A Holistic Model for the Selection of Environmental Assessment Indicators to Assess the Impact of Industrialization on Indigenous Health

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ABSTRACT

Objectives: Mainstream environmental assessment (EA) methodologies often inadequately address health, social and cultural impacts of concern for Canadian indigenous communities affected by industrialization. Our objective is to present a holistic, culturally-appropriate framework for the selection of indigenous health indicators for baseline health assessment, impact prediction, or monitoring of impacts over time.

Methods: We used a critical population health approach to explore the determinants of health and health inequities in indigenous communities and conceptualize the pathways by which industrialization affects these determinants. We integrated and extended key elements from three indigenous health frameworks into a new holistic model for the selection of indigenous EA indicators.

Results: The holistic model conceptualizes individual and community determinants of health within external social, economic and political contexts and thus provides a comprehensive framework for selecting indicators of indigenous health. Indigenous health is the product of interactions among multiple determinants of health and contexts. Potential applications are discussed using case study examples involving indigenous communities affected by industrialization.

Conclusion: Industrialization can worsen indigenous health inequities by perpetuating the health, social and cultural impacts of historic environmental dispossession. To mitigate impacts, EA should explicitly recognize linkages between environmental dispossession and the determinants of health and health inequities and meaningfully involve indigenous communities in the process.

Key words: Aboriginal health; environmental impact assessment; determinant of health; indicators

La traduction du résumé se trouve à la fin de l'article.

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For decades, the industrialization of northern Canada has been a cause for concern for indigenous communities who live on the land.¹ Recently, Fort Chipewyan, Alberta has been at the centre of ongoing controversy, drawing national and international attention for reported increased cancer rates attributed to environmental exposures.^{2,3} The largely indigenous community of about 1000 people is situated on Lake Athabasca, proximal to uranium mines and pulp mills and downstream from oil sands developments. Although published studies report evidence of environmental impacts in the area,^{4,5} health impact studies^{6,7} have generally been unable to find significantly increased cancer rates in the small population given the inherent limitations of traditional epidemiological methods. Nevertheless, community residents continue to question whether industrialization is adversely affecting health and worsening health inequities. The concerns raised are not limited to health outcomes, but include the air, soil, water, food, and plant and animal species comprising the physical environment and a wide range of social, economic and cultural issues.⁸ In effect, Fort Chipewyan and other indigenous communities similarly affected are seeking a holistic environmental assessment of the impacts of industrialization on their individual and community health and well-being.⁹⁻¹²

Environmental assessment (EA) is a formal process designed to predict and evaluate the environmental effects of proposed industrial development projects in a public and participatory manner.¹³

The necessity for considering health in EA has been explicitly recognized by Canadian provinces and territories under different legislative acts and requirements;¹³ however, significant limitations remain within EA as currently practised. Bronson and Noble surveyed government EA and health authorities, consultants and project proponents, and indigenous health interests to determine the extent to which health determinants are considered within northern Canadian EA methods.¹⁴ They found that concern generally remains limited to physical environments, with little attention paid to social and cultural issues. Furthermore, consideration of health determinants is usually limited to the level of baseline studies and impact prediction, and follow-up health monitoring is not treated with the same scientific rigour as the monitoring of environmental impacts. Finally, public consultation is often limited or missing in the process. Thus, mainstream EA methodologies inadequately address the issues of concern for indigenous communities, resulting in deficient impact assessments, significant gaps in knowledge of the long-term effects of industrialization, and further marginalization of the people most affected.^{15,16}

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Figure 1. The Medicine Wheel¹⁸

In consultations with indigenous peoples, health is often conceptualized holistically, integrating physical, emotional, mental and spiritual dimensions.¹⁷ Furthermore, “Aboriginal people from almost every culture believe that health is a matter of balance and harmony within the self and with others, sustained and ordered by spiritual law and the bounty of Mother Earth.”¹⁸ Thus, indicators selected for EA must represent complex interrelations between the health of individuals, communities and the environment. However, choosing indicators without the use of a comprehensive conceptual framework specified *a priori* can lead to overlooking existing or desirable indicators representing particularly key determinants of health.¹⁹ Therefore, the objective of this paper is to present a holistic, culturally-appropriate EA framework for the selection of health indicators that can be adapted by indigenous communities to address their issues of concern.

