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The evolution of health as an ecological concept

Hein Mallee

There is considerable controversy over how to define the concept of health, but the realization that it carries a positive connotation beyond the absence of disease has gained ground. Increasingly, 'health' is used as a metaphor to refer to a desirable, 'sustainable' state of ecosystems and this broad conceptualization has given rise to a several vibrant fields of research and action. This article reviews some of the literature that reflects the historical development of this 'ecological' health concept, in particular highlighting contributions from the humanities and social sciences where applicable.

Address
Research Institute for Humanity and Nature, Kyoto, Japan

Corresponding author: Mallee, Hein (hmallee@chikyu.ac.jp)

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Introduction

The word 'health' has etymological roots of wholeness and completeness, first and foremost applied to human wellbeing, but it is also often used as a metaphor, as in 'the health of the economy.' This article reviews how traditional ideas about health as balance with nature waned and waxed over the course of the 20th century and how the concept of health increasingly was employed to articulate concerns with ecosystem degradation. Not only did health become a criterion of sustainability, but also it became a lens for gaining ecological insight [1]. A secondary aim is to illustrate the growing contribution of the social sciences and the humanities to discussions of health and ecosystems.

Concepts of health

Perhaps reflecting an intuitive sense of health as the fundamental underlying base for daily functioning and wellbeing, unnoticed until it falters, the concept of health has eluded firm definition and is often referred to in terms of its opposites: disease, illness and sickness. The question how health (and in particular disease) can best be understood has been the subject of considerable debate involving medical scientists, philosophers, historians and sociologists. One view is that health is the absence of disease, which moves the debate to what constitutes disease. Here, a 'naturalist' position sees disease as a deviation from a normal state, often affecting functionality in some way. The biostatistical theory proposed in the 1970s by Christopher Boorse [2] is the most influential articulation of the naturalist position and is still subject to heated debate. The naturalist stance has wide support in medicine and philosophy [3•], but has been criticized by sociologists and historians of medicine who maintain that 'health' and 'disease' are socially constructed concepts [3•,4]: 'To provide a history of medical concepts is automatically to raise questions about the ontological character of disease states; to indicate that any phenomenon has a history is to imply a relativistic view of reality' [5]. Without questioning the biological base for health and disease, sociologists argue that all knowledge, medical included, is socially constructed [6]. The concept of normality that underlies the naturalist conception depends on the state of knowledge at the time and defining a normal range is to some degree arbitrary and normative [7•]. A further limitation of health as merely the absence disease is that, intuitively, health is commonly also understood as something positive [6,7•,8,3•,9]. Health is 'more desired than understood' [4] and it is an 'elusive as well as motivating idea' [10]. Therefore, a more holistic approach that accounts for the idea of positive health and wellbeing is called for [6]. The often-quoted definition adopted by the WHO in 1948 of health as a state of complete physical, mental and social wellbeing is an example of such a holistic and positive conception of health. It perhaps reflects the optimism and commitment to social improvement of the times but has also often been criticized as too broad and impractical.

Underlying the debate around the concept of health was a broader critique of the 'biomedical model' that formed the mainstream of Western medicine during much of the 20th century. The sociology of health and disease in part developed in reaction to the predominance of biomedicine [6]. As the discoveries of Pasteur and Koch revealed the role of bacteria and their pathways of transmission in the causation of disease in the 19th century, germ theory began to gain prominence and fundamentally changed the way disease was conceptualized. Once germ theory allowed the identification of specific pathological entities, biomedicine began to see diseases as universal categories

with specific etiologies. In medical practice, attention moved away from the patient as an individual and from the social and natural environment to specific pathogens and pathologies [6,7•]. In reaction to this, sociologists and humanities scholars argued for the importance of the patient as a whole, of the subjective experience of illness, and of the embeddedness of biological processes in social contexts.

Changing understandings of health and the environment

Like other ancient cultures, the Greeks understood the human body in terms of its relation to the environment and the spiritual: disease was seen as a condition of imbalance rather than as a specific pathological entity [4,5]. In the form of theories of humors and miasma, such thinking continued to shape Western understandings of health until the advent of germ theory.

