by Carolyn Raffensperger*

The precautionary principle states that if it is within our power, we have an ethical imperative to prevent rather than merely to treat disease, even in the face of scientific uncertainty. In this paper, I present an overview of what we know about changing patterns of disease, which provides an argument for implementing the precautionary principle, particularly concerning children's environmentally related developmental disabilities. These statistics are an indicator of the suffering of the world. Healthcare practitioners have an opportunity to use the precautionary principle both to bear witness to suffering and to alleviate suffering.

Status of Environmental Health

Where are we now? Some would argue that the precautionary principle is unnecessary because in northern countries, high life expectancy and decreasing child mortality indicate that human health is improving. However, new patterns of human disease are emerging that suggest a crucial connection between an increasingly degraded world and declining human health.

In the past, infectious disease, not chronic disease, was the significant issue in medical care. Infectious disease is still a pressing problem, particularly in southern countries. AIDS, cholera, dengue fever, and malaria continue to plague large populations of people. Some infectious diseases are of our own making. For instance, antibiotic resistance, including multidrug-resistant tuberculosis, is increasingly common.[1] Some antibiotic resistance may be associated with overuse by physicians. Some also may be related to the extensive use of antibiotics in industrial agricultural animal production. Other infectious diseases, such as West Nile virus, are occurring over a wider geographic area than in the past as a result of global climate change, global trade, and increased travel. The diseases are being homogenized and widely dispersed.

A key health pattern emerging in the United States and other western countries is the increase in chronic diseases, such as hypertension, heart disease, cancer, immune dysfunction, reproductive disorders, and increases in birth defects.

Dr. Ted Schettler has compiled a short list of the chronic problems that can have an environmental cause[2]:

** Asthma prevalence and severity is sharply increasing throughout the world and is often of epidemic proportions.

** Depression and other mental health disorders are becoming new public health threats in many parts of the world, with profound consequences for individuals, families, and communities.

** Nearly 12 million children in the U.S. (17%) suffer from one or more developmental disabilities. Learning disabilities alone affect 5-10% of children in public schools, and these numbers are increasing. Attention deficit hyperactivity disorder affects at least 3-6% of all school children, and the numbers may be considerably higher. The incidence of autism is increasing.

** The age-adjusted incidence of melanoma, lung cancer in women, non-Hodgkins lymphoma, and cancers of the prostate, liver, testis, thyroid, kidney, breast, brain, esophagus, and bladder has increased over the past 25 years.

** In the U.S., the incidence of some birth defects, including hypospadias, cryptorchidism, some forms of congenital heart disease, and obstructive disorders of the urinary tract is increasing.

** Sperm density is declining in some parts of the U.S. and elsewhere in the world.

Societal Consequences of Developmental Disabilities

Some of these problems, such as cancer, depression, and diabetes, disproportionately affect children. In a statement drafted at an international conference on the environment and children's health,[3] the signatories said that a quarter of the global burden of disease can be attributed to environmental factors. But more than 40% of environmental diseases affect children under the age of 5 years, even though that age group comprises only 10% of the world's population.

Of the many environmental health problems, developmental and neurobehavioral disabilities merit special attention because they have exceptional consequences in society. For instance, according to the 2000 United States census, special-education enrollment rose twice as fast as overall school enrollment in the past decade. In addition, a growing number of children receive federal Social Security payments because they suffer from serious disabilities.[4] In a study published in 2002, financial costs were calculated for lead poisoning, asthma, cancer, and developmental disabilities in U.S. children[5]:

[T]otal annual costs are estimated to be $54.9 billion (range $48.8-64.8 billion): $43.4 billion for lead poisoning, $2.0 billion for asthma, $0.3 billion for childhood cancer, and $9.2 billion for neurobehavioral disorders. This sum amounts to 2.8 percent of total U.S. health care costs. This estimate is likely low because it considers only four categories of illness, incorporates conservative assumptions, ignores costs of pain and suffering, and does not include late complications for which etiologic associations are poorly quantified. The costs of pediatric environmental disease are high, in contrast with the limited resources directed to research, tracking, and prevention.

Children with developmental and neurobehavioral disabilities are more likely than children without disabilities to end up in prison as they mature and become less likely to function well in the outside world. A legal memorandum examined the implications of the Americans With Disabilities Act[6]:

"[A]bout one third of prisoners are unable to perform such simple job-related tasks as locating an intersection on a street map, or identifying and entering basic information on an application. Another one third are unable to perform slightly more difficult tasks such as writing an explanation of a billing error or entering information on an automobile maintenance form. Only about one in twenty can do things
such as use a schedule to determine which bus to take. Young prisoners with disabilities are among the least likely to have the skills they need to hold a job."

A Utah survey[7] found that approximately 24% of male inmates had classic clinical attention-deficit/hyperactivity disorder (ADHD). According to a physician within the Utah system,[7]

[O]ther studies and our own experience have led us to believe that upwards of 40% of our residents in a medium security prison have findings along the Tourette/Add spectrum. If you separate out the nonviolent, impulsive criminals (my basic, charming and even lovable car thieves and traffic offenders), the percentage is much greater.