METHODS

Population health is an approach that aims to improve the health of an entire population and to reduce health inequities among population groups. To do this, it considers and acts on a broad range of factors that are determinants of health.²⁰ Critical population health extends this approach by seeking to understand the social, economic and political contexts within which determinants of health inequities are produced and structured.^{21,22} Critical population health research incorporates three perspectives: health is viewed as embedded in social relations of power and historically inscribed contexts; research is influenced by the interests of those who face the greatest health burden; and research aims to be health-promoting by increasing capacity of communities to take action.²³

To develop the framework, we took a critical population health approach to explore the determinants of health and health inequities in indigenous communities and conceptualize the pathways by which industrialization affects these determinants. Relatively few Canadian studies have specifically explored indigenous

Figure 2. The Community Life Indicators Wheel³⁰

determinants of health,²⁴ but some research suggests that the conventional determinants of health do not adequately consider indigenous conceptualizations of health.^{25,26} We therefore drew upon three indigenous health frameworks from the literature: the Medicine Wheel;¹⁸ the Community Life Indicators Wheel;²⁷ and the Integrated Life Course and Social Determinants Model of Aboriginal Health.²⁸ In this paper, we critique each framework for its applicability to EA. We then present a new Holistic Model for the Selection of Indigenous Environmental Assessment Indicators that integrates key aspects of these three frameworks. We describe its potential applications, supported by specific examples from published case studies that recount experiences of indigenous communities affected by industrialization. We conclude with a discussion of the model's strengths and limitations and considerations for future refinement.

RESULTS

Medicine Wheel

The Medicine Wheel is divided into four quadrants that represent the physical, emotional, mental and spiritual dimensions of health (Figure 1). It effectively conceptualizes the balance within oneself required to maintain good health and figures prominently in discussions of health for many indigenous people in North America.¹⁸ For example, Richmond and Ross interviewed Community Health Representatives in indigenous communities across Canada and identified six determinants of health: balance; life-control; material resources; social resources; education; and environmental-cultural connections.²⁶ Each of the identified determinants aligns with one of the quadrants of the Medicine Wheel. Determinants such as material and social resources also align well with Health Canada's list of 13 determinants of health;²⁰ however, the environmental-cultural connections determinant is unique. Its identification indicates that the natural environment is inseparable from indigenous culture and spiritual health.

The strengths of the Medicine Wheel are its holistic presentation of the determinants of individual health and emphasis on balance. Nonetheless, consideration of health in EA cannot be limited to individual health. Although community-level indicators are often

Figure 3. The Integrated Life Course and Social Determinants Model of Aboriginal Health^{28*}

* Adapted to emphasize relationships among proximal, intermediate and distal determinants.

based on individual aggregate data averaged to represent the community,¹⁹ community health is more than a summary measure of individual health. Therefore, we turn to the next framework to identify unique determinants of community health.

Community Life Indicators Wheel

Health Canada's Canadian Handbook on Health Impact Assessment is a guidance document that is intended to encourage greater consideration of health impacts within the framework of EA.^{13,29-31} The Community Life Indicators Wheel (Figure 2) is presented in the Handbook as a guide for the selection of indigenous community health indicators.³⁰ The framework was developed as part of the Effects on Aboriginals from the Great Lakes Environment (EAGLE) project, a comprehensive study conducted in the 1990s designed to examine the effects of environmental contamination on traditional ways of life and health of First Nations people in the Great Lakes Basin of Ontario and Quebec.²⁷

The health of the community is represented by the balance point in the centre of the wheel. In consultation with the community, indicators are selected to represent spiritual and cultural attributes that contribute to community wellness but that also indicate community successes and deficiencies. Indicators are placed around the circle within the sector they most closely resemble (corporeal, spiritual, intellectual, or visceral). Four explicit linkages between indicators identified by the wheel are economics/values, religion/spirituality, politics/responsibility and environment/morale. In order to maintain wellness, the community must take a balanced approach to life as represented by the interdependent community life indicators.

Strengths of the Community Life Indicators Wheel are its identification of unique determinants of community health and recog-

Figure 4. The Holistic Model for the Selection of Indigenous Environmental Assessment Indicators

nition of interdependencies among determinants. However, the relegation of indicators to specific one-to-one relationships linked across the wheel may limit the capacity of the model to fully describe more complex relationships among determinants of health. Furthermore, the wheel presents community in isolation of external political and historical structures that are important determinants of health and health inequities. The implications of the latter critique are considered further in discussion of the third framework.

