ABSTRACT

Place is more than physical and natural environment. The role of biophysical environment has still to be articulated in population health discourse and its relations with human health are fraught with scientific uncertainty and dissension. An environmental impact assessment (EA) evaluates the environmental effects of a proposal – a rational and technical process. Sometimes health assessments are included, usually by quantitative risk assessments which are subject to the limits of scientific knowledge and bedevilled by data limitations. The goal must be to add health to the process, yet the relevant features to include are complex. Impacts are non-specific and they interact and have spatial and temporal characteristics. To integrate environment into population health, there is a need for a physical environment-health database and intersectoral policy and action. There is also a need for different types of indicators to measure process, impact and effectiveness, and for new tools (stories, photography) to account for context and values.

ABRÉGÉ

Un endroit n'est pas seulement un environnement physique et naturel. Le rôle de l'environnement biophysique reste à définir dans le discours sur la santé de la population, et ses liens avec la santé humaine soulèvent beaucoup d'incertitudes scientifiques et d'opinions dissidentes. Les études d'impact sur l'environnement évaluent les répercussions d'un projet sur l'environnement – il s'agit d'un processus rationnel et technique. Il arrive que les évaluations sur la santé soient incluses, habituellement dans le cadre des évaluations quantitatives des risques qui sont limitées aux connaissances scientifiques et tronquées par les limitations des données. L'objectif doit être d'ajouter la santé au processus même si les caractéristiques qui intéressent sont complexes. Les impacts ne sont pas spécifiques; ils interagissent entre eux et possèdent des caractéristiques spatiales et temporelles. Pour intégrer l'environnement à la santé de la population, il nous faut disposer d'une base de données santé – environnement physique, avoir des politiques intersectorielles et agir. Nous avons également besoin de différents types d'indicateurs pour mesurer le processus, son impact et son efficacité, et nous devons également avoir de nouveaux outils (récits, photos) pour prendre en compte le contexte et les valeurs.

Health, Environmental Assessments and Population Health: Tools for a Complex Process

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There has been much effort in recent years to identify and research those factors that influence the health status of individuals and populations. From the early development of population health frameworks within and based on the Canadian Institute of Advanced Research,^{1,2} there is growing evidence of the salience of a range of individual and community factors, such as income and income disparity, lifestyle, social capital and unemployment rates.³⁻⁵ These have provided the impetus for strategies for individual behaviour change, health promotion strategies and healthy public policy. In the frameworks and in some of the research, the importance of environment as a determinant of individual and population health has been recognized.^{2,6} Indeed, its role has been examined as one of a constellation of factors that make up place.^{7,8} But place is more than the physical and natural environment and much of its meaning and significance emanate from its social and community importance, tellingly researched for its impact on health and morbidity.^{9,10} Yet the role of the biophysical environment remains to be fully articulated in the population health perspective and in health promotion strategies. Such articulation is a challenging task. The relationships between the biophysical environment and human health are fraught with scientific

uncertainty and dissension. For example, two recent Canadian studies on the relationship between electro-magnetic fields and childhood leukemia concluded with completely contradictory results.^{11,12} This is perhaps not surprising in light of measurement issues concerning outcome and exposure and uncertainty over plausible biological pathways and mechanisms.

It is not the purpose of this paper to address all these issues of uncertainty, most of which are likely to be present for the unforeseeable future. Yet it is important that they do not render us actionless. The environment is implicated in many health and illness concerns. Its (potential) role produces anxiety on the part of the public as it is an element over which we, as individuals and communities, seem to have little control.¹³ Its fragility is increasingly recognized¹⁴ and its links to human health concern the public and its governments.¹⁵⁻¹⁸ This paper will therefore point to some of the ways in which we can link considerations of environment and human health within a population health framework, and will conclude by suggesting some tools to assist in these linkages.

