

# Challenges and Directions for Environmental Public Health Indicators and Surveillance

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The official recognition of the state of many of the earth's modern environmental problems, and their influence on human health was first stated in unity by governments at the 1992 Rio Earth Summit. Issues such as anthropogenic contaminants in the environment, human-induced climate change, growing inequities between rich and poor, and the influence that these factors have on human health were identified and since then have been noted to be getting worse in many areas of the world. It was recognized that a better understanding and identification of these environmental health issues were required in order to begin to address them, and that this action would require collective efforts among communities and countries as many of these issues did not recognize political boundaries but were of a global nature. Here, we refer to "environmental health" in the following sense:

*"Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social and psychological factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect adversely the health of present and future generations."*<sup>1</sup>

Some recent yet preliminary calculations of the burden of disease relating to these environmental and occupational determinants<sup>2</sup> estimate that these factors are related to approximately 11% of all diseases in Latin American countries. Other World Health Organization (WHO) studies show that the poor, and especially children and women, share a disproportionate burden of disease relating to environmental sources. The contribution of environmental factors to disease among the most vulnerable populations has been roughly estimated by WHO to be between 25% and 33% of the global burden of disease (many more studies are currently underway to further refine these figures).<sup>3</sup> This situation has generated a high level of activity towards the development of environmental public health indicators and surveillance systems, primarily in Europe<sup>4</sup> and the Americas.<sup>5</sup>

## The Conference on Environmental Health Surveillance, Québec City, 2000

In October 2000, a group of researchers, practitioners and health professionals came together in Québec City to discuss the challenges facing environmental health monitoring and surveillance and to discuss the possibility of developing consensus on many of these issues (see List of Conference Attendees on page 71 of this Supplement). The conference was initiated and supported by the International Joint Commission (IJC), the Pan American Health Organization (PAHO), Health Canada, Environment Canada, and the U.S. Agency for Toxic Substances and Disease Registry (ATSDR). To initiate discussions, a number of papers were commissioned, providing a review of the state of the knowledge in various pertinent areas and proposing a list of potential indicators to monitor the interactions between specific environments and human health. A number of common or cross-cutting themes emerged from the papers and conference discussions and are used in this supplement to propose an approach to developing a set(s) of common environmental

health indicators to meet basic needs for environmental public health monitoring and surveillance.

## Overview of the Conference

The concept of environmental health is multifaceted and complex in nature, consisting of both biotic and abiotic components of physical environments as well as aspects of social, economic and political processes which influence the health of ecosystems and in turn, the well-being of the world's populations. For example, the demographic changes that are taking place in coastal zones and the dependence of many groups on the sea (e.g., resources, travel, etc.) have associated health benefits and risks as discussed by Dewailly et al.<sup>6</sup> and are exemplified by such things as the rates of incidence and impacts of marine toxin poisonings. Similarly, Morris and Cole<sup>7</sup> describe some effects that industrial activities have had on freshwater systems (e.g., the Great Lakes) and the influence that the presence of these chemicals has on the health of populations living in these regions in North America. Similar extrapolations could be made to other large freshwater ecosystems in which intensive development and high population densities exist.

In discussing the relationships between human populations and the environment, Pong et al.<sup>8</sup> remind us of the importance of how populations are defined in relation to the information we collect to monitor their health status. Indicators for rural populations currently do not exist in Canada and in fact, there are few data of an environmental nature that describe them. Specific rural environmental health indicators would allow us to assess and improve the state of these environments and their impact on health in rural areas – this remains to be done. Hancock<sup>9</sup> describes the links between urban populations and the various aspects of these environments. He includes aspects of the built environment, as well as the bioregional and natural ecosystem on which urban settings depend. Also, he expands the view of "environment" to include components of the social, economic and political settings and processes that are part of everyday life and which affect human-environment relationships. The importance of the built environment is critical to consider when contemplating human-environment interactions as half of the world's population now lives in

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urban settlements, with Europe and North America being approximately 80% urbanized and with individuals spending as little as 5% of their time in what one might consider “natural” environments. These urban areas are reported to consume 75% of the world’s resources and produce most of its waste.<sup>10</sup> Thus the “health” of these built environments is becoming increasingly important in assessing and monitoring the determinants of human health.

