts on salmon populations and health. First Nation health appears to be intrinsically linked to an urgent need to protect the health of the Fraser River system in an integrated manner. This study calls for attention to the health of the Fraser River and to the importance of salmon for First Nations. A more detailed review of the above recommendations can be found in the full HIA scoping phase report (Shandro et al., 2016).

Conclusion

The key objectives of the screening and scoping phases of the health impact assessment were to review existing health and environmental data; identify communities potentially impacted by the Mount Polley disaster; identify community-level health and social impacts; complete a gap analysis of the information needed to support a full health impact assessment; and identify interim measures to decrease on-going health impacts and risks for affected First Nations. The research team contacted 46 First Nations based on geographical location, recommendations of the First Nations Health Authority, and recommendations made by screening and scoping phase participants. The principal findings of this work, based on 22 First Nations that reported impacts, are as follows:

- Past and continued experiences with emotional stress are the key impacts shared among all communities in relation to the incident. The level of emotional stress is linked to the severity of potential impacts and risks perceived by the community and the level of uncertainty and lack of trust in the information provided.
- In general, First Nations experienced a decrease in subsistence (and at times, also commercial) fishing practices that resulted in shifts in dietary, physical activity, and cultural practices; lost income from commercial fisheries; and increased stress on administrators.
- Communities of Xatśūll, T'exelc, and Lhtako Dené reported more direct impacts to their traditional territories, located close to the Mount Polley Mine.
- Similar impacts were observed between Nations located closest to and furthest from the spill. The project team speculates that this is explained by salmon health as an important determinant of health among Fraser River First Nations.

Based on these results, the project team identified interrelated pathways of existing and potential health impacts. These themes provide a coherent framework for further analysis:

1. Environmental dispossession
2. Emotional stress
3. Altered dietary patterns with associated health impacts and risks
4. Changes to physical activity with associated impacts and risks

This work also creates a path forward for further investigation. The screening and scoping phases identified information requirements for a full health impact assessment on the impacts of the Mount Polley spill on First Nations. In addition, it also identified ongoing health impacts and risks for communities, and it recommends interventions that could significantly reduce them. These urgent recommendations include:

- Improve access to emotional counselling and cultural healing processes.
- Improve access to trusted information on an appropriate range of issues.

- Address ongoing constraints on access to traditional diets and medicine.
- Institute a grievance process for use by affected individuals and communities.

Finally, the project team recommends that the First Nations Health Authority play an advocacy role in explaining the critical importance of salmon fishing in the wide variety of determinants of First Nation health. In addition, we recommend that the First Nations Health Authority advocate for studies and mitigation actions that protect the river ecosystem and investigate the causes of observed impacts on salmon populations and health. As the health of First Nations involved in this study is intrinsically linked to the health of the Fraser River, it is essential to take action on reducing these environmental health risks.

References

Atkinson, R., & Flint, J. (2001). Accessing hidden and hard-to-reach populations: Snowball research strategies. *Social Research Update, Summer 2001*(33), 1–4. Retrieved from http://sru.soc.surrey.ac.uk/SRU33.pdf

BC Ministry of Environment. (2014). *Mount Polley Mine tailings breach: Environmental mitigation and remediation progress report*. Retrieved from http://www2.gov.bc.ca/assets/gov/environment/air-land-water/spills-and-environmental-emergencies/docs/mt-polley/p-o-r/2014-11-24_moe_environmental_mitigation_and_remediation_progress_report.pdf

BC Ministry of Environment. (n.d.). *Mount Polley Mine tailing dam breach*. Retrieved from http://www.env.gov.bc.ca/eemp/incidents/2014/mount-polley/

Canadian Institutes of Health Research. (2016). *Guide to knowledge translation planning at CIHR: Integrated and end-of-grant approaches.* Retrieved from http://www.cihr-irsc.gc.ca/e/45321.html

Chandler, M. J., & Lalonde, C. (1998). Cultural continuity as a hedge against suicide in Canada's First Nations. *Transcultural Psychiatry, 35*(2), 191–219. doi:10.1177/136346159803500202

