



Next Steps After Rio +5: A Physician Briefing on Health and the Environment

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A deteriorating environment is increasingly seen as having health consequences that are incompletely understood. In July 1997 heads of state joined environmental ministers in New York to review progress toward environmental goals spelled out at the 1992 Earth Summit in Rio de Janeiro. Of major concern were climate change, loss of biodiversity, and persistent organic pollutants. Changes in environmental policy are urgently needed, but have not kept pace with scientific and medical findings. Finding solutions to the threats posed by environmental change is the major challenge of the next decade. [M&GS 1998;5:35-41]

Five years ago, in June of 1992, the United Nations held the historic UN Conference on Environment and Development (UNCED)—the Earth Summit—in Rio de Janeiro. Warnings about global warming, species loss, deforestation, and toxic pollution were addressed in the published report of that conference, Agenda 21, a 40-chapter plan of action for governments, nongovernmental organizations, and industry [1].

Many countries have finished or are in the process of preparing plans for sustainable development, some of which emphasize environmental protection and human health. But even the UN and the World Bank

acknowledge that concrete actions as a result of such plans have been limited. The UN Environment Program (UNEP) recently stated that “from a global perspective the environment has continued to degrade” [2]. The World Bank acknowledges that “funding for environmental programs remains inadequate” [3]. The World Health Organization concluded in 1997 that “poor environmental quality is responsible for around 25% of all preventable ill health in the world today” [4].

Environmental change has tremendous consequences for human health. Health is traditionally viewed as a state or property of an individual. Environmental causes of illness are acknowledged, but risk is assigned only to specific exposures. In the last half decade, McMichael and others have developed the notion of ecosystem health, recognizing that humans are participants in complex ecosystems and have the potential for health to the degree that entire ecosystems are functional [5].

An ecosystem health perspective stresses the health-related services that the natural

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environment provides (e.g., soil production, pollination, water filtration) and acknowledges the fundamental connection between an intact environment and human health. To survive, humans need clean air, unpolluted water, and adequate food. Our environment provides these goods and services [6]. Public health activities that have assured these conditions are responsible for the remarkable improvements in human health and longevity that much of the world's population has enjoyed in the last century [7].

In a powerful set of articles Vitausek, Lubchenko, Dobson, and others have documented human impact on the earth's atmosphere, geosphere, and biosphere—impacts with as yet poorly understood consequences [8]. But the limits to present understanding should not obscure the easily understood evidence that the environment is deteriorating. The reports of the Brundtland Commission, the Worldwatch Institute, the World Resources Institute, and the UN document the progressive nature of pollution, species loss, habitat destruction, and deforestation [9,10,11]. Developed countries have demonstrated some success with environmental protection and a few international regimes such as the Montreal Protocol, which limits chlorofluorocarbon emissions to protect stratospheric ozone, have been effective. But unless one is a seriously optimistic cornucopian, the global environmental prospect is gloomy.

Five Years After the Earth Summit: A Reality Check

The fifth anniversary of the Rio Earth Summit was an appropriate moment to



Industrial air pollution in some parts of the world has led to drastic measures to protect health, including the use of masks to filter out particulate matter.

assess progress in environmental protection [10]. In July 1997 heads of state joined environmental ministers in New York for the week long special session of the UN General Assembly (UNGASS) to review progress towards the Rio goals spelled out in Agenda 21. Two meetings held during the week of the special session focused specifically on the linkages between health and

the environment.

On Monday, June 23, the Mount Sinai School of Medicine and the North American Office of UNEP presented a day long expert conference entitled "Human Health and the Environment: Five Years After Rio." The conference examined both the improvements in scientific understanding of the health and environment connection in the last five years and progress on international agreements that address these issues.

On Tuesday, June 24, the World Health Organization sponsored an event called "Health and the Environment in Sustainable Development: Five Years After the Earth Summit" and announced publication of a WHO document with the same title [4]. Although the report is quite complete, its focus is on the "traditional" hazards of air and water quality, sanitation and infectious disease; its tone suggests that international agencies have things under control; and its warning about the scope of global environmental change is muted.