Monitoring, as described here, involves the collection and analysis of measurements aimed at identifying changes in the environment, the health of human populations, or both. Further, it can involve the assessment of actions taken to address issues related to these environment-human interactions. Surveillance has become a critical task in many governmental organizations responsible for ensuring the health and well-being of populations and/or the environment (see Eylenbosch and Noah<sup>11</sup>). As described in this supplement, the relationships between environments and human health are complex, and thus it is difficult to know what measurements are most appropriate to take when monitoring the status of environmental compartments, human health, or the relationship between them. To measure all factors in these relational chains would be too time- and resource-intensive and thus measurements that are indicative of the relationships and impacts we are concerned about, or interested in, are chosen as “indicators” to document and track. Briggs et al.<sup>12</sup> define an environmental health indicator as:

*“an expression of the link between environment and health, targeted at an issue of specific policy or management concern and presented in a form which facilitates interpretation for effective decision making.”*

Thus, the exercise would appear to be to simply identify a number of indicators that are representative of the relationships between human health and various aspects of different environments and to monitor their progress over time, adjusting private and public actions accordingly. However, this alone is a time- and resource-intensive task. In their paper on the identification of risks related to Great Lakes pollutants and human health, Hicks and De Rosa<sup>13</sup> emphasize the need to identify and monitor the health status of “at risk” populations, or

sentinel situations. These geographic locations, populations, sub-populations, or individuals are defined as being the most susceptible to certain human-environment interactions, therefore more representative of the extent of the potential impacts on health and thus requiring more attention than the wider population. This choice of monitoring the ‘most susceptible’ becomes important when we consider the time and funds required to monitor all interactions for all environments and all populations.

Further, as Innes<sup>14</sup> states “*more is required to inform policy than simply producing academically certified data and handing it to policy makers.*” This point is discussed in detail by Aron and Zimmerman<sup>15</sup> in their paper on the communication needs for translating indicator data into government action. They discuss the importance of being able to understand and enhance the processes of collecting, interpreting and drawing conclusions from indicators for effective use in decision-making processes. Information is needed to assess and monitor trends, identify and prioritize problems, develop and evaluate policies, guide research and development, set standards, monitor progress and inform the public. It is important that these data be conveyed in a comprehensible way, but with due regard to the complexities and uncertainties inherent in the data.

Chapter 40 of the global action plan on sustainable development, Agenda 21, dealing with information for decision-making states that, “*in sustainable development, everyone is a user and provider of information in the broad sense.*”<sup>16</sup> While health, environment and development problems differ in various parts of the world, as do priorities with regard to their management, there is a need in all situations for decision-makers and the public to have access to accurate information on health hazards associated with development and the environment. In a paper on indicators within the context of sustainable development, von Schirnding<sup>17</sup> provides an overview of specifically what type of information this includes and how best it is organized.

As discussed above, the activities of identifying and collecting these data constitute no small task. Additionally, the capacities to do so differ significantly among jurisdictions, countries and continents. How then is it possible to collect and organize infor-

mation in a way that is valid, efficient and also meets the growing needs for comparable data across regions to address these environmental health issues that are bound by physical and chemical processes and not political boundaries? In their paper on information technologies and their application to environmental health monitoring and surveillance, Bédard and Henriques<sup>18</sup> describe some of the ways in which cost-effective and comparable data can be collected and analyzed. However, the reality of the situation is that the capacity to adopt and implement these technologies does not exist in all regions of the world. Cooperation, coordination, and commitment are required among governments and agencies to take advantage of the benefits these technologies offer in addressing data and information needs in environmental health practice. However, the Québec conference did show that common denominators link all of these levels of inquiry.

### A common approach

Whether it is in relation to the need for basic information on human interactions with urban, rural, freshwater or marine ecosystems in the form of indicators, or the need for comparable, valid data for national and international level monitoring on water quality in Brazil, the papers presented at the conference stress the requirement for the identification and collection of valid, reliable and comprehensive data. The generation of and access to this information require significant commitment of resources, coordination of efforts and collaboration among agencies and organizations at various levels. Cost-effective and efficient technologies must be developed to support and enhance abilities to conduct this cooperative and transparent collection, organization, analysis and communication of information. Without the development of consensus on the required elements and concepts of such monitoring and surveillance efforts, we will continue to collect data that are only of immediate value at the local, regional or national levels for many issues that are global in nature and require higher levels of organization and analysis. Considering the disparate nature of many capacities and resources dedicated to these efforts, one might ask whether it is possible to develop such a collection, and if so “what to monitor”. Many countries’ and

