

Toward a Global Agenda for Research in Environmental Epidemiology

Colin L. Soskolne,* Colin D. Butler,† Carel IJsselmuiden,‡ Leslie London,§
and Yasmin von Schirnding¶

EPIDEMIOLOGY & SOCIETY
A Forum on Epidemiology and Global Health



Abstract: The global environment is in critical decline. Whether one's concern about environmental epidemiology stems from the perspectives of environmental health, climate change, ecological collapse, or growing inequity, clear problems exist. Natural capital resources are being depleted; disregard for the integrity of ecosystems is entrenched in current business practices. Indeed, despite increasing rhetoric to the contrary, the disregard displayed by those who hold power globally toward long-term sustainability and, thus, the health and well-being of future generations, could be described as wanton. Six years ago, the Millennium Development Goals were announced by the United Nations as a rallying point for action to achieve a sustainable future, particularly by reducing the gap between the "have mores" and "have nots." The attainment of these Goals is now endangered, as is, apparently, the spirit of optimism and idealism that inspired them at the Millennium Summit. We call for a reinvigoration of both concern about—and action on—sustainability. In particular, we appeal to those engaged in the field of environmental epidemiology (and other specialties with whom they engage) to consider how they might help by incorporating sustainability issues (including global ecological integrity and global environmental justice) into their own research programs. This incorporation would make a vital contribution to protect both present and future generations and to reduce resource and health gaps between North and South. Simply put, we propose that sustainability becomes integral to advancing the science of environmental epidemiology and related environmental disciplines.

(*Epidemiology* 2007;18: 162–166)

Submitted 27 July 2006; accepted 17 August 2006.

From the *University of Alberta, Edmonton, Canada; †Deakin University, Melbourne, Australia; ‡Council on Health Research for Development, Switzerland; §University of Cape Town, South Africa; and ¶World Health Organization, New York, New York.

Editors' note: Related articles appear on pages 167 and 179.

Correspondence: Colin L. Soskolne, PhD, Department of Public Health Sciences, University of Alberta, 13-103 Clinical Sciences Building, Edmonton, Alberta, Canada T6G 2G3. E-mail: colin.soskolne@ualberta.ca

Copyright © 2006 by Lippincott Williams & Wilkins

ISSN: 1044-3983/07/1801-0162

DOI: 10.1097/01.ede.0000248480.19983.ba

Nearly 190 countries have now pledged support for the 8 Millennium Development Goals adopted at the United Nations Millennium Summit in September 2000.¹ The Development Goals (Table 1) include halving global poverty and hunger, environmental protection, and the ending of illiteracy and gender discrimination.

Eighteen targets were set for the international community to measure progress toward these goals. Many of these goals and targets fall within the scope of environmental epidemiology, broadly defined.

Given the hope, effort, and fanfare that accompanied the launch of these goals, it is lamentable that, despite some bright spots, its implementation has faltered. For example, although some progress has been made in some areas in sub-Saharan Africa, the number of people currently living there in poverty still exceeds that of 1990.²

Poorly recognized by the wider community and apparently even by the framers of the Development Goals, a failure to enhance environmental sustainability (Goal #7) is likely to render most of the other goals inconsequential.³ Despite being criticized for their imprecision,⁴ their comparative timidity,⁵ and their selectivity, the Development Goals represent an organizing principle for development—a principle reaffirmed at the World Summit on Sustainable Development⁶ held in Johannesburg in 2002. And although the spirit of these ideals and concerns permeated the 2005 International Society for Environmental Epidemiology (ISEE) conference held in South Africa, they also pertain to other epidemiologic subspecialties, as well as to many other disciplines and professional organizations, including those concerned with environmental exposure assessment.

On the one hand, the framework of the Millennium Development Goals describes the gap in needs between rich and poor populations. On the other hand, it offers environmental epidemiologists in both developed and developing countries practical ways to "... contribute to advancing our science in the context of reducing inequalities to better ensure global environmental sustainability." Through understanding the role of environmental epidemiology in addressing disparities in health, we expect overall improvements in indicators of health and well-being not only globally, but particularly within those countries where disparities remain extreme.