At both meetings experts elaborated on three dimensions of global change that have major implications for human health and for which international agreements or conventions are being developed: climate change, loss of biodiversity, and persistent organic pollutants. The speakers at these two meetings reviewed the research of the last five years, which has significantly advanced our understanding of these global environmental phenomena.

In a nutshell, global warming will likely bring weather extremes, new infectious illnesses, threats to food production, flooding, forced migration, and rises in sea level. Habitat destruction and species extinction threaten the loss of medical research materials, new medicines, and ecological services necessary for good health. Organic pollutants, particularly chlorinated hydrocarbons, may contribute to the rising incidence of many cancers and to developmental and reproductive disorders.

Climate Change

Climate change produced by the accumulation of greenhouse gases, primarily CO₂, seems increasingly certain. The recent second report of the Intergovernmental Panel on Climate Change (IPCC) concludes that human activities are changing the climate [12]. Global mean surface temperatures are up one degree F in the last century, consistent with simultaneous increases in atmospheric CO₂. The 1980s were the warmest decade on record. 1995 was the

warmest year since 1866 when modern recording began.

An important report by WHO and UNEP carefully reviews the likely health consequences of climate change [13]. Extreme weather consistent with global climate change, including record heat in India and Europe, the Mississippi flooding of the summer of 1992, and the five-day 1995 heat wave in the mid-West are consistent with global climate change models and greenhouse gas accumulation. The heat wave killed thousands of cattle, tens of thousand of chickens, and more than 500 hundred persons in Chicago. The worst hurricane season on record occurred in 1996. Yet at the IPCC Climate Change Conference in Berlin in November 1996, CO₂ emission reductions were opposed by the petroleum and other industries, but were strongly supported by the insurance industry. The insurance industry takes these changes very seriously [14].

Biodiversity Loss

We have seen overwhelming devastation of habitat and loss of species not just in the tropical rainforest but in our own backyard, with no clear understanding of what these losses might mean. Warming of the oceans off San Diego has produced in some areas an 80% reduction in zooplankton near the bottom of the ocean food chain [15]. The decline in populations of some amphibian species worldwide is believed to be due in part to an increase in ultraviolet B radiation caused by ozone depletion [16]. Amphibians are the top predators of invertebrates, including mosquitoes, in many ecosystems and the implications for human health may be enormous. A recent book, *Biodiversity and Human Health*, presents a good summary of the science [17].

Plants and animals have provided crucial information to medical science about human physiology and disease in the past and there is more to be learned. More than 50% of the most frequently prescribed drugs in the U.S. are derived from or are patterned after substances derived from bacteria, fungi, plants, or animals. As of today researchers have tested only 2% of known plant species for pharmacologic activity. Species loss limits the possibility of many groundbreaking future medical discoveries [18,19]. Citizens need to understand the significant connection between species loss and

human health. Several bills seeking to "reform" the Endangered Species Act, which protects species and their habitats, are being considered by the U.S. Congress.

Persistent Organic Pollutants

Chlorinated hydrocarbon chemicals produced in the plastics, paper, and pesticide industries have long been recognized as potentially dangerous to human health. These fat-soluble, toxic chemicals are not easily degraded, they persist for many years in the environment, they concentrate up the food chain, and they accumulate in animal and human tissues. Two developments have drawn renewed attention to the health risks of these persistent organic pollutants (POPs):

the identification of medical waste as a major source of toxic pollution and the new toxicology of endocrine disruption.

One particularly toxic POP is dioxin, a byproduct of industrial combustion processes such as waste incineration. Dioxin is released when chlorine-containing organic material is burned. In 1994 the U.S. Environmental Protection

Agency (EPA) issued its "Dioxin Reassessment," which identified emissions from medical waste incineration as the leading source of dioxin, accounting for more than 50 percent of all known atmosphere releases. Dioxin, distributed globally through the atmosphere, is ingested by humans from their food, particularly meat, and accumulates in human tissues where it remains for years. The Inuits of Arctic Canada, whose diet is rich in fish and fatty meat, have particularly high tissue dioxin levels. In 1997 the International Agency for Cancer Research declared dioxin a carcinogen. In addition dioxin has many toxic effects on reproduction, growth, and development. Health authorities agree that dioxin production and release, particularly from medical facilities, must be prevented [20].