TABLE I

**Water-related Public Health Targets and Underlying Questions**

Suggested Targets for 2015	Examples of Underlying Questions
(Source: WSSCC, 2001 <sup>11</sup> )	
1. Universal public awareness of hygiene	Is the importance of personal hygiene well known?
2. Percentage of people who lack adequate sanitation decreased by 50%	What is the access to effective sanitation?
3. Percentage of people who lack safe water decreased by 50%	What is the access to sources of microbiologically and chemically safe water?
4. 80% of all primary school children educated about hygiene	Is the level of awareness and training in basic personal hygiene adequate?
5. All schools equipped with facilities for basic sanitation and hand washing	What is the access to facilities for basic hygiene in schools?
6. Diarrheal disease incidence reduced by 50%	other public buildings?
	What is the incidence of water-related diseases?

regions' environmental health problems are of a more "basic" nature than others, and many regions of the world do not have the resources, technologies or abilities to implement high technology surveillance programs to identify and address these issues.

### Identifying a common set of indicators for global environmental health

In consideration of the articles in this supplement and the current dialogue relating to environmental health surveillance in various countries around the world, we argue that there is common ground among scales, jurisdictions, priorities, and abilities relating to environmental health surveillance and monitoring. Establishing a set of "basic environmental public health questions" founded in some basic needs may be one way through which to unify many resource and concept-related perspectives. These questions, or basic environmental health needs, remain the same on all scales. As stated in many papers in this supplement, indicators serve a purpose, which is usually presented in the form of a public health objective. For example, some United Nations agencies have recently suggested some basic water-related public health targets,<sup>19</sup> and in Table I we suggest some related environmental health questions we believe will remain the same across all geographic scales, levels of economic development and over time.

Similar objectives have been proposed by PAHO<sup>20</sup> for other sectors in the Americas such as indoor and outdoor air quality, toxic chemicals exposure management, climate change, technological and natural disasters, as well as for organizational needs in preparedness, surveillance, laboratory support, etc. Related questions could similarly be formatted for these objectives. In response to each of these questions regarding basic environmental health needs and objectives, there are a number of potential indicators or measurements that could be applied, many

of which already exist but some (especially for interventions) for which new indicator development is required. In order to be comprehensive in the approach and allow indications of status from all regions, it is necessary to be flexible in the ways this information is collected.

### Basic and reliable ways of gathering data

It is not always possible to have quantitative, organized and easily accessible data to answer these questions. Therefore, a flexible approach to "data collection" must be taken which includes the opportunity for traditional quantitative evaluations but also qualitative assessments comprised of such things as expert opinions, sentinel stories and questionnaires. These methods can still be applied at the smallest available scale in a valid and reliable manner (see Eyles and Furgal<sup>21</sup>) to allow for some form of rapid assessment. Of course, this is in lieu of an advanced monitoring and surveillance system. However, the identification and tracking of issues in whatever reliable and feasible manner, will support the establishment of priorities and implementation of programs to address these issues. Imperfect information collected under known constraints is much better than no information at all to support public health decision-making processes and represents a first and significant step towards a longer term commitment.