EXPANDING THE SCOPE OF ENVIRONMENTAL EPIDEMIOLOGY

The pursuit of global equity implies a substantial shift in the scope of the questions to be addressed in future

TABLE 1. The Eight Millennium Development Goals

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV and AIDS, malaria, and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

environmental epidemiologic research. In outline, the following challenges need to be considered:

1. Sustainability and equity have to become a core component of environmental epidemiologic research programs.^{7,8} Population health and equity are central to “sustainability” and vice versa.
2. Better integration of environmental health research for both more and less affluent populations is needed.
3. Recognition of the changing balance of local and global environmental hazards to health, especially in an era of a globalized economy with increasing scale of human activity and impact, is needed.⁹
4. Recognition of the diminishing returns of etiologic health research in isolation from other policy-relevant sectors (eg, urban planning, industry, agriculture, demography), each with its own determining influence on population health, also is needed.
5. Transdisciplinary approaches must be actively fostered to facilitate newer inter- and multidisciplinary modes of research¹⁰ that are required to address complex, interconnected, systems-based, environmental health topics of relevance to longer-term sustainability.
6. Capacity building and technology-transfer need to be explicitly addressed in research involving developing countries.

These 6 challenges underlie 2 key themes related to formulating a global agenda for environmental epidemiology research that emerged from the range of plenary presentations at ISEE 2005.

Beyond Traditional Environmental Epidemiology

A combination of interlinked factors has resulted in a paucity of research into causes of inequality, as well as a disproportionate focus of research on health problems in developed countries. Although this research has explored environmental health inequalities, such investigations are uncommon, largely confined to inequalities in developed countries.

This comparatively limited focus derives from the deeply entrenched inequalities that characterize our world. Overcoming these systemic inequalities remains a formidable challenge. The first step must be to recognize the impact of inequalities on sustainability and, consequently, on health and well-being. These limits apply not only to the scope of

environmental epidemiology, captured in the 10/90 gap where 90% of research funding is channeled into diseases affecting only 10% of the world's population,¹¹ but also derive from a lack of funding and the problems in sustaining genuinely multidisciplinary research.

As globalization proceeds, however, a contested global research agenda is emerging. Tentative steps are being taken to overcome the most egregious biases in funding and infrastructure, driven by the nascent realization by some that the most cost-effective approach to attaining sustainable population health requires a genuinely global dimension in health research. There is growing understanding that the health of affluent populations cannot be guaranteed if inequalities increase. As herd immunity protects unvaccinated individuals against communicable disease, so, too, sustainable global health is fostered by minimizing the exclusion of vulnerable groups. This calls for a truly large-scale effort to reduce poverty and ignorance, including more effective provision to poor populations of tools needed to advance their own health.

Although this broader agenda may superficially appear beyond the scope of environmental epidemiology, it is, in fact, close to the central message of the Development Goals. Therefore, we in environmental epidemiology are not alone. At the same time, because those goals are themselves in peril, we call for the environmental epidemiologic community to engage with and to support their attainment. For all their limitations, the Development Goals are *not* simply idealistic statements, but rather form a platform from which to advance sustainable global health.

What the Developing World Can Offer in Strengthened North–South Collaboration

Progress in fostering sustainable global health clearly requires partners between the research communities in the developing and developed worlds.¹² Synergisms arising from such alliances can stimulate environmental epidemiologic research. However, it is crucial to demonstrate that a wider environmental epidemiology agenda—one that includes developing-world interests—also can directly benefit populations and research communities in developed countries.

Recognizing the world as an interlinked community, we argue that harmful perturbations in one region can adversely affect other areas that are geographically remote, such as through the environmental carriage of pollutants, and even the spread of harmful policies, ideas, dogmas, and behaviors. Traditionally, societies have relied on walls and quarantine for protection from invaders and disease. The accumulation of greenhouse gases shows that this approach is failing, even for privileged populations.