Study of organic pollutants has resulted in the discovery of an extremely important new toxicological mechanism, endocrine disruption. Rachel Carson described, but did not name, this mechanism in her book *Silent Spring*, which alerted the world to the reproductive and developmental effects of pesticides on wildlife [21]. Endocrine disruptors are chemicals that, often at extremely small doses, imitate or block hormones, the chemi-

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Burning oil well in Kuwait in March 1991. The destruction during the Gulf war caused tremendous damage to the region's environment.

cal messengers that circulate in the blood and regulate many body functions. Endocrine-disrupting chemicals include many persistent organic pollutants.

These chemicals can produce a wide variety of toxic effects in wildlife, in laboratory animals, and in humans. The incidence of breast, prostate, and testicular cancer and male reproductive disorders, including undescended testicles, has increased in recent decades. Occupational exposures to some pesticides have caused reduced sperm counts and infertility in men. There is speculation that POPs may be associated with observed global declines in human sperm counts. The

children of women who have eaten food contaminated with polychlorinated biphenyls (PCBs) have impaired intelligence and nervous system function [20].

Many researchers increasingly place endocrine disruption of reproduction and development on a par with cancer as an outcome of exposure to POPs. Endocrine disruption is a newly appreciated phenomenon and the toxicology of these chemicals is not yet well developed [22]. But the science is developing rapidly and endocrine disruption is being taken seriously by governments and industry. The EPA has initiated the Endocrine Disruptor Screening and Tracking Advisory Committee (EDSTAC). Endocrine disruption science and policy have recently been reviewed by Schettler et al [23].

The scientific community is treating endocrine disruption by toxic pollutants as a potential global health threat. During an international workshop on endocrine disruptors sponsored by the Smithsonian Institution, UNEP, and the EPA and held in Washington, D.C. in January 1997, the establishment of a major new body analogous to the Intergovernmental Panel on Climate Change was proposed to monitor and recommend policy on endocrine disrupting chemicals.

Despite these studies—and despite all the warnings of the scientific community—we humans seem oblivious to these changes and to the environmental dangers we may face. We seem not to grasp the urgent need to reduce our production of greenhouse gases and to slow down the course of these

runaway experiments with the earth's ecosystems, the outcomes of which no one can fully predict. In many parts of the world, in fact, we seem to be turning away from energy conservation, from increased gasoline and energy taxes (racing, instead, to purchase more gas guzzling vans and sport utility vehicles), from habitat preservation, and from renewable energy sources. Rather than keep to 1990 levels as promised at the Rio Summit, the U.S. will have increased its energy use by 13% by the year 2000.

War and the Environment

A central link between health and the environment is war. The assurance of health promotion and environmental protection is clearly conditional on disarmament. The 20th century has been the bloodiest in human history, with an estimated 250 wars accounting for 110 million persons killed, a countless number wounded, and perhaps 550 million refugees [24]. Munitions, defoliants, and radiation—used as instruments of war—degrade the environment directly. War and preparation for war consume enormous amounts of resources that otherwise would be available for environmental protection and health promotion. We cannot hope to assure the health of the public or of the environment at present levels of military expenditure [24]. These issues were omitted from the UNGASS and other post-Rio assessments. Because of narrow missions and turf constraints, many health, development, and environmental agencies—UN and NGO alike—neglect both the centrality of militarism and the necessity of peace as a precondition of all other aspirations.

On the other side of the ledger, environmental problems such as scarcities of water, food, and other natural resources, are already causing conflicts in many parts of the world and those conflicts will only become exacerbated in the future, threatening social and political stability [25].

