HEALTH

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Contents

Summary

Health is defined by its physical (physiological), mental (emotional), and social characteristics. Many of these characteristics can be assessed objectively in individuals and in populations, but there is no single linear measurement scale. Health is a multidimensional quality, and is always partly subjective—an individual's own perception of health status is as relevant as a physician's diagnosis. Human health is interdependent with the health of other living things that share the ecosystem; and the ecosystem is influenced beneficially and adversely by human activities. Humans are an integral part of the biosphere, and human health and well-being cannot be dissociated from ecosystem health. By all objective measures, individual and population health improved at an unprecedented rate throughout the twentieth century because of improved economic, social, educational, and cultural conditions, and advances in medical and public health sciences. Theories about the reasons for good health and causes of disease recognize many physical, biological, and behavioral (including social and cultural) determinants of health. Ultimately human values may be the most important determinant of health, mediated by their influence on both individual and collective behavior.

Indicators of population health include conventional vital statistics, of which life expectancy is the most widely used and best understood; refinements used by the World Health Organization include adjustment of life expectancy for disabilities. Death rates, especially infant mortality rates, and common causes of death such as heart disease, stroke, and cancer are also widely used indicators. Additional useful health indicators include statistics on notifiable diseases, sickness absence from work or school, and records of spells in hospital. Health indicators reveal large and increasing disparities in levels of health between those who are well educated and economically well-off, and those who are not. There are even greater disparities between the industrially developed and the poorest developing nations. In most of the world, health indicators show progressive improvement throughout the past 50 years, but eastern Europe and the former Soviet Union, and sub-Saharan Africa, do not show these trends.

Individual and population health are promoted, protected, preserved, and restored by personal and public health services, which are provided by a mixture of private and publicly funded agencies.

Early in the twenty-first century, the prospects for the future of human health are mostly favorable, but newly emerged and identified pathogenic organisms, e.g. HIV/AIDS, pose serious dangers to health. Moreover, the integrity of life-supporting ecosystems is endangered by global climate change, and this will be an important future determinant of human health.

1. Introduction

This article describes and defines health and its components and determinants; discusses indicators of health, and measurement of health status; briefly reviews the services and resources devoted to health; and includes some historical, philosophical, and ethical considerations of human health in relation to the integrity of planetary life support systems.

The Middle English word *hal*, meaning whole, sound in wind and limb, evolved to the modern English *health*, with its original meaning intact. Dictionary definitions mention soundness and efficient functioning and give the same meaning to financial as to bodily health. In medicine and public health the concern is for the health of individuals and populations. Health professionals assess, measure, and compare the health status of individuals, groups and classes of people at different times and places, and study the factors that influence health status, as they fulfill their mission, which is to promote, preserve, and protect good health, and restore good health when disease, injury, or disability occur.

For most individuals and for many cultures, health is a subjective and perhaps mainly an abstract or a philosophical concept. Few of us can describe or define it, but we readily recognize it and become concerned about even trifling departures from our customary state of health.

2. Definitions and Concepts of Health

In the preamble to the constitution of the World Health Organization (WHO) in 1948, health is described as:

"A state of complete physical, mental and social wellbeing, not merely the absence of disease or infirmity"

This description recognizes that health is multidimensional: it is possible to have excellent physical health but to be severely impaired emotionally or intellectually; or vice versa; or to be in a poor state of physical and mental health but in excellent social health, that is, to possess every possible social and economic advantage but to suffer from a disabling physical or mental illness or to be a sociopath. But despite its recognition of the many facets that make up health, WHO's 1948 definition has been much criticized because it is so vague, it describes an ideal state rarely attained by most people, and it contains no ingredients that can be readily measured or counted either in an individual or in the population. It also implies that health is a "steady state" rather than a condition that fluctuates in response to many influences.

There have been many other definitions. One that spells out some tangible (i.e. measurable) features of health is:

"A state characterized by anatomical, physiological and psychological integrity; ability to perform personally valued family, work and community roles; ability to deal with physical, biological, psychological and social stress; a feeling of well-being; and freedom from the risk of disease and untimely death"

Most of the components in this definition can be measured and counted at the individual and at the population level, although it is difficult and challenging to assess some of them, such as a feeling of well-being, and freedom from the risk of disease; and in an imperfect world beset by innumerable hazards, no one is ever free from the risk of untimely death.

Increasing interest in health promotion in the early 1980s prompted a WHO working group to develop a definition (actually a description) recognizing the role of individuals and communities in determining their own health status. This can be paraphrased to:

The extent to which an individual or a group is able to realize aspirations and satisfy needs and to change or cope with the environment; health is a resource for everyday life, not the objective of living; it is a positive concept, emphasizing social and personal resources as well as physical capabilities.

