

Clinical medicine, public health, ecological health: making decisions in the face of uncertainty

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Food Med 2005

I was asked to address the evidentiary basis for making decisions in the face of uncertainty. The question is whether or not there are, or should be, different standards for clinical medicine and public health.

I am going to frame those questions in a somewhat larger way before trying to answer them.

SLIDE

	Clinical medicine	Public health	Ecological health
focus	individual, family	+community, population	+ecosystem
scale (time, space)	Small, lifetime+	→	+large; evolutionary time
ethics	individual rights, duties, responsibilities	+public good; communitarianism; +responsibility	+responsibility; other species; systems
education	biomedical, more emphasis on cure than prevention	+sociology, epidemiology, cultural anthropology, economics	+ecology, evolutionary biology
evidentiary basis for intervention	clinical trials, controlled	inc. complex epidemiologic studies	+added complexity, uncertainty

At the risk of oversimplification, and without wanting to put too fine a point on some of the details, it's probably worthwhile to think across a spectrum of clinical medicine, public health, and ecological health with respect to focus, scale, ethics, education, and the nature of the science, before answering the question, "what do we do?". The disciplinary categories are somewhat artificial but do, I think, serve a useful purpose for today's discussions. Moreover, they also unfortunately represent disciplinary "silos" which social and educational institutions tend to maintain and in which many of us spend entire careers.

The differences in focus and scale are in many ways self-evident, although there is considerable overlap across the categories. I won't spend a lot of time on these. Clinical medicine focuses primarily on the individual patient, public health on communities, and ecological health on those plus entire ecosystems. Relevant time frames in clinical medicine are usually single lifetimes or perhaps two generations while public health and ecological health gaze further into the future, as well as into the past, ultimately reaching even evolutionary time scales.

I also want to mention differences in the ethical framework across these categories. But first, a few comments on "why".

There is no doubt that scientific understanding, new and improved treatments for disease based on new technologies, and public health interventions during the 20th century lengthened human life and dramatically reduced human morbidity and mortality from many diseases. These advances, along with other technological achievements during the same time frame, did not, however, benefit all species and ecological systems. Just looking close to home, medical technologies and medical care consume large amounts of natural resources, produce a large and toxic waste stream, consume electricity second only to manufacturing in the US, and pollute the air, water, sediments, and soils with mercury, dioxin, toxic flame retardants, pesticides, and a variety of pharmaceuticals.

And, while providing the US population with a relatively inexpensive and abundant food supply, agricultural practices widely adopted during the 20th century have changed the nutritive value of food, severely degraded the environment with loss of topsoil, soil fertility, and biodiversity as well as surface and groundwater pollution and directly led to socioeconomic distress in rural areas of the country. Evolution of the current food production and delivery system, dominated by vertically integrated corporate agribusinesses, large commodity markets in corn, soybeans, and wheat, industrial scale beef, pork, and poultry production, dependence on fossil fuels for food production and transportation have resulted in dramatic changes in the human diet over the past 50-75 years. Changes in food production systems have fundamentally altered the nature of what we eat.

And while progress in the treatment or elimination of some diseases has been dramatic, new patterns of human disease have also emerged from the mix of new technologies and social practices, including increases in asthma, learning disabilities, autism, chronic degenerative diseases, some malignancies, infertility, obesity, and so on.

More recently, there is general agreement that the public health infrastructure has deteriorated in the US and is in a very rudimentary state in many parts of the world.

Life as we know it depends on ecological systems that have been severely degraded over the past century. Worldwide, soil, water, and air quality, fisheries, forests, pollinators, wetlands, coral reefs, and biological diversity are under severe stress, in some cases beyond the tipping point of no return.

Ecological medicine is an attempt to address these realities by integrating clinical medicine with public and ecosystem health. But of course, beyond scope and scale, ecological medicine raises new questions about ethics, education, scientific understanding, and tensions inherent in any ecological framework.

An ecology of ethics as part of the story:

As we move from clinical medicine to public health to ecological health, we move through an expansion of constituencies, an expansion of ethical considerations; a growth of ethical complexity.

Medical practitioners advocate for individual people. That's what we are supposed to do.

Public health practitioners advocate for the public—for communities and populations of people—drawing in social, environmental, economic factors as they directly impact the health of humans.

Ecological medicine advocates for ecological health and includes, but does not focus primarily on, the health of humans, to the exclusion of other species and ecosystems.

Conventional medical practice:

In conventional medical practice, ethical concerns are largely centered on the rights of individuals and the obligation of practitioners to provide competent care with compassion.