For decades, the greenhouse gas, carbon dioxide (CO₂), has been disproportionately emitted by high-income populations. However, because CO₂ is distributed evenly within the atmosphere, this pollutant has been dumped in the atmosphere over the oceans and developing countries. But this “strategy” is faltering: global CO₂ will soon reach a level beyond which its harmful effects will negatively impact the affluent as well as the poor, such as from an increased frequency of severe storms.¹³

The study of these effects challenges conventional epidemiologic methods and concepts. Further, environmental variations in many developing countries in qualities such as population density, nutrition, and genetics,¹⁴ as well as in water, air, and soil, can create special vulnerabilities and exposures to both pollutants and protective factors. Some of these variations constitute natural experiments that could be ethically and cost-effectively researched to explicate dose-effect relationships. Of course, we recognize that such exposure-effect relationships require adjustment for their cultural and historical context, such as colonial exploitation and gender disparities.

Developing world countries contain much of the world's remaining biodiversity and comparatively intact ecosystems—important for air purification, climate stabilization, wild foods, and as-yet unknown pharmaceuticals.⁹ A rich—although diminishing—reservoir of indigenous knowledge persists in many developing countries. Such knowledge—more integrative and systems-based than the reductionist fundamental to most approaches in the industrialized world—could help catalyze a more sustainable society, if it could be coupled with fundamental changes to the culture and values of materially privileged populations.

Some forms of institutional governance in developing countries could be models for developed countries. For example, recent changes in constitutional governance in South Africa have incorporated innovative and substantive protections for the environment.¹⁵ These constitutional provisions find expression in a carefully constructed institutional framework for public participation in environmental decision-making. Although not yet operationalized in case law, the South African constitution has recognized the health needs of future generations and provides evidence that legislative frameworks can facilitate primordial prevention.¹⁶

Despite the fact that much-needed information about health effects resulting from environmental pollution exists in developed countries, the Precautionary Principle is heavily challenged there because of the influence of vested interests.^{17,18} This situation offers a potential contribution from strengthened North-South partnerships. Given different vested interests, implementing the Precautionary Principle in the developing world might well be more readily achievable. For instance, African countries' resistance to using genetically modified crops as part of U.S. aid illustrates the idea that precautionary decisions in the South could be supported by data from the North.

Some environmental health realities in the developing world provide valuable research opportunities but are underused because of human and technological limitations. Even when trained people are found, their research capacity may be restricted by their scientific milieu. Exceptionally, modern communication technologies (including by open-access journals) are fostering networks and overcoming distance.

A GLOBAL AGENDA FOR ENVIRONMENTAL EPIDEMIOLOGY

The rationale advanced in this article provides the nucleus for a new global agenda for environmental epidemi-

ology. Elements discussed during the ISEE 2005 conference include the following key points

The Need for "Systems Thinking"

Our scientific enquiry must embrace greater complexity, including long time scales, complex dynamics, and diverse causal pathways associated with disruptions in the natural systems underpinning health. The traditionally used, reductionist, linear approaches are inferior for understanding the interactive webs that are critical for sustainable development and for the health and well-being of future generations.

Enhancing Multi- and Interdisciplinary Approaches

Socioecological changes, already in motion, have potentially catastrophic implications for the health and well-being of populations on a grand scale.^{7,19} Multi- and interdisciplinary approaches, including collaboration by epidemiologists with ecologists, social and behavioral scientists, and human rights and law experts, are needed to recognize, prevent, and mitigate these effects on communities worldwide. In the best case, pursuit of the Development Goals will foster creative and rewarding interdisciplinary approaches, including interaction among the various specialties with whom environmental epidemiologists engage.

Surveillance and Monitoring

"Old" epidemics are re-emerging in new populations, whereas "new" epidemics from novel biologic and chemical hazards continue to arise. Both of these trends challenge existing surveillance methods, which must increasingly consider new population settings and exposures, and provide systems to assess routes of contamination.