This description and discussion of what comprises health is functional, "ecological" and draws attention to the need for partnerships among individuals and communities, and to the importance of protecting the integrity of the environment in the cause of promoting good health. It views health as a form of personal and societal capital, conceptually similar to Bismarck, Lloyd George, William Beveridge, other social reformers and the World Bank who recognize that health and wealth are interconnected and mutually dependent.

The health of humans cannot be dissociated from the health of the life-supporting ecosystems (i.e. the biosphere) with which humans interact and are interdependent. Moreover, no matter how healthy the present generation may be, our well-being as a species (i.e. the health of future generations) is dependent upon the integrity and sustainability of these ecosystems. A definition of "sustainable health" that recognizes the interconnectedness of humans and other living creatures, past, present and future, is:

"A sustainable state of equilibrium among humans and other living things with which we share the earth"

The key word in this definition is "equilibrium," or harmony. The concept of harmony among the life forms that share the earth is part of the belief system of some so-called primitive or savage tribal communities in parts of the world that have remained relatively untouched by the advances of industrial civilization but it is fast disappearing. This concept is alien to the belief system of many reared in Judeo-Christian culture, because biblical traditions enshrined in the Genesis myth state that man shall have dominion over the earth and all that lives on it. Many European explorers and colonists

expressed their belief in this biblical tradition in their writings on travel and natural history; and although industrial and commercial developers throughout the twentieth century seldom said so explicitly, some were driven by a similar belief and used it to rationalize their exploitation of the environment.

3. Health as Dynamic Equilibrium: Ecology of Human–Pathogen Interactions

Humans cannot long remain healthy in an environment in which they are out of harmony, or dynamic equilibrium, with other living things with which they are interdependent. If other species die—become extinct—as a consequence of human actions, the human species too may suffer grievously. Humans are an integral part of the "Great chain of being." This is true of innumerable life forms from the largest mammals to the smallest microorganisms.

Indeed, humans and other mammals cannot survive without a great many varieties of microorganisms on which they are utterly dependent. Microorganisms in the intestines play an essential role in digesting food, others in the soil and in lakes, rivers and the sea break down dead organic matter into basic ingredients that can be recycled through other living plants and animals; other microbes ferment liquids containing sugar or protein—milk to make cheese, sugar and malt to make beer, grape juice to make wine, etc. The list of essential microorganisms is enormous. Only a tiny minority, a few thousand out of billions, cause diseases. We call these microorganisms *pathogens*.

Since the beginning of the twentieth century, we have been trying to kill or "conquer" pathogens with "magic bullets" the first of which were arsenical drugs to treat syphilis. Since the 1940s, we have pursued this strategy with antibiotics—sulfa drugs, penicillin, streptomycin, and a host of others. All have worked for a brief time, then lost their efficacy. This is a war we ultimately cannot win because microorganisms have very short generation times, often measurable in minutes or less. Pathogens can breed antibiotic-resistant strains much more rapidly than we can develop new antibiotics. The same applies to most insects and other life forms with very short generation times. Moreover, our efforts to exterminate insect vectors of disease, such as mosquitoes, and to control agricultural pests with pesticides, herbicides, etc., are proving to have undesirable, sometimes devastating, environmental effects, occasionally harming health, even endangering life.

An alternative strategy that is increasingly often implemented is based on what we now recognize as ecological concepts in which humans are viewed as integral partners in the biosphere, the planetary ecosystem. This strategy has been gaining strength for over 200 years, since its origins in vaccination (immunization) programs aimed at protecting people from diseases caused by infectious pathogens.

The first effective vaccination method was developed by Edward Jenner, an English physician and naturalist. In 1798, Jenner demonstrated that inoculation with secretions from the little blisters of cowpox conferred protection against smallpox. Immunization against diphtheria, tetanus, and tropical diseases such as yellow fever came into use in the first half of the twentieth century and was followed in the second half of the twentieth century by vaccinations against an ever-widening range of diseases—

poliomyelitis, measles, mumps, rubella, hepatitis B, and several other dangerous diseases, including epidemic influenza (although there are uncertainties about the efficacy of influenza vaccine). The pathogens responsible for most of these diseases are still there, in our throats, the soil, wherever is their usual habitat. But once we are protected by immunization, we can live in harmony with these previously dangerous microbes.

The challenge in the next few decades is to develop methods that will enable humans to live in harmony with other dangerous microorganisms and with common insect vectors of disease such as mosquitoes. This will be a more certain way to ensure long-term good health for the population than the impossible goal of attempting to exterminate these other life forms.