The Principles of Medical Ethics of the American Medical Association focus on individual patient rights—right to competent care and respect, right to know, right to choice. The physician is charged to be competent, to obey the law and to regard responsibility to the patient as paramount. The physician is to seek changes in legal requirements that are contrary to the best interest of the patient. (note the duty to respond to LEGAL requirements). The physician is also advised to contribute to the improvement of the community and the

betterment of public health. But, the principles explicitly state that, while caring for a patient, the individual patient is of paramount concern.

Public Health:

Public health ethics engage the tension within what is best for individuals and what is best for communities and populations of people.

A number of ethical traditions are relevant to public health, including communitarianism, civil liberties, human rights, social justice, and environmental justice, among others. From the communitarian perspective, public health ethics are based on the recognition that individual liberty and indeed human existence relies heavily upon the interdependent and overlapping communities to which all of us belong (families; neighbourhoods; workplace, religious and other social groups).

The exclusive pursuit of private interest erodes the network of social environments on which we all depend. The ability of an individual to be autonomous depends upon the active maintenance of the institutions of civil society where citizens learn respect for others as well as self-respect. Community flourishing is dependent on individual contributions to shared projects.

The relationship of private and public interest is manifest by a mixture of complimentary and reciprocal rights and duties. A spirit of solidarity gives voice and support for community members who are less well off. The fundamental idea of the commons finds expression.

Here tensions begin to arise between individual and public interests. Arguments of social justice run into the realities of disagreement about the rights of individuals or limited social resources. There may be conflicting views about what is in a child's best interest or whether or not the interests of future generations should even be considered.

In practice, public health policies reveal more than one of these tensions.

The code of ethics of the APHA:

Principles of the Ethical Practice of Public Health

1) Public health should address principally the fundamental causes of disease and requirements for health, aiming to prevent adverse health outcomes.

2) Public health should achieve community health in a way that respects the rights of individuals in the community.

3) Public health policies, programs, and priorities should be developed and evaluated through processes that ensure an opportunity for input from community members.

The principles then go on to address empowerment of disenfranchised PEOPLE—providing information, respect for diverse values, beliefs, and cultures, and confidentiality and professional competence.

One principle begins hesitantly to address an even larger framework:

9) Public health programs and policies should be implemented in a manner that most enhances the physical and social environment.

And among the values underlying the code you find:

“People and their physical environment are interdependent. People depend upon the resources of their natural and constructed environments for life itself. A damaged or unbalanced natural environment, and a constructed environment of poor design or in poor condition, will have an adverse effect on the health of people.

Conversely, people can have a profound effect on their natural environment through consumption of resources and generation of waste.”

Ecological Medicine:

Ecological medicine extends beyond humans to include other species and ecological systems more generally.

Ecological medicine focuses even more on relationships and encounters more fundamental ethical tensions.

Here we are concerned about our relationships not only with each other, but with other species, the land, water, atmosphere, forests, soil, and the like. A human rights perspective suddenly seems narrow. Some people make efforts to extend a rights-based approach to other species and ecosystems. But a rights-based approach is one of contracts and negotiations. Historically, it is based on reason. Organisms and systems that can't speak the language of rights don't get to sit at the negotiating table.

Ecological Ethics

Recognition of the need for an environmental or ecological ethic is not new. In 1949 Aldo Leopold wrote:

“An ethic, ecologically is a limitation on freedom of action in the struggle for existence. First, ethics dealt with the relation between individuals. . .later . . . with the relation between individual and society. The extension of

ethics to land is. . an evolutionary possibility and an ecological necessity. All ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts. . A person's instincts prompt him to compete for a place in the community, but his ethics prompt him to cooperate (perhaps in order that there may be a place to compete for)... The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land.”

Now the ethical tensions become even more pronounced. This is not just about competing interests of individual people and human communities. Now the framework has expanded to include all communities and the physical basis of the earth. The struggle is over differing points of view. Humans are no longer at the center of the ethical universe. This is hotly contested ground.

In the 16th century Copernicus proved that the earth is neither the center of the universe nor even the center of the solar system, though his findings were not published until the year he died. In his wake, Galileo did not fare well when he strengthened Copernican science. He was put under house arrest for the rest of his life. Some ideas die hard.

What are some of the underlying principles, values, and tasks of ecological medicine:

First is the need to recognize that individual components of an ecological system and the system as a whole co-exist in a dialectic relationship. The whole is contingent upon and reciprocates with its components and with the greater whole of which it is a part.

Whole and parts co-evolve. Cause becomes effect and effect becomes cause. The properties of parts come into existence in the context of a whole. Even human rights, based on the inherent worth and dignity of individuals, exist within a complex set of relationships. In fact, it is precisely this set of relationships that defines the individual. Without relationship, individuals do not exist.