CIHR, NSERC, & SSHRC. (2014). *Tri-council policy statement (TCPS2): Ethical conduct for research involving humans, Chapter 9: Research involving the First Nations, Inuit and Métis Peoples of Canada.* Canadian Institutes of Health Research, Natural Sciences and Engineering Council of Canada, and Social Sciences and Humanities Research Council of Canada. Retrieved from Panel on Research Ethics website, Government of Canada: http://www.pre.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/chapter9-chapitre9/

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). Thousand Oaks, CA: SAGE Publications.

Cunsolo Willox, A., Harper, S. L., Ford, J. D., Edge, V. L., Landman, K., Houle, K., … Wolfrey, C. (2013). Climate change and mental health: An exploratory case study from Rigolet, Nunatsiavut, Labrador. *Climatic Change, 121*(2), 255–270. doi:10.1007/s10584-013-0875-4

Dillard, D. A., Smith, J. J., Ferucci, E. D., & Lanier, A. P. (2012). Depression prevalence and associated factors among Alaska Native people: The Alaska education and research toward health (EARTH) study. *Journal of Affective Disorders, 136*(3), 1088–1097. doi:10.1016/j.jad.2011.10.042

First Nations Health Authority [FNHA]. (2009). *Healthy food guidelines for First Nations communities.* Retrieved from http://www.fnha.ca/Documents/Healthy_Food_Guidelines_for_First_Nations_Communities.pdf

First Nations Health Authority [FNHA]. (2014). *FNHA fish tissue sampling project 2014.* Retrieved from http://www.fnha.ca/newsContent/Documents/Mt_Polley_Tracking_Sheet_FNHA_Fish_Tissue_Project_2014_Prelim.pdf

First Peoples' Heritage, Language and Culture Council. (2010). *Report on the status of B.C. First Nations languages.* Retrieved from http://www.fpcc.ca/files/pdf/2010-report-on-the-status-of-bc-first-nations-languages.pdf

Gibson, G., & Klinck, J. (2005). Canada's resilient North: The impact of mining on Aboriginal communities. *Pimatisiwin: A Journal of Aboriginal and Indigenous Community Health, 3*(1), 116–140.

Hacker, K. (2013). *Community-based participatory research.* Thousands Oaks, CA: SAGE Publications.

International Finance Corporation [IFC]. (2012). *Performance Standard 4: Community health, safety, and security.* Retrieved from http://www.ifc.org/wps/wcm/connect/a40bc60049a78f49b80efaa8c6a8312a/PS4_English_2012.pdf?MOD=AJPERES

International Finance Corporation [IFC]. (n.d.). *Performance Standard 4—Community health, safety, and security: Stakeholder feedback.* Retrieved from https://www.ifc.org/wps/wcm/connect/b58c498049800a56aa3bfa336b93d75f/Phase3_QCR-PS4.pdf?MOD=AJPERES

Jokinen, L., Roberts, R., Tom, V., Moh, N., Kerr, K., Shandro, J., & Ostry, A. (2015). *Community health risks and opportunities associated with resource development in Tl'azt'en Nation.* Retrieved from http://uvicahm.geog.uvic.ca/sites/default/files/Community Health Risks and Opportunities Associated with Resource Development in Tl%27azt%27en Nation-June 2015_1.pdf

Kant, S., Vertinsky, I., Zheng, B., & Smith, P. M. (2013). Social, cultural, and land use determinants of the health and well-being of Aboriginal Peoples of Canada: A path analysis. *Journal of Public Health Policy, 34*(3), 462–476. doi:10.1057/jphp.2013.27

Kishigami, N. (2010). Climate change, oil and gas development, and Inupiat whaling in northwest Alaska. *Études/Inuit/Studies, 34*(1), 91–107. doi:10.7202/045406ar

