

## Ethical Issues in Environmental Health Research

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Environmental health research encompasses a wide range of investigational topics, study designs, and empirical methodologies. As that arm of public health research concerned with understanding the health effects of the many environments in which humans live and work, the field is intimately connected with social concerns about environmental quality and disparities of power and privilege that place differential burdens upon members of underserved communities. Environmental health researchers thus engage many ethical and social issues in the work they do. These issues relate to the choice of research topics to study, the methods employed to examine these topics, the communication of research findings to the public, and the involvement of scientific experts in the shaping of environmental policy and governmental regulation. These and other topics are reviewed in this article. These ethical, legal, and social issues are becoming increasingly more complex as new genetic and molecular techniques are used to study environmental toxicants and their potential influence on human and ecologic health. *Key words:* environmental health research, ethics, governmental regulation, justice, participatory research, public policy. *Environ Health Perspect* 111:1786–1788 (2003). doi:10.1289/ehp.6778 available via <http://dx.doi.org/> [Online 6 October 2003]

Environmental health research is that arm of public health concerned with understanding the health effects of the many environments in which humans live and work. It is a diverse field, encompassing a range of research methodologies and study designs. This spectrum of activities includes *a*) identification of ecologic hazards and environmental toxicants, *b*) assessment of biological mechanisms through which environmental toxicants affect human health, *c*) evaluation of interventions designed to mitigate harms associated with environmental hazards, and *d*) identification of susceptible populations at increased risk of developing occupational and environmental diseases.

Each of these basic spheres of environmental health research presents its own set of ethical, legal, and policy challenges, some of which are familiar to environmental health researchers; whereas others have received little attention (Coughlin and Beauchamp 1996; Lavery et al. 2003). In addition, as in other scientific fields, some of the perennial ethical and social challenges raised by environmental health research are being transformed by new molecular and genetic techniques that aid investigators in studying human and environmental health (Christiani et al. 2001). Several of these ethical, legal, and policy challenges are reviewed below.

### Identifying Environmental Toxicants

Identifying environmental toxicants is a normative enterprise on several levels (Vineis 1995). The decision to regard a particular substance as toxic, for example, carries moral force—environmental toxicants are harmful agents that should be avoided. Hence, the decision to regard a particular substance as a

toxicant requires that researchers reach some level of moral consensus regarding the level of risk that is sufficient to regard a substance in the environment as a potential threat to human and ecologic health (Vineis and Soskolne 1992). Similarly, after a decision has been made to regard a particular substance as an environmental toxicant, researchers knowledgeable about the presence of that agent in a specific environment must then consider how best to disclose this information to persons who may have been or continue to be exposed to that substance (Carpenter 1995; Schulte and Singal 1996). This can involve disclosures to individual research participants or disclosures to members of geographically defined communities in which an environmental toxicant has been identified (Deck and Kosatsky 1999). With all knowledge comes responsibility—in this case, the responsibility to develop effective strategies for communicating known health risks to persons who may be living in areas where an environmental toxicant is believed to be present.

In addition to issues surrounding the interpretation of research findings and their dissemination to members of lay communities, the identification of environmental toxicants often introduces questions of social justice (Bullard and Wright 1993). The selection of geographic localities to study, for example, has direct implications for the distribution of potential research benefits and burdens. Frequently, epidemiologists and other environmental health researchers interested in the identification of specific environmental toxicants face the challenge of how best to respond to local community concerns about a perceived hazard (Sexton et al. 1993). The choice to study a purported environmental hazard gives voice to those

persons concerned about what they see as a threat to their health. The decision to study this purported hazard legitimates (to varying degrees) the perspectives of those concerned (Brown 2003).

Moreover, where the presence of an environmental toxicant in a community is the direct result of existing disparities of power and privilege within the community, the choice to study an environmental hazard often cannot be separated from judgments about the moral propriety of existing social relationships in that community (Weed and Mink 2002). The choice to investigate whether a factory is polluting residential areas within a community, for instance, will inevitably affect ongoing social relationships between industry advocates, political officials, and various members of those communities (Wing 1998). Thus, how environmental health researchers respond to community concerns has a direct influence on the development of long-term relationships between scientists and the communities they purport to serve through their research.