Integrated Life Course and Social Determinants Model

The Integrated Life Course and Social Determinants Model of Aboriginal Health (Figure 3) is a conceptual framework for understanding relationships between social determinants and health status as well as examining potential trajectories of health across the life course.²⁸ The model was developed by the National Collaborating Centre for Aboriginal Health from data describing health inequities in Canada.

In the model, determinants of health are categorized as proximal, intermediate and distal and are filtered through life stages and health dimensions (physical, emotional, mental and spiritual) to shape overall well-being. Proximal determinants include conditions that have a direct impact on individual physical, emotional, mental or spiritual health. These proximal determinants are health behaviours, employment and income, education and food insecurity. Intermediate determinants, including health care systems, educational systems, community infrastructure and resources, environmental stewardship, and cultural continuity, are considered to be the origin of the proximal determinants. Distal determinants are economic, social and political contexts that construct both intermediate and proximal determinants. Although differences exist within and between indigenous communities, experiences with colonialism, social exclusion and self-determination are the

distal determinants that most profoundly influence the health of populations.^{17,18,28}

The strengths of this model are its inclusion of distal determinants of health and identification of external contexts as the most influential determinants of health. For indigenous communities affected by industrialization, individual life-control and community self-determination are key determinants of health;^{11,12} they are central in the new model for the selection of indigenous EA indicators proposed here.

Holistic Model for the Selection of Indigenous Environmental Assessment Indicators

We constructed a new framework for the selection of indicators for use in EA by integrating the unique aspects and key strengths of each of the frameworks described previously: the individual determinants of health and the concept of balance from the Medicine Wheel, the community determinants of health and the concept of interdependencies among determinants from the Community Life Indicators Wheel, and the distal determinants of health and the concept of self-determination from the Integrated Life Course and Social Determinants Model.

In the Holistic Model (Figure 4), the health of the individual is situated within the wider context of the health of the community. Each individual determinant of health points across the circle towards a related, but unique, community determinant of health. Furthermore, these interrelations between individual and community determinants of health are embedded within external social, economic, political and historical contexts. Indigenous health and health inequities are the products of interactions among multiple determinants of health. Within the individual, community and external context levels of the model, specific indicators for each determinant of indigenous health can be identified.

DISCUSSION

The Holistic Model visually depicts the relationships between industrialization and contextual, community and individual-level determinants of health. Thus, indigenous communities can use the model to articulate the multiple pathways by which industrialization directly and indirectly affects health and select representative indicators. Examination of the validity and utility of the proposed framework in planned consultations with residents of Fort Chipewyan will serve to strengthen and refine the model. However, the Holistic Model's construct validity is supported by four of the relatively few published case studies that exist that illustrate the pathways by which industrialization affects indigenous individual, community and contextual determinants of health.

The Aamjiwnaang First Nation (Ontario) is surrounded by the largest complex of petrochemical plants in Canada and routinely exposed to multiple industrial emissions. Luginaah et al. conducted in-depth interviews to examine the perceptions and coping strategies of community residents.⁹ Residents strongly associated past and present health problems in the community with perceived environmental threats and employed action-focused coping strategies intended to minimize environmental exposures. However, emotional coping strategies ranged from denial to pragmatic acceptance to cynical pessimism, reflecting profound anxiety and sense of helplessness among community residents. At an *individual level*, the consequences of the uncertainty caused by industrializa-

tion are loss of *life-control* and ability to cope with health threats posed by environmental exposures.

At a *community level*, place is a significant anchor to the history and culture of the community, and sense of place, or *environmental-cultural connection*, has been identified previously as an important determinant of indigenous health. Loss of place to industrialization may be dramatic, as in the case of Cheslatta T'En First Nations (British Columbia) who were forcibly removed from their ancestral lands in the 1950s to allow construction of a private hydroelectric dam.¹⁰ Loss of place may also be gradual whereby communities lose land and resources incrementally due to environmental impacts. Regardless, the accompanying loss of sense of place is significantly associated with weakened cultural identity and diminished community health.