Individual people exist only in relationship within larger communities of people, fungi, bacteria, plants, animals, forests, rivers, farms, and cities, among others. A limited view of the individual standing alone does not account for a much richer and more complex set of relationships that not only prop us up but actually define us.

Ecological medicine rests on an ethical framework of tensions inherent in an expanded perspective.

Reconciliation of these tensions may not be plausible or even desirable. Tensions give the ecological system shape and help to create the conditions for system-wide health or disease. Too much force in one direction, however, breaks the tensions of current system dynamics. Resilience and adaptability are lost. This can be

disastrous to current system conditions and lead to a new dynamic that has its own inherent stability from which there is no return. If your family's welfare is dependent on current system conditions, you change them at your peril.

Ecological medicine recognizes the dialectical relationships inherent in ecosystems. It does not depend solely on human health concerns as the basis for forming relationships within a larger ecological perspective. Ecological medicine puts human rights in a broader perspective. Human rights are, of course, important, but ecological medicine returns to the original meaning of "bioethics", a term coined first by oncologist, cellular biologist, and inter-disciplinarian Van Rensselaer Potter.

Van Potter saw "bioethics" as a concept that could provide a science for survival and aid in securing lives of quality. For him, bioethics was based on the notion of "biological wisdom". Potter traced this term back to Scottish geneticist, C.D. Waddington, although surely "biological wisdom" directed the activities of many early human communities. Waddington argued that "what is demanded of each generation is a theory of ethics which is neither mere rationalization of existing prejudices, nor a philosophical discourse so abstract as to be irrelevant to the practical problems with which mankind is faced at that time." Waddington thought that biological wisdom would help us to judge between different ethical rules in the context of current circumstances.

Bioethics has become largely limited to the narrower field of medical ethics, usually focusing on the rights and responsibilities of individuals. Autonomy, not community and relationship, has taken over discourse in bioethics.

Philosopher Herschel Elliott noted that "an acceptable system of ethics is contingent on its ability to preserve the ecosystems that sustain it." Bioethics has a responsibility to life-supporting systems—not just patient rights or human rights. Good public health and ecological health are essential to bioethics.

In their book, The Ethics of Environmentally Responsible Health Care, Pierce and Jameton argue that philosophies are available to save bioethics, but only by re-thinking the roles and meaning of beneficence, biocentrism, ecocentrism, autonomy, coercion, justice, and modesty.

Kinds and qualities of evidence—decision-making and uncertainty:

With the preceding, I am suggesting that we should look beyond familiar disciplinary boundaries as we apply our particular gifts and skills in the settings where we live and work. In clinical medicine, this can be a challenge.

The development of medical specialties, pharmaceuticals, diagnostics, therapeutic medical and surgical interventions, evidence-based practice standards, medical education and peer review requirements, basic biomedical research, controlled clinical trials and epidemiologic studies have all contributed to major medical advances. This entire enterprise is subject to rigorous standards of evidence and proof related to claims of what we know, how we know it, and what we should do.

Clinicians feel most comfortable with what they have been trained to do and have experience doing. These bear directly on patient safety. Interventions and recommendations should have proven efficacy and should be appropriate for a given clinical setting. Applied correctly, they are based on solid evidence derived from research and clinical practice. Even so, some uncertainty about diagnosis or response to therapy is not uncommon although mechanisms and practices are available to reduce uncertainty and monitor responses in order to minimize unintended consequences of interventions.

In the realm of public health, however, where complex communities are the focus, more variables involved in complex interconnected systems make it more difficult to study, understand, and predict the impacts of changes in single variables or interventions. Evidence comparable to that from controlled, double blind clinical trials is rarely available. Confounders and effect modifiers make epidemiologic studies difficult to design, carry out, and interpret. Heterogeneity within populations limits the utility of models.

This complexity becomes even more pronounced when addressing entire ecological systems, including their human and non-human members. The field of ecology deals with uncertainties and methodological challenges that are far greater and more difficult to resolve than those in clinical medicine or public health. Understanding is facilitated to some degree by statistical tools designed for complex, adaptive systems and interventions based on adaptive management techniques that are designed on a scale that is safe-to-fail and monitored carefully for impacts. Even so, evidence that meets the standards required for interventions in clinical medicine is hard to come by.

So, what are we to do? If it is true that the health of individuals, communities, and entire ecological systems fundamentally inter-penetrate and are inter-dependent—and it seems clear that it is true—then we must become more comfortable advocating for some interventions based on standards of evidence that do not meet the requirements of clinical medicine. To do nothing, while waiting for evidence or “proof” to evolve is to advocate for the status quo, even though we may be disturbed by certain trends in human or ecological health that we can easily see.