The Evidence

The evidence that environmental health problems have environmental causes is growing. Landrigan and others[5] calculated that the fraction of disease attributable to environmental factors was 100% for lead poisoning, 30% for asthma, 5% for cancer, and 10% for neurobehavioral disorders. This suggests that those diseases often may be preventable.

Of course, the link connecting a specific cancer or neurobehavioral problem to a specific exposure is notoriously difficult to establish. Yet we know that chemicals such as neurotoxicants are present in the environment in significant quantities and in all media—air, water, and soil. A great deal is known about lead in paint, mercury in tuna, dioxins in incinerated plastics, and various neurotoxicants in pesticides. Much of this information, found in the Toxic Release Inventory, which documents the amounts of some toxic substances released into the environment annually, gives a sense of the sheer volume of neurotoxicants (or carcinogens, mutagens, and teratogens) in the environment. For instance, more than a billion pounds of neurotoxicants are deposited in the air and water or on land every year. Is it surprising that with every breath, every drink, and every bite that human health is being diminished?

Of course, some of these environmentally linked disorders, such as cancer or birth defects, have a genetic influence, and some of the increase may be the result of better detection. But the authors of the book In Harm's Way say,[8,9]

"We are now certain that complex interactions among genetic and environmental factors play extremely important roles. It is no longer in keeping with the state of scientific understanding to attribute the bulk of these developmental disabilities to genetic inheritance. Rather we now understand the outcomes are the result of interacting factors, among which are exposures to environmental contaminants that are preventable."

Every one of these preventable illnesses represents the suffering of children and their families.

The Precautionary Principle

The precautionary principle states that it is an ethical imperative to prevent harms such as developmental disabilities if it is within our power to do so. The principle is of German origin. "Precautionary" is a rough translation of a word that literally means "forecaring," caring for a difficult future. As codified in several treaties, including the Biosafety Protocol and the Treaty on Persistent Organic Pollutants, the precautionary principle always contains 3 elements: scientific uncertainty, the plausibility of harm, and precautionary action.

All 3 of these elements are in the Wingspread[10] definition of the precautionary principle, which states: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically."

The Wingspread statement on the precautionary principle was written by an international group of academics, scientists, and environmentalists in 1998 as an implementation process for the principle that explores those 3 elements of uncertainty, harm, and action.

There are 4 implementation steps in the Wingspread statement:

First, people have a duty to take anticipatory action to prevent harm. That is, action must be taken before the harm occurs.

Second, the burden of proof for a new technology, process, activity, or chemical lies with the proponents, not with the public. There are some technologies or activities where the proponent has more information -- or should have more information -- about the potential harms, as well as the uncertainties, and so has a greater obligation to prevent damage. Such technologies include pharmaceuticals, nanotechnology, chemicals, and biotechnology. Mechanisms such as performance bonds posted before a technology is released onto the market ensure that the polluter pays for damage rather than externalizing the cost of the damage.

The notion that the burden of proof rests with the proponents provides a real impetus for proponents to think carefully about proposed activities before they undertake something hazardous. Is this activity necessary? Are there other ways to accomplish the same ends?

Third, implementing the precautionary principle requires examining "a full range of alternatives"[10] before starting a new activity, whether it is using a new chemical or a new technology. If this activity is potentially harmful, it is necessary to ask if there are other options that are less destructive.

Fourth, decisions applying the precautionary principle must be "open, informed, and democratic"[10] and "must include affected parties."[10] The precautionary principle requires democratic participation because when we make decisions that are unresolvable with science, these decisions, by their very nature, involve ethics and politics. Also, by involving affected parties, we are more likely to get better science and a better array of options.

Implications of the Principle for Healthcare Practitioners

The precautionary principle provides an impetus not only to bear witness to suffering but to help alleviate suffering. Healthcare practitioners have a special role in implementing the precautionary principle and improving the lives of individuals and their communities. Possibilities abound in both patient care and policy.

Environmental health is a rapidly developing field, with new information appearing almost daily about the connections between human activities and environmental
health effects. A handful of books provides basic information about endocrine disruptors, reproductive toxicants, and neurotoxicants,\[8,9\] as well as the role of biodiversity in human health.[11] The journal Environmental Health Perspectives, published by the National Institute of Environmental Health, is a good source of up-to-date research.

**Patient Care**

Greater Boston Physicians for Social Responsibility has created an environmental health medical history form that can be used to evaluate the environmental component of a patient's health and disease. It is useful as a beginning guide to thinking about people within their environmental context.

Where does the patient live vis-a-vis a local incinerator? In his or her neighborhood, are there enough female plants co-planted with male plants to attract the pollen and thereby reduce allergies? How good is the air quality?

Frijtof Capra has said that mapping relationships, not measuring things, is the ecological future.\[12\] It is also the precautionary future, because mapping helps us to understand connections even when those connections are not certain or quantifiable. A wonderful example of mapping environmental health occurred in 1854 during the cholera outbreak in London. A local physician, John Snow, didn't fully understand the cause of cholera in London, but he began mapping the outbreaks of disease and traced them to a single water pump.\[13\] Snow had the foresight to take the handle off the pump so that no one else would catch cholera from the contaminated water.

Fully understanding the environmental context of a patient or client helps the practitioner prevent disease and promote health just as John Snow was able to do by taking the handle off that water pump. [To be continued.]

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