4. Historical Perspectives

The foregoing discussion helps to explain why the life of humans throughout history, until very recently, was, in Hobbes' phrase, "Nasty, brutish, and short." There were brief interludes of good health among "noble savages" in hunter-gatherer societies, but once humans settled in fixed but insanitary communities they fell prey to pathogens that passed from their infected bowel to that of others; and living at close quarters, often with several children sharing the same bed, respiratory infections spread very rapidly. Some civilizations seem to have been healthier than others; for instance well-to-do people had longer lives in classical Greece and ancient Rome than in medieval Europe, to judge from surviving records. This can be partly explained by some climatic and ecological factors, perhaps partly by their regard for athletic events that set a high value on fitness.

From time to time great epidemics, or pandemics, cut a swath through the population, indiscriminately killing children and their parents; and at all times other diseases were endemic, always present in sufficient numbers to be a perpetual threat, especially to infants and young children. There were usually enough life-ending diseases to ensure that the average life expectancy ranged from 30 to 40 years, compared with well over 70 by the end of the twentieth century. The main killers were infections of the gastrointestinal and respiratory systems—dysentery or diarrhea, and bronchitis, pneumonia, and croup. The lethal epidemic and pandemic diseases were smallpox, typhus, cholera and plague, and malaria in subtropical and tropical regions. Tuberculosis has existed since Paleolithic times, as evidence in ancient bones attests. (It is still with us: at the end of the twentieth century, one-third of the world's people were infected with the tubercle bacillus). Famine or severe shortages of food have occurred often too, and still do, sapping the vitality of entire populations, making them more vulnerable to infections, including tuberculosis.

The names by which we know some of the great epidemic diseases reflect their history—we speak of visitations of the plague, as of visitations from a wrathful, vengeful god or evil spirit that punished humankind for unspecified sins or misdeeds. Influenza means (evil) influence, malaria, another great killer now as well as in the past, means bad air, reflecting the observation that it was and is associated with swamps and marshes. Typhus means "clouded" and alludes to the state of consciousness of the

victims. Cholera recalls the humoral theory of disease, and smallpox describes the skin lesions of the victims. Consumption (tuberculosis) describes how the body is consumed and wasted away by the ravages of this disease. The development of large towns in the industrial revolution renewed the scourge of tuberculosis, "the captain of all these men of death" as John Bunyan put it; and workers in mines and factories fell victim to dust diseases of the lungs.

The second half of the nineteenth century was a revolutionary period, not only in industry and politics but also in medical science and even more so in public health. The sanitary revolution, provision of clean drinking water and sanitary disposal of human excreta, transformed health. Infant deaths fell dramatically. In the 1850s, about 200–250 of every 1000 babies born alive in industrial Europe and North America had died before they were a year old. By 1900 the figure had fallen to less than 100 per thousand (by the 1990s it was down to about 5 per thousand). Development of vaccines and sera contributed considerably, too, to improved infant and child health, and so did better economic conditions that made it unnecessary for several children to share the same bed. Another important factor that has led to improved health has been rising levels of literacy and greater awareness of what harms and what improves health. Rising literacy levels have contributed to elevating the status of women and this too has led to improved health of women and their children.

5. Theories about Health

Beliefs about the foundations of good health are inseparable from theories of disease. Primitive beliefs about good and evil spirits, benevolent or malevolent intervention of fate, the gods or ancestors, were superseded by the theories of Aristotle and Galen about the balance of bodily fluids ("humors" in the humoral theory of disease) and by beliefs about the effects of miasmas or "bad air" in the miasma theory, which regarded many diseases as due to emanations from decomposing corpses or rotting vegetation. Preference for holiday resorts and convalescent hospitals at the seaside and in the mountains reflects not only aesthetic sensibilities but also our belief in the notion that some environments are inherently healthier than others.

Although these theories had a long vogue, there has always been a concurrent belief in the contagion theory, based on empirical observation that close contact favored the spread of some diseases. Oddly enough, leprosy, one of the least contagious of communicable diseases, powerfully reinforced the concept of contagion, perhaps because of the stigma associated with the disfiguring lesions it caused. Lepers have been shunned and segregated since biblical times. The contagious nature of some diseases was first described clearly by a fifteenth-century monk, Fra Castor, or Fracastorius, in his book *De Contagione*. Fracastorius was also responsible for giving the modern name to the sexually transmitted disease syphilis, which ravaged Europe in his time; the name was part of the title of his mock heroic poem, *Syphilis, sive morbis Gallicum*—syphilis, the French disease.