Looking back from a 21st century perspective, we can perceive a movement away from conceptions of health as balance with the environment, to the modern biomedical model focused on disease as caused by specific pathogens, and more recently again toward more ecological understandings of health. This is brilliantly illustrated in a case study of the Californian Central Valley from the late 18th century to the present, in which historian Linda Nash traces evolving American understandings of health and environment [11••]. She distinguishes between an 'ecological' conception of the body, one where a person's body is in harmony with the wider world, and a 'modern' conception, in which health is a quality of an individual body. Into the early 20th century, while contagion was recognized, the local environment was always regarded as critical to health or illness. With the ascendance of germ theory, 'the healthy body was no longer a body in equilibrium with its environment, a 'body in balance,' but a pure body, one that was free from germs and parasites.' After World War II, the modern conception of the body as separate from the environment was challenged by new types of disease, in the agricultural Central Valley in particular by pesticide poisoning. The effects of pesticides did not only depend on their chemical properties, but also on a host of environmental factors, so that toxicity was 'a complex relationship between a chemical and the environment in which it was applied.'

As the 20th century progressed, it became clear that industrialization, urbanization and other forms of human interference with ecosystems were taking a toll on human health—by exposure to pesticides, radioactivity, air and water pollution and also by creating situations where people were more vulnerable to infectious diseases. Such issues spurred the development of the field of environmental health, which tended to focus on quantifying exposure–response relationships for toxins encountered in the human-dominated environment [12]. Other researchers began to explore the relationship between health and environment in a wider sense.

Ecosystem health

In the latter part of the 20th century, researchers concerned with the threats to the sustainability of ecosystems, turned to a medical metaphor derived from Aldo Leopold's idea of 'land health' [9,13•], with at its core a naturalist conception of health: 'An ecological system is healthy [. . .] if it is stable and sustainable—that is, if it is active and maintains its organization and autonomy over time and is resilient to stress' [14]. However, being concerned with ecosystem management and policy, the ecosystem health perspective also incorporates normative (ethical) dimensions. Management goals need to be based on values [15] and ecosystem health was primarily conceived as a policy concept [14]. The definition of health as overall functioning gives the ecosystem health approach a holistic, systems perspective, that explores how human health and ecosystem are linked and that argues that 'environmental problems at local, regional, and global levels are reflections of a global ecosystem distress syndrome' [16•]. While the medical analogy, where ecosystem stress and degradation can be diagnosed, prevented and rehabilitated, appears to focus narrowly on 'disease,' this is accompanied by efforts to conceptualize ecosystem health in a positive sense in terms of natural vigor, resilience, and organization [13•]. Moreover, the use of the health metaphor stimulates consideration of the relationship of human health to ecosystem health [16•,17]. The work on ecosystem health was foundational to approaches such as ecohealth (see below), conservation medicine [18] and can also be seen as one of the sources of inspiration for the Millennium Ecosystem Assessment, which elaborated the relationships of ecosystems with human health as mediated by ecosystem services [19,20,13•]. The influence of ecosystem health thinking, combined with the ecosystems services approach, is continuing to be reflected in recent work on, for example, indices to measure the health of oceans [21].

Ecohealth

In the early 2000s, several research communities came together under the banner of 'Ecohealth' and established the interdisciplinary journal *EcoHealth* and the International Association for Ecology and Health. An important conceptual foundation was the ecosystem health perspective, but this confluence also included [22,23] conservation medicine [18], research on global change and health [24], and ecosystems approaches to human health [25,26••,27]. The broad conceptualization underlying Ecohealth is that the health of humans, wildlife, and ecosystems are inherently interdependent. Described in the opening editorial of *EcoHealth* as 'those exploring the perspectives, theories, and methodologies emerging at the interface between ecological and health sciences' [22], this is a diverse, even heterogeneous, community.

An important connecting element, however, is a commitment to transdisciplinarity, combining research and practice in contributing to equitable solutions in the context of a quest for sustainability [22,23,26••,27,28]. Ecohealth research addresses a wide range of issues and, where the focus is on infectious diseases, there is considerable overlap with the One Health approach (discussed below). However, a large body of Ecohealth research is concerned with non-communicable diseases and health issues, including pollution relating to mining and agrochemicals, diet and nutrition [27], the relation of wellbeing to place, and so on.