The precautionary principle is an overarching guide to decision making that says: When there are credible threats of harm to human health or the environment, precautionary action should be taken, even if some cause and effect relationships are not fully understood scientifically.

The need for the precautionary principle is based on the realization that, in complex systems, uncertainty is often difficult to resolve and at some point, indeterminacy and even ignorance become prominent. Yet, if we want to reverse certain trends, maintain resilient, adaptive, healthy systems, or provide for the needs of future generations, we will often need to act on evidence that is less developed than what we require for interventions in clinical medicine.

Putting this in the context of today's topic, we know enough now to realize that our current food production and delivery system, as well as dietary habits, are not optimal for maximizing individual, public, or environmental health. We may not understand all of the mechanisms by which today's diet contributes to sub-optimal health and disease—and to environmental degradation—but we know that it does. We know that our diet interacts with the presence or absence of smoking, exercise, exposure to toxic chemicals, stress, and poverty as it contributes to health outcomes.

Here are just a few examples of features of our current food system that bear directly on human health:

- Many people's diets are calorie rich and nutrient poor. Obesity has become a major public health concern. Although obesity is no doubt a multi-factorial problem, increased caloric intake contributes in several ways. Some people do not have ready access to nutritious food and have limited choices.
- Iron deficiency affects about 10% of toddlers in the US and up to 30% of toddlers living in poverty. Iron deficiency facilitates lead absorption from the GI tract. Iron deficiency and lead exposure alone, and in combination, cause cognitive deficits in children. Attempts to address one without the other are not successful.
- It is estimated that approximately 30% of women of reproductive age are zinc deficient. Zinc deficiency is associated with birth defects in numerous animal studies and in limited epidemiologic studies in humans. Zinc deficiency also increases the risk of birth defects after exposure to teratogenic agents, including some pharmaceuticals.
- The meat of beef raised primarily on corn and other calorie dense foods intended to shorten the time to market has a significantly higher omega 6:3 fatty acid ratio than grass fed beef. In fact, the omega 6:3 fatty acid ratio in the typical US diet can be as high as 20:1 whereas 50 years ago, it was approximately 5:1. Animal studies show that a diet high in omega 6 fatty acids during pregnancy alters brain

development. It also alters tissue differentiation in the breasts of female offspring, making them more susceptible to breast carcinogens in adulthood.

- Organic arsenic is intentionally used as a growth promoter in industrial poultry production systems. Some of the arsenic is retained in the meat and converted to more toxic inorganic forms, adding to the total arsenic intake of consumers. It is estimated that this source alone can contribute up to 65% of the “safe” arsenic intake in regular chicken consumers. Some areas have naturally elevated arsenic levels in drinking water. Arsenic in chicken manure migrates to groundwater. Rice grown in the US has elevated levels of arsenic when compared to foreign-grown rice because of the historic use of arsenicals as pesticides. The soil is contaminated. Aggregate exposures matter. Arsenic is a carcinogen and neurodevelopmental toxicant.

These are just a few examples of direct impacts. Large industrial agricultural systems also consume large amounts of fossil fuels, contribute significantly to air and water pollution, loss of biodiversity, antibiotic resistance through the routine use of antibiotics as growth promoters, and the like.

In his recent study of historical social collapses, Jared Diamond identifies several kinds of failure that set the stage for collapse:

Failure to anticipate problems; failure to perceive problems; failure to act; and failure of an action to solve a problem. Diamond argues that important components of resilience are not only adaptability, but also a willingness to engage in long term planning and openness to reconsider core values.

It seems to me that medical professionals and institutions have a particular obligation to address those system-wide factors that directly and indirectly affect the health of people and the ecological systems on which people's health depends. Few factors are as important in this regard as what we eat and how we produce that food. This then circles back to an ethical imperative to act based on the best available evidence, no matter how complete or incomplete it may be.

In 1965, Bradford Hill, who is responsible for the Hill criteria commonly used for asserting causality in modern epidemiology, said: "All scientific work is incomplete-whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action it appears to demand at a given time."

With this in mind, I hope that medical practitioners and others in medical institutions will do several things:

- incorporate biological wisdom, ecology, and evolutionary biology into their decision making;
- return to bioethics its original meaning;
- Meaningfully involve all stakeholders in decision making.
- Act on the best available evidence when problems are perceived. Use interventions appropriate for scale, uncertainty, and stakes.
- look and learn beyond disciplinary silos; and
- be willing to advocate for systemic change that will contribute more fully to the health of this and future generations.

Returning to medical ethics as articulated by the American Medical Association, recall that “the physician is to seek changes in legal requirements that are contrary to the best interest of the patient.” Why shouldn’t we add something about a requirement to respond when ecological changes are contrary to the best interest of the patient?