In terms of infrastructure, mechanisms to coordinate reporting systems at different levels and tiers of government must be developed, incorporating eco-regional considerations with traditional geo-political boundaries.¹⁹ Also needed are integrated databases on environmental exposures, development hazards, and health effects.

Promote Partnerships With Organized Civil Society

To remain relevant and better equipped to engage policy makers, we call for greater co-operation with nongovernmental organizations and existing associations of complex systems scientists.

Environmental health scientists have a rich history of partnership with communities, especially in developed countries. Environmental epidemiologic research adds value to such partnerships, honing tools to measure influences amenable to public policy intervention.²⁰

Values, Ethics, and Philosophy

Epidemiologists need to be aware of the moral dimensions of their work. For example, Canada continues to export asbestos to many developing nations. Although legally permissible, this action is ethically unacceptable, not least because recipient countries largely lack the resources to eliminate personal asbestos exposure. Such double standards²¹

illustrate forms of institutionalized violence and eco-crimes against humanity.²²

Environmental justice^{23,24} and ethical considerations must be incorporated into our work and should underpin environmental epidemiologic research, guiding studies from problem identification and hypothesis formulation to conduct, analysis, reporting and dissemination.²⁵ Yet, many disadvantaged communities, especially in developing countries, lack the educational and political capacity for genuine participation. The active involvement of leaders of disadvantaged communities will sometimes facilitate research communication, including the dissemination of research findings.

Environmental epidemiologists also need to consider their individual roles, morally and ethically, in the business of “manufacturing doubt.” Exposed by Michaels in 2005,²⁶ this enterprise has been growing in the United States, working against the ability of regulatory control to protect public health interests over big business interests.

Given that human rights are essential for the new global health agenda, environmental epidemiology must tackle power structures that adversely affect environmental health. Avoidance of this focus is illustrated by the language surrounding health inequalities in the United States.²⁷ A discourse of “disparities” sanitizes and divorces inequities from their historical context, attenuating the recognition of the power inequalities at their root. To an ethically naive researcher, “disparities” suggest quasinatural events rather than manifestations of value failure and social injustice. Although the recognition of the historical and political dimension of inequity will not instantly remedy the situation, it is more likely to be part of a lasting benefit than superficial analyses alone.

A New Look at Generating and Translating Knowledge

What ways exist for creating new knowledge and for translating existing knowledge? For instance, when we think of capacity building and knowledge creation, North–South collaboration in epidemiology tends to be unidirectional in terms of topic selection, funding, and staff selection—a situation akin to “cultural imperialism.” What can we learn from case studies—in environmental epidemiology and elsewhere—reflecting more equal partnerships? How was this accomplished? What knowledge is valued, translated, and applied, and why?

Not to be forgotten is the need to value the wisdom of indigenous cultures and their ways of seeking consensus and action. Mainstreaming such methods could have profound impacts in cultures in which research and interventions have been “compartmentalized.”

Strengthening Intersectoral and Interagency Actions

Integration of the 3 pillars of sustainable development’s social, economic, and environmental goals will aid in aligning sectoral policies, which ought to include health. Foundational to this integration will be the strengthening of knowledge on health and environmental links.^{6,28} Consequent to these changes, environmental health services likely would require restructuring. This is also called for in the 2005 Paris

Declaration on Aid Effectiveness, essentially calling on partners in development to align with country-set priorities and harmonize work among agencies.²⁹

WHAT ROLE CAN ISEE PLAY TO ADVANCE THIS AGENDA?

We hope this initial thinking stimulates the debate needed to clarify the widening roles and responsibilities of environmental epidemiology to promote global health and development objectives. The World Health Organization (WHO) should, of course, lead this debate. However, ISEE can play a valuable role in stimulating the involvement of WHO, using its recently accorded status as a nongovernmental organization in official relations with the WHO. Other groups and epidemiologic subspecialties, as well as other disciplines, also may engage in support of this collaboration.

