REFLECTIONS

Ecological Change and the Future of the Human Species: Can Physicians Make a Difference?

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ABSTRACT

Global environmental change is occurring so rapidly that it is affecting the health and threatening the future of many of Earth's inhabitants, including human beings. Global warming; contamination of the air, water, and soil; and rampant deforestation have led to a collapse in biodiversity that threatens the integrity of the biophysical systems upon which all organisms depend.

A basic cause of environmental degradation is human overpopulation and the nonsustainable consumption of natural resources by the human community. Everything that we have accomplished in the fields of medicine and public health could be undermined if we do not pay attention to these rapid environmental changes. As healers, human beings, and members of the biological community, we need to broaden our perspective on health and disease. Unless we devote our attention to stabilizing and repairing the ecosystem, our professional and personal accomplishments as health professionals may be swept away.

Health care providers—particularly physicians—can play a role by adopting an ecosystem health perspective as we ply our trade. By helping people avoid unwanted pregnancies, by using resources parsimoniously, and by staying engaged in the natural world, we can help to prevent the collapse of the biological systems upon which we all depend.

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CASE REPORT

The patient is an elderly woman, beloved in her community, who comes to your office with a list of serious problems. She has night sweats and fevers that have been getting worse for the last few years. She has difficulty breathing and on examination seems to have suffered from aspiration pneumonia. She has alopecia, having lost her hair in a patchy distribution. Her normal gastrointestinal flora has been invaded by a few noxious species, and she has persistent diarrhea. Her skin is marked by an extensive dermatitis: it is fissured, inflamed, gouged, scraped, denuded, and cracking in many places. These excoriations are caused by a small but extremely industrious organism whose numbers have grown exponentially during the last few years, displacing and even eliminating other organisms that used to be widely distributed on the skin of our patient (Figure 1).

Differential Diagnosis: Global Environmental Change

The patient, of course, is Earth. Each symptom reflects one of a series of environmental perturbations that are threatening the homeostasis of the marvelous planet we call home.[1] It is useful to consider each of these symptoms individually and to examine the way they interact to spawn a

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Figure 1. Patient Earth.

Source: Earth taken from Apollo 13, April 14, 1970. Available at: http://nssdc.gsfc.nasa.gov/imgcat/html/object_page/113_h_60_8588.html.

disease complex that demands our urgent attention as physicians, humans, and members of a biological community.

Night Sweats and Fevers: Global Warming

Human production of greenhouse gases—in particular carbon dioxide, methane, and the chlorofluorocarbons—has led to increases in Earth's surface temperature.[2] Global warming is a reality, and the inevitable rise in carbon dioxide alone will lead to further increases in mean global temperature of 2°F to 10°F this century. The problem is even more acute in the growing number of mega-cities in which the human population increasingly clusters.[3] These population centers become heat islands that are 7°F to 10°F hotter than the surrounding countryside.

The consequences of global warming will have profound effects on Earth and its inhabitants. Rising sea levels will cause flooding of low-lying islands and coastal communities.[4] Heat itself causes devastating heat waves. The 2003 summer heat wave in France killed 10 times more people than died from severe acute respiratory syndrome (SARS) worldwide between 2002 and 2004.[5,6] This climate change is very likely to increase the range of insect vectors that carry a number of virulent diseases, including malaria, dengue fever, West Nile virus, and encephalitis.[7]

The greatest culprit is the burning of fossil fuels to run our cars, factories, and the air conditioners with which we attempt to survive the heat waves that cause these global night sweats. As the developing world strives to match the lifestyles of the Western world, the problem will accelerate.

Respiratory Distress: Poor Air Quality

We take air for granted—usually. Breathe in, breathe out, thousands of times a day, millions of times in a lifetime. But breathing can be misery, and for growing numbers of people, respiration is a constant grim challenge.

Asthma is among the most common afflictions, and both the prevalence and the severity of this disease are increasing. Despite the development of powerful new treatments for asthma, wheezing kids fill our urban emergency departments. Epidemics of asthma sweep through urban communities with the rapidity and morbidity of influenza, but immunizations cannot protect the vulnerable.[9]

Although we do not fully understand all the elements of the respiratory disease epidemic that has swept the world during the last few decades, one factor is contaminated air.[7] The Clean Air Act of 1970 led to some improvements in air quality in the United States, but progress has not been uniform, and the administration of George W. Bush has attempted to weaken existing environmental protections.[9] Global warming exacerbates the impact of air pollution; ozone levels rise in tandem with air temperature, and ozone is one of the more virulent causes of air pollution.[7,8]

As we spew pollutants into the great common air sheds upon which we depend, everybody inhales equal opportunity toxins. Deteriorating air is further paralleled in polluted water, another rate-limiting substance upon which not only humans, but all species, depend.