Science Backlash

There are strong voices, including those of a few scientists, who dismiss concerns about climate change, ozone depletion, population growth, pollution, and loss of biodiversity. Some are clearly expressing what they believe is reasonable scientific uncertainty. But many represent vested interests that are clearly trying to undermine the credibility to those who voice environmental concerns. These people, whose tactics of choice are obfuscation and name calling, are given equal time by the media as though they represented

valid opposing scientific viewpoints (which they do not), making it hard for an inexperienced public to know what and whom to believe [26].

Perhaps most important is the fact that many people still see themselves as separate from the environment, viewing it as something to be exploited for human consumption rather than as an integral basis of human life. The belief that we can change the chemistries of the atmosphere and the oceans, diminishing biodiversity in the process, without all these changes affecting the survivability of our own species, may be more dangerous than any technology we have yet invented.

Barriers to Action

Finding solutions to the threats posed by environmental change is the major challenge of the next decade. One of the barriers to progress is our failure to make the connections between environmental change and human health. For example, the 1992 UNCED conference in Rio—the most important international environmental meeting of the decade—did not deal with health. No health NGOs participated with the exception of three physicians from Physicians for Social Responsibility (PSR). An excellent WHO report, *Our Planet Our Health*, prepared in 1991 especially for UNCED, received almost no attention. Agenda 21, the final report of the conference, gave superficial attention to health issues.

The agencies in the U.S. responsible for environmental protection employ few health professionals. Of the 23,000 employees of the EPA, two or three are physicians. There is little support for training in research and environmental health. The National Institute for Environmental Health and Safety (NIEHS) for the last decade has had the smallest budget of the 23 institutes of the National Institutes of Health (NIH).

Medical schools do not recognize the importance of environmental health issues and medical students get an average 4-6 hours of training in these topics [27]. The Boston-based Center for Environmental Education in Medicine (CEEM), which maintains a database on the World Wide Web of curricular resources related to issues of the environment and health, is providing leadership in the U.S. for improvements in this area¹. In the recent debate over health care reform, environmental protection as a cost-effective form of preventive medicine was not addressed. In the current move to man-

1. The address for CEEM on the World Wide Web is www.ceem.org.

age care, environmental health is neglected.

A New Look at Policy Priorities

Three dimensions of global change have major implications for human health: global warming, loss of biodiversity, and persistent organic pollutants. The Framework Convention on Climate Change (FCCC), one of the international agreements signed at Rio, acknowledges that climate change is a serious problem, suggests that developed countries should take the lead, and proposes that compensation should be paid to developing countries for the additional costs of implementing the Convention. Under the provisions of the Convention, developed countries have committed themselves to return to 1990 emission levels of carbon dioxide (CO₂) by the year 2000. Few are likely to attain this target. Those that are on course are likely to reach the target as a result of policies they would have undertaken in any event, such as switching from coal to oil or closing inefficient industries (e.g., in East Germany). The UK has taken a strong line amongst industrial countries and is calling for a 20% reduction in CO₂ from 1990 levels by the year 2010. The U.S. government was unwilling to give a specific target at UNGASS but pledged one billion dollars over five years to help developing countries install energy efficient technology—a small sum in relation to the magnitude of the task.

Loss of biodiversity is likely to have a negative effect on health because habitat destruction and species extinction cause the loss of medical research materials and threaten ecosystems that underpin good health in many communities. Work on the Biodiversity Convention has been impeded by conflicts with the World Trade Organization rules, which promote free trade and economic growth without adequate regard for environmental protection [28].

A number of responses have been proposed at regional, national, and international levels to the risks posed by POPs. The International Joint Commission of the U.S. and Canada, responsible for the protection of the Great Lakes, has recommended the “virtual elimination” of chlorinated organic chemicals and “zero discharge” of these chemicals into that ecosystem. Efforts by UNEP to create an international regime for the control of POPs are in progress. In 1995 the UNEP governing council took a decision to work toward developing instruments to reduce and ultimately eliminate the manu-

A Parallel with Nuclear War

Why is political action on global environmental issues so limited and public concern so muted? The reasons may be similar to the way in which the public greeted the prospects of global nuclear war. In the early 1980s official U.S. government policy asserted that, if necessary, we would fight and win a nuclear war with the Soviet Union. This nuclear war fighting strategy included “plans” to protect our people by relocating them to the countryside where they would make shelters to defend themselves from nuclear attack. In retrospect these policies sound incredible. They were in fact widely challenged by many officials including some of the governments own scientists [31].