Some investigators maintain that persons living in communities of interest to environmental health researchers should be actively involved in the design of studies aimed at identifying local environmental hazards (MacQueen et al. 2001). This commitment frequently is seen both as a way to empower members of lay communities and as a means to help increase the likelihood that the research conducted will be valued by members of those communities (Cornwall and Jewkes 1995; Strauss et al. 2001). However, whether or not environmental health researchers advocate such community-based participatory methods, it is clear that the decision to examine one locality and not another has normative significance. These decisions reflect moral judgments that the concerns of a particular group of individuals are significant enough to warrant further investigation (Wing 2003). Hence, an investigator's choice to study a particular locality or purported

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environmental hazard will serve the interests of some persons and not others. In that sense, environmental health research is an enterprise of immediate relevance to matters of social justice and fair distribution of potential research benefits and harms (Weed and McKeown 2003).

### Assessing Biological Mechanisms of Action

Assessing biological mechanisms through which environmental toxicants influence health outcomes raises other ethical, legal, and policy considerations. For example, many such studies involve the use of animal models—and animal research continues to be among the most socially contentious areas of scientific investigation (Loeb et al. 1989). Environmental health researchers working with animals are expected to conduct their studies in accordance with various federal, state, and institutional policies. In addition, there is a clear social expectation that researchers conducting animal experiments should be accountable to the lay public as well (Rollin 2003). Among these expectations, researchers using animal models should be able to provide a clear rationale for the specific animal model selected, the number of animals required to conduct their studies, the potential benefits that may result from the experiments proposed, and how animal pain and suffering will be minimized during the investigation.

In addition to this level of social accountability, toxicologists and other environmental health researchers relying on animal models also must struggle with the extent to which findings from animal studies can be extrapolated to assist in the evaluation of possible threats to human health. Conveying the limitations of animal-to-human extrapolations to the environmental policymakers, for example, falls clearly within the spectrum of social challenges facing environmental health researchers. In that capacity, environmental toxicologists and others involved in these activities can become acutely aware of the many political pressures and social agendas that combine to shape environmental policy and regulation. The professional challenge facing these researchers is to help environmental policymakers interpret the potential health implications of mechanistic data and epidemiologic findings. This includes an obligation to clarify how relevant scientific considerations may limit the use of this data for setting of environmental standards and development of new regulations.

In this regard, interpretative disputes concerning epidemiologic findings on health outcomes associated with cigarette smoking illustrate how scientific disputes about data quality often are difficult to disentangle from

the various social agendas and personal interests of research sponsors and investigators (Barnes and Bero 1997). Although not a new issue for environmental health researchers, how best to manage potential conflicts of interest, especially in the application of research findings to environmental regulation and policy setting, remains a pressing issue for professionals in the field (Weed 1994).

### Evaluating Environmental Interventions

The ultimate goal of environmental health research is to improve human and ecologic health. In pursuit of this goal, environmental health researchers often seek to evaluate the effectiveness of an interventional strategy designed to mitigate the harmful effects of an environmental toxicant. For example, researchers may be asked to assess the practicality of removing, or otherwise responding to, an environmental toxicant. Similarly, researchers may be asked to help evaluate the likely costs of eliminating a specific toxicant from a contaminated ecosystem or to develop new ways of limiting human exposure to that toxicant through the use of protective equipment.

These investigations raise a number of ethical and policy issues around the topic of who should be asked to bear the burdens of responding to an environmental hazard. The findings of environmental health studies might be used in support of increased industry regulations, for example, or calls for increased personal vigilance in the avoidance of environmental hazards. Although environmental policymakers and public consensus address these matters, the choices of environmental health researchers directly inform these discussions (Cairns 1999). As a result, researchers have tremendous power in shaping these discussions through the work they do and the types of results they produce. Environmental health research is thus intimately linked to policy decision making. A researcher's choices regarding areas of scientific investigation cannot be easily separated from the eventual use of research data by policymakers. Environmental health research both informs environmental policymaking and shapes the nature of those policy debates.