TABLE 2. Toward a Global Agenda for Research in Environmental Epidemiology: Action Points Emerging From the ISEE 2005 Annual Conference

Actions for the North	Actions for the South
Focus on more effective transfer of environmental epidemiology technology	Place environmental health and environmental epidemiology on the health, science, and technology agendas
Apply resources to environmental health problems of the South, as part of and in addition to those of interest to the North	Invoke human rights, social justice and global solidarity as complementary frameworks to the Millennium Development Goals, to justify strengthened collaboration with the North
Make more funding available for Northern researchers to work in the South	Research policy and priorities which ensure investments are consistent with national health and health research development
Increase funding allocations for North–South collaborations	A more precautionary approach based on knowledge and experience from the North
Strengthen North–South solidarity in the field of environmental epidemiology	Build on environmental health successes in the South, eg, Wangari Maathai ³⁰
Recognize the need for environmental justice in relation to the practice and impact of environmental epidemiology	Build national research systems that include environmental epidemiology, monitoring, and evaluation
Understand the role of vested interests in influencing research funding and agendas, and in the manufacture of doubt. Work to correct imbalances that serve to maintain disparities in health and well-being	
Require funding applications to advance environmental justice	
Work with related professions to develop inter- and transdisciplinary approaches for the study of complex problems; team with complex systems organizations	
Work with agencies to achieve greater flexibility in the provision of data, including on an ecoregional basis	
Strengthen knowledge of health and environment links (ie the influence of ecological disintegrity—population growth, affluence [ie, consumption and waste] and inappropriate uses of technology—on health and well-being)	
Integrate databases on environmental exposures, development hazards, and health effects	

In particular, specific representation from the South also should be sought. An effective way of moving forward the development of a global agenda for environmental epidemiology research would be the establishment of a working group to foster this project.

A well-articulated vision is urgently needed to enable us to focus actions for implementation, along with goals and indicators of progress. For this purpose, we frame a set of possible actions (Table 2)³⁰ and invite the broader membership of ISEE to respond with specific issues, concerns and suggestions. Indeed, we invite other subspecialty organizations of epidemiologists and related disciplines to engage with us in this endeavor.

ACKNOWLEDGMENTS

This work follows from the closing plenary session of the annual conference of the International Society for Environmental Epidemiology, held in Johannesburg, South Africa, September 13–16, 2005. CLS had been charged with the summation closing plenary lecture by the title of this work. Input to that lecture was provided by Tony Fletcher, Angela Mathee, Anthony J. McMichael, Yasmin von Schirnding, Kuku Voyi, and Daniel Wartenberg. The theme of the annual conference was “Sustaining World Health Through Environmental Epidemiology: setting a new global research agenda.” Anthony J. McMichael provided valuable feed back on an earlier draft of the manuscript.