Emerging infectious diseases and One Health

At the high tide of modern medicine, there was a pervasive confidence that the threat of infectious diseases was about to be overcome. The HIV/AIDS epidemic demonstrated the fallacy of this position and, in the 21st century, the SARS epidemic and outbreaks of avian influenza H5N1 led to the recognition of the (re-) emergence of infectious diseases (EIDs) and potential pandemics as a matter of international concern [29,30]. The powerful EID narrative pervaded media accounts and writings for the general public (*e.g.*, [31–34]). It also facilitated a movement that became known as 'One Health.' The concept of One Health is traced to the idea of 'one medicine' developed by Calvin Schwabe in the 1970s that the health of humans and animals are fundamentally connected and united [35]. Conceptually, 'one medicine' evolved toward 'One Health' by the incorporation of contemporary thinking on health and ecosystems [36] and the consideration of the social and ecological determinants of human and animal health [37]. The primary preoccupation of the One Health movement is with zoonotic EIDs and responses to them, which require coordinated, multidisciplinary and cross-sectoral approaches [38] as exemplified at the global level by the tripartite partnership among the WHO, FAO and OiE.[1] The conceptual framework of One Health, however, has broadened beyond human–animal–pathogen interactions to integrate the environment and there is now considerable overlap (and collaboration) with Ecohealth [37,39,40]. Social scientists have pointed out some weaknesses in the One Health approach, in particular that the global approach needs to be localized and contextualized to bring out issues of equity, access and rights ('Whose world, whose health') [41,also 42].

The field of EIDs is one where social scientists and humanities scholars have been very active. At the core of much of this literature is the analysis of the narratives surrounding EIDS, of 'epidemics and plagues as *ideas*,' how these are constructed and have developed historically, how certain explanations come to dominate researchers' positions, and how they frame the issues and promote particular goals and values [43–48]. In the age of EIDs, the scientific certainty of modern medicine has given way to a fundamental biological and situational uncertainty [49], upsetting assumptions of known risks [46]. The impact of EID countermeasures on local people's livelihoods in the developing world is also highlighted [41,50].

Planetary health

In some ways, the extension of health concepts to the environment finds its culmination in the idea of Planetary Health. In 2014, Horton *et al.* issued a manifesto calling for a social movement to address the unsustainable system humanity has created [51]. It describes Planetary Health as "an attitude towards life and a philosophy for living. It emphasizes people, not diseases, and equity, not the creation of unjust societies." The Rockefeller Foundation–Lancet Commission on Planetary Health in its report in 2016 expanded on this [52]. Building on the concepts of the Anthropocene [53], planetary boundaries [54] and the great acceleration [55], and noting that health has generally improved despite environmental degradation, it connects human health and wellbeing with the growing threats to the earth system. Perhaps echoing the ambition of the WHO definition of health almost 70 years earlier, it defines Planetary Health as 'the achievement of the highest attainable standard of health, wellbeing, and equity worldwide through judicious attention to the human systems—political, economic, and social—that shape the future of humanity and the Earth's natural systems that define the safe environmental limits within which humanity can flourish. Put simply, planetary health is the health of human civilisation and the state of the natural systems on which it depends.'

Conclusion

Historically, conceptions of health have evolved around ideas of wholeness and balance, both internally and with the environment. This understanding of health as connected to the environment faded into the background during the heydays of modern medicine, with germ theory providing a framework that focuses on specific diseases rather than the patient and their environment. In the second half of the twentieth century, sociologists and public health researchers documented the social embeddedness of health and environmental threats like pesticides, air and water pollution and the emergence of new infectious diseases helped the environmental conception of health regain prominence. Moreover, increasingly were health metaphors beginning to be used to articulate concerns about the degradation of ecosystems and eventually about the human impact on the earth system.

The development of interdisciplinary understanding of health and ecosystems involved the intertwining of

[1] See www.fao.org/ag/againfo/home/en/news_archive/AGA_in_action/2013_Tripartite_partnership_at_the_human-animal-ecosystem_interface.html.

medicine and ecology (and, recently, environmental and earth science). It also involved a growing engagement with the social sciences and humanities. The sociology and anthropology of health and of the environment are now well-established fields. Medical or health humanities are beginning to gain recognition as well [4,56], and calls for taking social science and the humanities serious in discussions of the Anthropocene are being voiced [57–59]. The sustainability of human civilizations in the Anthropocene requires a powerful interdisciplinary imagination and organizing some of our thinking about the future around health-inspired ideas can continue to help realize new conceptual connections.

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