Alopecia: Deforestation

Our patient's alopecia is mirrored in the deforestation of our globe. In the Amazon, forests are burned to allow crops to be planted, even though the thin soil is depleted after one or two crop rotations. In Nepal and Central America, growing rural populations walk farther each day from their villages to cut firewood from the dwindling forests. In Africa, drought and global warming feed the expanding deserts. In the 1990s alone, human activities led to the loss of more than 500,000 square miles of forests.[10]

The story of Easter Island illustrates how much our well-being is tied to the trees that support our world in more than a metaphoric way. Polynesians colonized the island in the fifth century, attracted in part by existing forests that seemed to offer an inexhaustible supply of wood to build houses, sea-going canoes, and the log rollers that allowed them to construct the fantastic stone monuments for which the island is famous.[11] The entire civilization collapsed several generations later largely because the trees were harvested unsustain-

ably, leading to mass famine when the Easter islanders could not replace the canoes upon which their fishery depended.[12] The Polynesians who cut the trees did not imagine the catastrophic consequences of deforestation for their once-thriving civilization. Can we?

Diarrhea: Loss of Biodiversity

Just as our gastrointestinal tracts need a spectrum of normal bacteria for healthy functioning, our globe benefits from the amazing diversity of life. Evolution is beginning to run in reverse. Species that inhabited Earth long before humans emerged are being eradicated by mass extinctions.[13] As we crowd out other species by our manipulation of the globe, we are impoverished by the loss of species that provide us with food, oxygen, medicine, and aesthetic enjoyment.

Species extinction is invisible to most of us. The planetary system seems so robust that it seems unlikely that we could be threatened by the loss of a few bugs or birds that few of us have heard of. The whole intricate complex is quite fragile, however, and our genomic sciences are no substitute for the immense archive of DNA that is the legacy of billions of years of evolution. Which is the keystone species whose loss will lead to the collapse of the whole edifice?

Dermatitis: Overpopulation

The world's population has grown from fewer than a 100 million people 3,000 years ago to 6.3 billion people today, with two thirds of the increase in the last 50 years.[10] By the year 2050 the world population is projected to range from 7.4 billion to 10.6 billion people.[14] The rapid growth in human population, and the increased resource consumption generated both by the sheer number of humans and the rapid pace of development has transformed Earth and altered the basic geochemical cycles upon which life depends.[15]

Although it may seem demeaning to think of the human species as a form of lice, our collective impact on the surface of the globe is even greater than that of scabies on the skin of our hapless patient. The human population has not only affected Earth's crust and the thin organic layer that covers it, but human activities have also depleted and polluted ground water, altered the chemistry of the atmosphere, and changed the genetic composition of much of the plant life growing on the planet.[16,17] The population burden of humans affects our own species as well as those with whom we share the globe.

Overpopulation not only drives environmental degradation but can contribute to poverty, social polarization, and large-scale human migration. Stabilization of Earth's human population is an important first step in any attempt to restore equilibrium to our natural and social processes.

THE MEDICAL RESPONSE: WHAT CAN WE DO?

As Paul Ehrlich has pointed out, the human species is superb at countering acute crises and dismal at addressing slow-moving threats.[18] We have mobilized a rapid and effective global response to the threats represented by bioterrorism and SARS, but we seem paralyzed in the face of the much slower collapse of the ecosystem on which all depend.

Despair is unacceptable—the situation is much too serious for acquiescence. There are some concrete steps that we as citizens and health professionals can take.[19]

Expand Your Perspective

Just as we have gone beyond the purely biological in medicine to incorporate both the psychological and the social, so can we realize that there is an ecological dimension to much of what we do. We are related to all the other species carrying shards of billion-year-old DNA in their cells, and we share a common existence and a common fate. By increasing our awareness of the connectedness of all living organisms, we can use our talents as healers to restore the vitality of the web of life.