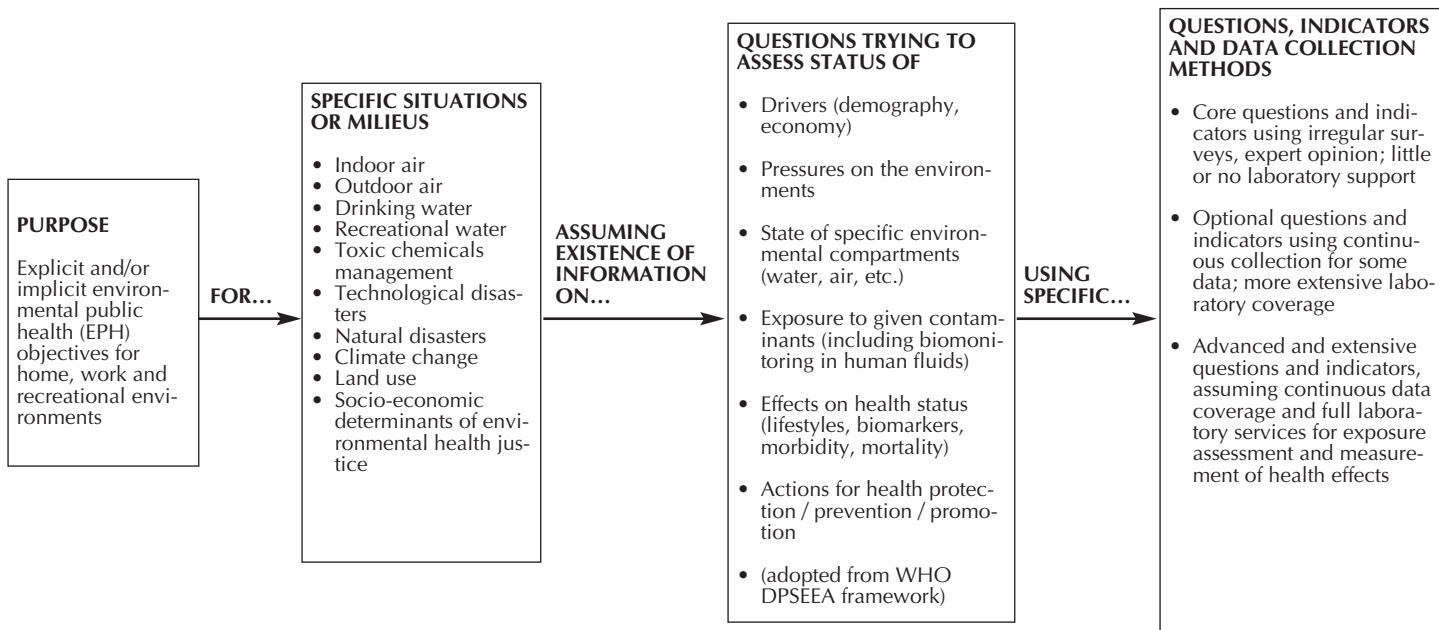
### Selecting a core: Being flexible to regional needs and capacities

Evident in the papers presented in this supplement and the environmental health literature is the unique aspects of many environments, regions, and locales around the world. At the same time many basic environmental health issues are global and not only local in nature. It is for these reasons that a "core" set of indicators has been proposed and great effort has been put

forth in utilizing these indicators by such organizations as the World Health and Pan American Health Organizations. Similarly, a set of basic or "core" questions could be proposed which are common to many or all regions and jurisdictions. Respecting the nature of global variability in environments and human-environment relationships (e.g., small island states vs large urban areas), "optional" questions could be developed in the same manner which involve many indicators and for which data could be collected in a variety of ways dependent upon resources and feasibilities in the respective locations. In order to move towards basic and standardized abilities to collect and access data though, these core questions must be comprehensive in their approach, including not only the basic needs, but access to basic services which support these needs, and the abilities to collect and organize these data. This will enable environmental health professionals and decision-makers to track not only the status of human-environment interactions, but also the inequities in access to services to meet these needs and the abilities to monitor such phenomena.

## CONCLUSIONS

This paper argues that in consideration of the complex nature of human-environment interactions and our increasing understanding of their inextricably interwoven nature, it is critical to monitor the feedbacks and status of these relationships in the interests of human health. Further, as many anthropogenic-related environmental challenges, and the level of global industrialization and development increase, it is critical to keep a close eye on the impact we are having on the environment, and in turn, that environments are having on us. As many of the environmental influences on human health are global in nature and such problems as atmospher-



**Figure 1.** Process for development of a common approach in environmental health indicators and surveillance.

ic and ocean transport of environmental contaminants do not stop at political boundaries, collective efforts and actions are required (e.g., as recognized in the recently signed Stockholm Convention on Persistent Organic Pollutants). However, not all countries and regions have the same capacity to take part and act on these issues, thus some form of unifying or common approach must be proposed and pursued. This paper outlines the steps of an approach based on “basic questions” to develop indicators for environmental health considering the challenges of scale, capacity, data comparability and reliability. Such an approach would consist of the development of consensus around basic objectives (founded on basic environmental health needs), basic core and optional questions recognizing the unique nature of many environmental regions and geographic locations, and a 3-tiered approach to monitoring and surveillance for these questions reflecting the capacities present in various regions around the world to conduct such activities (Figure 1).

Finally, in order to better understand the impacts of human activities on the environment, and conversely, to protect and promote the health of both humans and the ecosystems upon which we rely, a common commitment and effort to cooperate on initiatives must be adopted. This commitment must include the enhancement of capacities in regions of the world where

such capacities to monitor and act on these issues are challenged, in order to ensure a common minimal standard of global environmental health.

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