At a *contextual level*, the processes underlying the formation of health inequities cannot be narrowed to a single explanation. However, there is growing evidence that attributes the current health status of Canada's indigenous peoples to *colonialism* and its legacy of health, social and cultural impacts that persist today.^{18,24,26,32} Richmond et al. conducted interviews with members of the 'Namgis First Nation (British Columbia) to explore perceptions of the risks and benefits of salmon aquaculture.¹¹ Community members identified strong associations between reduced access to environmental resources, limited participation in the paid labour economy, and declining community health. Most respondents indicated that the cause of the community's poor health is colonialism, a process that has marginalized them from their traditional territory and resulted in lack of control over or participation in government decisions that affect them as First Nations. Industrialization perpetuates the legacy of colonialism by pressuring indigenous communities to surrender ties to the land.

Conversely, *self-determination* has been cited as the most important determinant of health among indigenous peoples.¹⁷ Parlee and O'Neil provide a perspective on health developed with the Lutsel K'e Dene First Nation (Northwest Territories) in the wake of the EA of Canada's first diamond mine.¹² Industrialization was considered a threat to community health and well-being if it would disrupt "the Dene way of life". Frustrated by the narrow scope of indicators proposed during the EA process, community residents developed indicators of health organized around three themes related to community self-determination: self-government, healing, and cultural preservation.

Other applications of the model can help mitigate the impacts of industrialization by addressing some identified limitations of mainstream EA. First, consideration of indigenous health in EA cannot be limited to health outcomes like community cancer rates, but must include consideration of the determinants of health.¹³ The model emphasizes the holistic and interrelated conceptualization of indigenous health and thus provides a culturally-appropriate framework for selecting health indicators. The model is not intended to be universally applicable, and indigenous communities are encouraged to individualize and adapt it for different purposes, including baseline health assessment, impact prediction, and monitoring of impacts over time. Finally, the model emphasizes that individual life-control and community self-determination are key determinants of indigenous health. In keeping with a critical population health approach, the model aims to be health-promoting by increasing the capacity of communities to take action.

A limitation of the Holistic Model is that its development was not done with indigenous researchers, although its key aspects were drawn from research done with indigenous communities in accordance with research guidelines.³³ However, and importantly for EA processes that involve indigenous communities, government and industry, the model combines both “emic” (based on cultural particularities) and “etic” (based on universally shared human characteristics) approaches to understanding health and as such may help enhance communication in EA processes. The proposed Holistic Model is a tool with which EA can integrate holistic health impact assessment, and its use must involve indigenous communities meaningfully in decision-making processes, or else industrialization will continue to perpetuate the legacy of colonialism and historic environmental dispossession.

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RÉSUMÉ

Objectifs : Souvent, les méthodes d’évaluation environnementale (EE) ordinaires n’abordent pas suffisamment les impacts sanitaires, sociaux et culturels de l’industrialisation sur les populations indigènes du Canada. Nous avons voulu présenter un cadre holistique, adapté aux différences culturelles, pouvant servir à sélectionner des indicateurs de santé indigène qui se prêtent 1) à l’évaluation de l’état de santé de départ, 2) à la prédiction des impacts et 3) à la surveillance de ces impacts au fil du temps.

Méthode : Au moyen d’une approche critique de santé des populations, nous avons analysé les déterminants de la santé et les iniquités en santé dans des populations indigènes et conceptualisé les voies par lesquelles l’industrialisation influence ces déterminants. Nous avons intégré et

généralisé les éléments clés de trois cadres de santé indigène afin de créer un nouveau modèle holistique de sélection d'indicateurs indigènes pour les EE.

Résultats : Notre modèle holistique conceptualise les déterminants individuels et collectifs de la santé en tenant compte des contextes sociaux, économiques et politiques externes, ce qui donne un cadre global pour la sélection d'indicateurs de la santé indigène. La santé indigène est le produit des interactions entre de multiples contextes et déterminants de la santé. Les applications possibles du modèle sont abordées à l'aide d'études de cas impliquant des populations indigènes touchées par l'industrialisation.

Conclusion : L'industrialisation peut aggraver les iniquités en santé vécues par les populations indigènes en perpétuant les impacts sanitaires, sociaux et culturels de la dépossession historique de leur environnement. Pour atténuer ces impacts, une EE doit explicitement reconnaître les liens entre la dépossession environnementale, les déterminants de la santé et les iniquités en santé et impliquer concrètement les populations indigènes dans le processus.

Mots clés : Indiens d'Amérique nord; étude d'impact environnemental; déterminant de la santé; indicateurs d'état sanitaire

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