Assessing the health outcomes of environment

Assessing environmental impact is a relatively commonplace activity across Canada, pursued with more vigour in some provinces (e.g., British Columbia) than others (e.g., Ontario). An environment assessment (EA) is a comprehensive attempt to evaluate the environmental effects of a proposal through identifying issues, gathering data, predicting impact, developing mitigation strategies, and engaging in community consultation and expert review. It is a rational and technical

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process, the purpose of which is to assess the magnitude, extent, duration and frequency of impacts, as well as to comment on those likely to be affected and the costs of (and capacity to deal with) the impact.¹⁹ In sum, an EA evaluates the potential for and nature of any adverse impacts of a proposal for, say, a landfill, chemical plant or expressway. In many EAs, the human health assessments are directly included, especially in settled areas and if the project has actual or perceived health effects.²⁰

The conventional way of carrying out the health assessment is through a quantitative risk assessment in which a possible hazard is identified and the relationship between exposure to the hazard (dose) and adverse health outcome (response) is calculated.^{21,22} This allows for an exposure assessment to be made so that the risk to the relevant population may be characterized. The risk characterization usually takes the form of calculating excess or additional mortality or (less frequently) morbidity. There is often little epidemiological information for these assessments so animal studies are often used,²³ thus requiring assessment of the salience of these data for human exposure. Risk assessments can help determine acceptable contamination concentrations in soil, air, water and other media. Yet risk assessments are themselves subject to the limits of scientific knowledge²⁴ and may be criticized for failing to portray accurately exposure, latency and outcome. This has led to the 'dismissal' by epidemiologists and courts of law of many key environmental exposure events such as Love Canal, N.Y. and Woburn, Mass.^{25,26} Yet these dismissals have themselves led to challenges, especially by publics and their political and legal representatives concerned over low chronic exposures with non-specific or long latency outcomes. These public concerns cannot be dismissed and require the formal integration of health assessment in the EA process.

Integrating health and environmental considerations

The need for this formal integration has been recognized by many health authorities, such as the WHO.²⁷ Canadian interest in incorporating health in EAs has also grown with escalating scientific, public and political interest and concern. Indeed, in a

recent summary document,¹⁹ it was recognized that health assessment in EAs can contribute to important federal, provincial and municipal strategies for health for all and sustainable development, address public concerns and minimize the need for separate health impact assessments (HIAs). It can also minimize adverse and maximize beneficial effects on health. Yet the features to take into account for such integration are complex. For example, hazard and exposure conditions must be examined and the various effects on physical health (e.g., on mortality, morbidity, exacerbation of existing conditions, cumulative effects) and social well-being (e.g., on income, way of life, service delivery, employment opportunities) must be taken into account. Davies and Sadler¹⁹ put forward a model of the environmental impact process, identifying the modification necessary to a conventional EA through the utilization of such tools as epidemiological knowledge, census information and risk and economic assessment studies. Such use of tools presents problems, such as limits to understanding of chemical toxicity and environmental disease, the difficulties of identifying and measuring all exposure pathways, biological variations in response to exposure, and resource issues such as data availability and assembly and the need for specialized staff to undertake such a complex process.^{19,24} Yet the linking of health and EAs is occurring, especially at the local level and often over site-specific remediation projects. These may rely unduly at the present time on conventional quantitative risk assessments. But other types of health study may be needed to capture elements not present, e.g., qualitative research, mixed methodologies, time series, multi-level quantitative models. If such studies are carried out, the commensurability, credibility and salience of the findings from these different approaches may be problematic and fuel controversy, some of which may be abated should health and EA become integrated within a population health framework.

Integrating environment in a population health framework

How might this occur? The population health framework is more than the recognition of the determinants of health and

the interactions between them. It also recognizes a need for intersectoral policy and action and for considering the salience and roles of different stakeholders (individuals, families, community, governments) in enhancing the health of populations.²⁸ For integrating health in EAs, we must recognize that different approaches to the issues are required and are likely to produce different but complementary solutions. Yet first and foremost, to integrate health in EAs within a population health framework requires full recognition of the physical environment as a determinant of health. In this, there is much to learn from the incorporation of health in EAs to ensure sustainable and health-enhancing land use practices.²⁹ Yet few EAs have incorporated more than the 'idea' of health. Practical incorporation is as elusive as it is complex.