MacDonald, D., Sinclair, J., Crawford, M., Prencipe, H., & Meneghetti, M. (2011). *Potential effects of contaminants on Fraser River sockeye salmon* (Technical Report 2, Cohen Commission). Retrieved from Watershed Watch website: https://www.watershed-watch.org/wordpress/wp-content/uploads/2011/08/Exh-826-NonRT.pdf

Morgenstern, N. R., Vick, S. G., & Van Zyl, D. (2015). *Report on Mount Polley tailings storage facility breach: Independent Expert Engineering Investigation and Review Panel*. Retrieved from Mount Polley Review Panel website: https://www.mountpolleyreviewpanel.ca/sites/default/files/report/ReportonMountPolleyTailingsStorageFacilityBreach.pdf

Neil, N., Malmfors, T., & Slovic, P. (1994). Intuitive toxicology: Expert and lay judgements of chemical risk. *Toxicologic Pathology, 22*(2), 198–201. doi:10.1177/019262339402200214

Nguyen, V. M., Young, N., Hinch, S. G., & Cooke, S. J. (2016). Getting past the blame game: Convergence and divergence in perceived threats to salmon resources among anglers and Indigenous fishers in Canada's lower Fraser River. *Ambio, 45*(5), 591–601. doi:10.1007/s13280-016-0769-6

Petticrew, E. L., Albers, S. J., Baldwin, S. A., Carmack, E. C., Déry, S. J., Gantner, N., … Vagle, S. (2015). The impact of a catastrophic mine tailings impoundment spill into one of North America's largest fjord lakes: Quesnel Lake, British Columbia, Canada. *Geophysical Research Letters, 42*(9), 3347–3355. doi:10.1002/2015gl063345

Reading, C. L., & Wien, F. (2009). *Health inequalities and social determinants of Aboriginal Peoples' Health.* Retrieved from National Collaborating Centre for Aboriginal Health website: http://www.nccah-ccnsa.ca/docs/social determinates/nccah-loppie-wien_report.pdf

Richmond, C. A. M., & Ross, N. A. (2009). The determinants of First Nation and Inuit health: A critical population health approach. *Health & Place, 15*(2), 403–411. doi:10.1016/j.healthplace.2008.07.004

Schnarch, B. (2004). Ownership, control, access, and possession (OCAP) or self-determination applied to research. *Journal of Aboriginal Health, 1*(1), 1–35.

Shandro, J., Jokinen, L., Kerr, K., Sam, A. M., Scoble, M., & Ostry, A. (2014). *Ten steps ahead: Community health and safety in the Nak'al Bun/Stuart Lake region during the construction phase of the Mount Milligan Mine.* Retrieved from http://uvicahm.geog.uvic.ca/sites/default/files/pdf/Nak%27al Bun Construction Phase Report December 2014.pdf

Shandro, J., Winkler, M., Jokinen, L., & Stockwell, A. (2016). *Health impact assessment of the 2014 Mount Polley Mine tailings dam breach: Screening and scoping phase report.* Retrieved from First Nations Health Authority website: http://www.fnha.ca/Documents/FNHA-Mount-Polley-Mine-HIA-SSP-Exec-Summary.pdf

Swan, C., Epps, D., & Miller, L. (2014). *Impact assessment monitoring in the Quesnel Lake watershed after the Mount Polley Mining Company tailings dam breach* (BC Ministry of Environment poster). Retrieved from Government of British Columbia website: http://www2.gov.bc.ca/assets/gov/environment/air-land-water/spills-and-environmental-emergencies/docs/mt-polley/sample-monitor/moe_impact_assessment_monitoring_in_quesnel_lake.pdf

Winkler, M. S., Krieger, G. R., Divall, M. J., Cissé, G., Wielga, M., Singer, B. H., … Utzinger, J. (2013). Untapped potential of health impact assessment. *Bulletin of the World Health Organization, 91*(4), 298–305. doi:10.2471/BLT.12.112318

World Health Organization [WHO]. (n.d.). *Health impact assessment.* Retrieved from http://www.who.int/hia/en/