REFERENCES

- Millennium Development Goals. Available at: <http://www.dfid.gov.uk/mdg/>. Accessed October 17, 2006.
- Chen S, Ravallion M. How have the world's poorest fared since the early 1980s? *World Bank Res Observer*. 2004;19:141–169.
- McMichael AJ, Butler CD. Climate change, health, and development goals: needs and dilemmas. *Lancet*. 2004;364:2004–2006.
- Attaran A. An immeasurable crisis? A criticism of the Millennium Development Goals and why they cannot be measured. *Public Library Sci Med*. 2004;2(10).
- Pogge T. The first United Nations Millennium Development Goal: a cause for celebration? *J Human Dev*. 2004;5:377–397.
- World Summit on Sustainable Development (WSSD) 2002. Available at: <http://www.un.org/events/wssd/>. Accessed October 17, 2006.
- Butler CD, Corvalán CF, Koren HS. Human health, well-being and global ecological scenarios. *Ecosystems*. 2005;8:153–162.
- Butler CD, McMichael AJ. Environmental Health. In: Sidel V, Levy B, eds. *Social Injustice and Public Health*. Oxford, UK: Oxford University Press; 2006:318–336.
- Corvalán C et al. Millennium ecosystem assessment. Chapter 16: Consequences and options for human health. In: Chopra K, Leemans R, Kumar P, et al, eds. *Ecosystems and Human Well-being*, Volume 3. Washington, DC: Island Press; 2005:65–84.
- Rosenfield PL. The potential of transdisciplinary research for sustaining and extending linkages between the health and social sciences. *Soc Sci Med*. 1992;35:1343–1357.
- Global Forum for Health Research: Helping Correct The 10/90 Gap. 10/90 Report on Health Research 2003–2004. Available at: http://www.globalforumhealth.org/Site/002_What%20we%20do/005_Publications/001_10%2090%20reports.php. Accessed October 17, 2006.
- Editorial. Bill Gates: a 21st century Robin Hood? *Lancet*. 2005;365:911–912.
- Kerr RA. A tempestuous birth for hurricane climatology. *Science*. 2006;312:351.
- Tishkoff SA, Virrilli BC. Patterns of human genetics diversity: implications for human evolutionary history and disease. *Annu Rev Genomics Hum Genet*. 2003;4:293–340.
- South African Constitution's Bill of Rights (1994). Available at: <http://www.polity.org.za/html/govdocs/constitution/saconst02.html?rebookmark=1#24>. Accessed October 17, 2006.
- Beaglehole R, Bonita R, Kjellström T. *Basic Epidemiology*. Geneva: World Health Organization; 1993.
- Harremoës P, Gee D, MacGarvin M, et al. *The Precautionary Principle in the 20th Century: Late Lessons from Early Warnings*. London: Earthscan; 2002;1–284.
- Soskolne CL. On the even greater need for precaution under global change. In: Grandjean P, Soffritti M, Minardi F, et al, eds. *The Precautionary Principle: Implications for Research and Prevention in Environmental and Occupational Health*. *European Journal of Oncology Ramazzini Foundation Library*. 2003;2:93–101.
- Soskolne CL, Broemling N. Eco-epidemiology: on the need to measure health effects from global change. *Global Change & Human Health*. 2002;3:58–66.
- Maselli D, Lys Jon-Andri, Schmid J. Improving impacts of research partnerships. *Swiss Commission for Research Partnerships with Developing Countries*. Berne, Switzerland: KFPE; 2004.
- Soskolne CL, Bates D. Edmonton Journal. April 26, 2006. Guest Column: Ideas. Canada's Double Standard on Asbestos. Page A17. Available at: <http://www.canada.com/edmontonjournal/news/ideas/story.html?id=c254a6d5-3bb8-4a1d-a7be-45c4d45a12c1>. Accessed October 17, 2006.
- Westra, L. *Ecoviolence and the Law: Supranational Normative Foundations of Ecocrime*. Ardsley Park, New York: Transnational Publishers, Inc.; 2004.
- Coughlin SS. Environmental justice: the role of epidemiology in protecting unempowered communities from environmental hazards. *Sci Total Environ*. 1996;184:67–76.
- Westra L. *Environmental Justice: The Rights of Unborn and Future Generations*. London: Earthscan Publications; 2006.
- Soskolne CL, Light A. Towards ethics guidelines for environmental epidemiologists. *Sci Total Environ*. 1996;184:137–147.
- Michaels D. Doubt is their product. *Sci Am*. 2005;96–101.
- Prüss-Üstün A, Corvalán C. Preventing disease through healthy environments: towards an estimate of the environmental burden of disease. *World Health Organization*. Available at: http://www.who.int/quantifying_chimpacts/publications/preventingdisease/en/index.html. Accessed October 17, 2006.
- Navarro V. The politics of health inequalities research in the United States. *Int J Health Services*. 2004;34:87–99.
- OECD (Organization for Economic Co-operation and Development). Available at: http://www.oecd.org/document/18/0,2340,en_2649_201185_35401554_1_1_1_1,00.html. Accessed October 17, 2006.
- Summary Biography of Professor Wangari Maathai. Available at: <http://www.greenbeltmovement.org/w.php?id=3>. Accessed October 17, 2006.