Environment (and place) are key determinants of health and must be fully implicated in a population health framework. It is a determinant of intense concern to Canadians in part because of the damage to ecosystems associated with human activities. A significant proportion of Canadians – up to 90% in some surveys^{15,29} – are concerned about the impact of the environment on their health and that of their children. The environment is 'troublesome' as there is a lack of research consensus on its effects on human health. It is not seen as being under human control and is the source of involuntary, often unequal, exposures. Most Canadians also see themselves as detached from the environment so they lack personal experience of its potential force as a hazard, intensifying the fear of the unknown. It may be seen as the determinant of risk society³⁰ in that its effects are seen as hazards and its consequences as risks. It is therefore necessary to fully detail the nature of the physical environment as a determinant of health. Cole et al.³¹ suggest that different approaches may enhance our understanding. The investigative and analytic tools of toxicology, microbiology, epidemiology, environmental engineering and environmental psychology, among others, can help assess environmental hazards and the environmental burden of illness; those of ecology, economics, geography and environmental planning can help assess ecosystem conditions and human well-

being; and those of law, philosophy and the policy sciences can help assess environmental justice and the human condition.

These different types of investigation will help integrate the science. This is, however, only the first task. The integrated knowledge must be utilized for integrated policy development so that risk management and assessment, health surveillance, standard setting, creating the conditions for supportive environments and clean production, and health public policies and public health ethics are all seen as appropriate policy end-points for considering health in EAs in a population health framework. Such integrated knowing and policy development recognizes that there is more than one way to enhance the health of populations. There is a need to pursue rigorous alternative approaches to ensure that health is incorporated and addressed in EAs and environment in population health frameworks and practices.

Tools for a complex process

It is axiomatic that integration within a population health framework points to the need for a shared responsibility to develop ways of knowing and tools to understand, explain and manage health concerns and to enhance health of populations in specific environments. We thus require tools for a complex and somewhat (scientifically and politically) fraught process. A shared approach – the recognition of the rights (and obligations) of different stakeholder groups – helps in the development of the most important tool we require, which is the ability to ask the right questions. Asking the wrong questions, type 3 errors, are difficult to avoid if experts work in isolation. But even when they do not, such errors are still to be expected! We need to learn from those mistakes and change practice.

What other tools may be suggested? Much has been made of the need to develop relevant and appropriate knowledge-bases and indicators for all determinants in assessing population health, including the physical environment. It might be worth considering including health in EAs and environment in population health HIAs to assess the environmental contribution to morbidity and well-being. Environment

(and places) are important for good health but are also potentially damaging to physical, psychosocial and spiritual health. It is, however, important to note that data overload may be problematic. Psychological research suggests that we can handle 7 ± 2 bits of information. As we develop appropriate indicators, this must be kept in mind. Different types of indicators are also required – to demonstrate process, impact and effectiveness. While quantitative risk assessments remain important, we must add lay epidemiology³² and qualitative and experiential knowledge.³³ In assessing the impact on health of environment or environmental projects, attention to process is vital and we can learn most from the literatures on risk perception, risk communication and participatory research to ensure assessment is transparent, sensitive and empowering. It also is important to judge the effectiveness of integrating environmental health issues in HIAs (or vice versa), carried out by recognizing the salience of different types of evidence, ensuring an acceptable definition of success and isolating and encouraging best practices.

Finally, tools to support decision-making and management practices that seek to incorporate environment fully in population health in a sensitive and appropriate way are required. For this, the recognition of the different types of indicator is itself important. This may be aided by conceptual tools that assist in understanding how environment and health are connected not only scientifically but in people's minds. For this, stories, poems, drama, video, and photographs may be useful tools.³⁴ The importance of the story in furthering policy, practice and behavioural change is increasingly recognized.^{35,36} Further, policy and public response to any issue is shaped not only by evidence (e.g., indicators) but also by context, ideas and values. A useful tool will, therefore, be one that allows for a rapid environmental scan to elucidate and update these ideas.³⁷ Yet little may change if the political or regulatory climate is too permissive or constraining. There is then the possibility of an advocacy role to further the incorporation of health in EAs. The information – the science – remains key but without appropriate circumstances,

it may be difficult to consider all health determinants and ensure policy responses which enhance the health of Canadians.

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