But how could people have gone along while knowing intuitively that these were absurd notions? There are features of the nuclear threat that have made it dif-

difficult to understand, even to this day.

Nuclear war was an abstraction, beyond people's imaginations, and therefore hard to believe as a reality.

The science was highly complex and technical, and difficult to understand. The prospect of nuclear war, with destruction and death on such a massive scale, was so terrifying to contemplate that people avoided thinking about it. Many of these same features characterize global environmental change—the scenarios involving climate change, sea level rise, and drought are too frightening—almost biblical in their proportions. The changes predicted are too abstract, outside of people's everyday experience, and the science is too technical and complicated. In addition, political leaders, in general, lack the scientific and public health knowledge that would allow them to understand the implications of global environmental changes and, therefore, they are often unaware of the dangers these

facture, sale, and use of twelve POPs previously identified by the Convention on Long-Range Transboundary Air Pollution. A North American coalition of environmental, health care, labor, agricultural, and community organizations in 1996 formed a campaign called Health Care Without Harm, the goals of which are to eliminate the nonessential incineration of medical waste and to phase out the medical use of mercury, polyvinylchloride plastic, and other toxic chemicals [29].

Five Years After Rio

Was the 1992 Earth Summit a success? If the objectives of the conference were to draw attention to environmental issues, to initiate major international conventions on the environment, and to stimulate the participation of nongovernmental organizations in environmental protection, then the answer may be a qualified yes. For example, more than 1,000 local authorities in 26 countries are developing plans to implement Agenda 21. In the UK 60% of the district councils are said to be implementing such plans. If success is to be measured in terms of concrete environmental outcomes, however, post-Rio progress leaves much to be desired.

Developments since Rio have done little to stem the tide of resource flows from poor to rich. For example, Agenda 21 sets a target for developed countries to transfer 0.7% of GNP in the form of aid to the poorest countries; but in the last five years the proportion of GNP as aid has dropped to an average 0.27% amongst the OECD countries. The financial mechanism to provide new resources that will help developing countries comply with the conventions on climate change and biodiversity (the Global Environmental Facility) has been heavily criticized and the resources that are available are insignificant compared with the scale required [30]. There is currently a lack of political will in some countries to make the reductions in greenhouse gases necessary to prevent substantial adverse effects on health and development.

The scene in the U.S. is particularly discouraging. The sober, at times apocalyptic, messages of scientists at the UN meeting were poorly covered by the U.S. press. President Clinton's assertion that "the science is clear and compelling: we humans are changing the global climate," was widely reported, but relegated to a sound bite. While President Clinton acknowledged in detail the "real and imminent" threat of

global warming to produce drought, floods, and the spread of infectious disease, he has refused to commit the U.S. to quantitative goals for CO₂ emission reduction by a certain date [20]. Mr. Clinton needs to follow the example of leaders in Great Britain, Germany, and France and offer environmentally sound energy policies. Instead, he is delaying hard choices by claiming he must first educate the American people and the Congress that global environmental change is real and dangerous. The medical, public health, and environmental communities must hold him to his word.

The Professional Response

For all these reasons health professional must become more actively involved in promoting the understanding of links between the environment and health and in urging governments and industry to place emphasis on the need to protect the environment. Organizations of health professionals, such as PSR in the U.S., Medical Action for Global Security (MEDACT) in the UK, and the International Society of Doctors for the Environment are campaigning on such issues and deserve widespread support.

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changes pose for human beings. Physicians and scientists served an important function by educating the public and political leaders about the medical consequences of nuclear war and they have a responsibility to do the same in the environmental arena.

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