Help Prevent Unwanted Pregnancies

Probably the most important thing we can do as a physician is to help people control their own fertility. The most logical place to begin for those of us in family medicine would be in the area of family planning, an area in which we already have the clinical responsibility and the requisite skills. One of the most effective ways to stabilize population levels is to prevent unintended pregnancy.

A distressingly large proportion of pregnancies are unplanned and unwanted, often disrupting and impoverishing the families where they occur. Simply by reducing the number of unintended pregnancies, we could achieve a dramatic reduction in the overall birth rate, a reduction that if replicated worldwide could have a marked impact on the rate of population rise. Even though much of the problem lies outside the industrialized world, the United States has a disproportionate effect on the policies of other countries.

Encourage Sustainable Economies

We can use our influence to shape the economic activities of our own community, and change our own behavior to set an example. Economic development is critical to the social well-being of a community, but not if it destroys the resources on which it depends.[20]

Stay Engaged With the Natural World

Life is not a pixilated image on a shimmering screen. We must immerse ourselves in the exhilarating sym-

phony of the natural world—cherish and preserve the beauty that remains, work to repair the damage done by others, and walk gently on this Earth.

The doctor is sanctioned by society as a healer and, as such, has the opportunity to influence the conditions that promote or undermine good health. This position of privilege also carries the responsibility to use our talents and energy, not only to mend the ills of our individual patients, but to improve the milieu in which they live. It is time to acknowledge the enormous ecological issues that affect the very substrate of life itself but that lie outside the traditional boundaries of our profession. The practice of medicine cannot proceed in a vacuum, insulated from the catastrophic changes in the ecosystem upon which life depends. We have the ability to repair much of the harm we have done. Now we need the will.

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References

1. McMichael AJ. Global environmental change and human population health: a conceptual and scientific challenge for epidemiology. *Int J Epidemiol.* 1998;221:1-8.
2. Intergovernmental Panel on Climate Change. *Third Assessment Report, Vol. 1*. Cambridge: Cambridge University Press; 2001.
3. National Research Council. *Our Common Journey: A Transition Towards Sustainability.* Washington, DC: National Academy Press; 1999.
4. Tibbets J. Coastal cities: living on the edge. *Environ Health Perspect.* 2002;20:674-681.
5. Leicester J. France says 11,435 people died in heat wave. *The Detroit News*. August 30, 2004.
6. Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003. WHO, Communicable Disease Surveillance and Response, 2004.
7. Haines A, Patz JA. Health effects of climate change. *JAMA*. 2004;291:99-103.
8. Thurston GD, Ito K. Epidemiological studies of acute ozone exposure and mortality. *J Expo Ann Environ Epidemiol*. 2001;11:286-294.
9. Paralysis on clean air [editorial]. *New York Time*s, January 4, 2004:6.
10. De Souza R, Williams JS, Meyerson FAB. Critical links: population, health and the environment. *Pop Bull*. 2003;58:1-44.
11. Chu EW, Karr JR. Environmental impact, concept and measurement. In: *Encyclopedia of Biodiversity, Volume 2*. Washington, DC: Academic Press; 2001.
12. Rees W. Revisiting carrying capacity: area-based indicators of sustainability. *Popul Environ.* 1996;17:195-215.
13. Wilson EO. *The Future of Life.* London: Little, Brown; 2002.
14. *United Nations (UN) Population Division, World Population Prospects: The 2002 Revision*. New York, NY: United Nations; 2003.
15. McMichael AJ, Powles JW. Human numbers, environment, sustainability, and health. *BMJ*. 1999;319:977-980.
16. Ehrlich PR, Ehrlich AH, Daily GC. Food security: population and environment. *Pop Devel Rev.* 1993;19:1-31.
17. Moomaw WR, Tullis MD. Population, affluence or technology? An empirical look at carbon dioxide production. In: Baudot B, Moomaw WR, eds. *People and Their Planet, Searching for Balance.* New York, NY: Palgrave Macmillan; 1999.
18. Ehrlich PR, Ehrlich AH. *Healing the Planet*. New York, NY: Addison-Wesley Publishing Company; 1991.
19. Gruen RL, Pearson SD, Brennan TA. Physician-citizens – public roles and professional obligations. *JAMA*. 2004; 294:94-98.
20. Madden CW. Health care policy, economics, and ecological health. *Illahee.* 1994; 10:114-118.