A good example of this is a researcher's choice regarding the study of specific environmental hazards. Living organisms can be exposed to harmful environmental conditions via many routes. Some environmental hazards are natural, whereas others are introduced. When environmental health researchers choose to examine hazards that are the result of human activities, their work will inevitably inform judgments about the ethical acceptability of the actions that produced those hazards (Coughlin 1996). These data can

support moral arguments condemning human actions resulting in the production or release of environmental toxicants; or alternatively, such data can be used to relieve moral responsibility by suggesting that the environmental hazard is not as significant as may have been thought prior to the research.

In addition to these considerations, there are additional questions surrounding the interpretation of uncertain results (Brandt-Rauf and Brandt-Rauf 1997). Frequently, assessments of environmental interventions produce ambiguous or inconclusive findings (because of the immense complexity of such assessments). How best to communicate these ambiguities to the public is a persistent challenge for environmental health researchers (Schulte et al. 1997). Policy decision makers are accustomed to acting in the face of such uncertainty, and broad policy guides such as the precautionary principle reflect their comfort with a certain level of ambiguity in the setting of environmental standards (Marchant 2003). Researchers, by contrast, may endorse a more reserved approach to the application of data to environmental policymaking. These different dispositions regarding epistemic matters can create circumstances where researchers and policymakers disagree about the need to continue gathering data on the effectiveness of an environmental intervention.

### Identifying Susceptible Subpopulations

It has been recognized for a long time that individuals do not bear the health burdens associated with environmental toxicants equally. For example, individuals are placed at increased risk during different phases of the life cycle. Young children, for instance, are known to be particularly susceptible to harmful neurologic effects associated with exposure to lead dust. Similarly, genetic differences appear to influence susceptibility to environmental toxicants. This later finding, along with the emergence of new molecular techniques for investigating genetic variation between individuals, is now allowing environmental health researchers to examine inherited susceptibilities more carefully.

Many environmental health researchers hope that new genetic technologies will permit identification of individuals and subpopulations at increased risk of developing environmentally associated illnesses (Burke et al. 2002; Henry et al. 2002). This capacity to identify susceptible subpopulations, should it become available, would introduce many new ethical and policy issues (Sharp and Barrett 2000). Environmental regulations have historically included safety factors to account for the uncertainties associated with differential susceptibilities to environmental toxicants. In the future, it may be possible to define exposure

standards in a manner that more accurately reflects the actual risks of susceptible subpopulations (Au et al. 2001).

As environmental health researchers begin to employ genetic techniques more frequently, this will also introduce difficult questions about how best to convey the potential risks and benefits associated with the identification of a genetic predisposition to environmental or occupational disease (Schulte et al. 1999; Vineis and Schulte 1995). Genetic analyses and the interpretive uncertainties that accompany their use in research contexts frequently present difficult practical issues for environmental health researchers committed to obtaining meaningful informed consent from research volunteers (Hainaut and Vahakangas 1999; Van Damme et al. 1995). For example, researchers often struggle with how best to describe the potential implications of genetic susceptibility testing for a research participant's future employment opportunities and insurance matters (Frank 2001). Although most researchers want to be complete and thorough in their disclosure of potential research risks, some of these less common harms that might occur in the distant future are difficult to present to prospective volunteers in a manner that does not significantly bias their decision making.

## Looking Ahead

The ethical, legal, and policy considerations described in this article are by no means exhaustive. Indeed, the scope of moral and social commitments environmental health researchers acknowledge is enormous, as are the many challenges facing individual investigators as they strive to define an appropriate balance among these normative commitments in the research they do (Callahan and Jennings 2002; Coughlin 2000; Kass 2001). This moral discourse is reflected in, and we hope furthered by, the articles in this mini-monograph.

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