The earlier beliefs about their causes survive in the names by which we know some common or important diseases—influenza, malaria, cholera, rheumatism, etc. We can trace the evolution of medical science in the changing names by which we know

diseases. Some modern diagnostic labels reveal a very precise understanding of causal mechanisms of disease, for example “streptococcal septicemia” or poisoning of the body or bloodstream by the streptococcus; others reveal our ignorance about what actually causes the disease, for example “essential hypertension” is just another term for high blood pressure—we do not know what actually causes the common variety that carries this label.

Modern medical science embraces several theories, mostly well supported by empirical and experimental evidence, and accompanied by an increasingly broad and deep understanding of ways in which the health of individuals and populations can be impaired, endangered, or permanently lost.

We recognize that many diseases are caused by pathogenic microorganisms: rapidly expanding knowledge of these in the late nineteenth century confirmed the “germ theory” of disease. Some common diseases are due to deficit or excess of dietary ingredients such as vitamins or trace elements; others are caused by malfunction of various organs such as endocrine glands, responsible for efficient working of the complex chemistry of the human body (although to say this may evade the question of what actually happens, what leads the pancreatic cells to malfunction and cause diabetes, for instance). Some diseases are associated with states of mind and types of personality although in the present state of knowledge we cannot say how, or what the connections are between, for instance, a particular personality type and predisposition to high blood pressure or coronary heart disease.

Medical and public health services aim to minimize the risk of serious departures from good health. The scope and methods of modern medical and public health practice demonstrate the depth and breadth of our understanding of the causes of disease, disability and premature death and also our expanding (but far from complete) understanding of the causes of good health. Everyone who remains fit throughout a long lifetime attributes their good health to their behavior: to abstaining from alcohol or tobacco, or to drinking whiskey and smoking several bowls of tobacco every day, to exercising daily, or to leading a quiet, sedentary life. Some credit their parents, that is, their genetic heritage, which, like many environmental and behavioral factors, is an important determinant of longevity.

Ideas about determinants of good health date back at least to the ancient Greek philosophers—their maxim “Nothing to excess” remains a valid guide to good health. That said, there are more myths and dogma than facts or empirical observations about what really causes some people to be healthy and others not. An old axiom has it that happy people do not get cancer. Anecdotal evidence strongly suggests that happy people are less prone to many diseases than are their unhappy kin. Some recent insights are further discussed below. Modern approaches to health education and health promotion make use of a health belief model and several other theoretical constructs. These are based on assumptions derived from empirical studies of how people perceive health and their understanding of what has to be done to preserve and protect their own health or that of their children. But the variations on the health belief model are no more than a guide to methods of health education and health promotion; they tell us little or nothing about the causes of good health.

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Biographical Sketch

John Last was born and educated in Australia. He graduated from the University of Adelaide medical school in 1949. He has worked as an epidemiologist and educator in Australia, England, Scotland, the United States, and for the World Health Organization and other agencies in Colombia, Indonesia, India, Sri Lanka, Singapore, Thailand, China, Saudi Arabia, Pakistan, and Kuwait, and for WHO Headquarters in Geneva on several occasions. He has held academic positions with the British Medical Research Council in London, at the Universities of Sydney, Vermont (US), and Edinburgh and has been professor of epidemiology and community medicine at the University of Ottawa since 1969. He was the editor of the 11th, 12th and 13th editions of *Public Health and Preventive Medicine* and editor emeritus of the 14th edition ("Maxcy–Rosenau–Last"); editor of the 1st, 2nd and 3rd and forthcoming 4th editions of the *Dictionary of Epidemiology*, and author of the 1st and 2nd editions of *Public Health and Human Ecology*. He was the scientific editor of the *Canadian Journal of Public Health* 1981–1991, the editor of *Annals* of the Royal College of Physicians and Surgeons of Canada 1990–1997, and has served as editor or member of the editorial board of several other medical journals. He is one of three editors of the 3rd edition of the *Oxford Illustrated Companion to Medicine* (summer 2000) and one of the five editors of the Macmillan *Encyclopaedia of Public Health* (2001). He is the author of chapters in 40 books and over 200 original articles in journals of medicine and science.

Dr Last was president of the American College of Preventive Medicine 1987–1989, Canadian Vice-President of the American Public Health Association 1988–1989, and has held office in several other national and international professional colleges and associations. He is an honorary life member of the Society for Social Medicine (UK), the International Epidemiological Association, and the American College of Epidemiology. Dr. Last's principal research interests are in the sustainability of human health in environments and ecosystems that are becoming less sustainable, and aspects of medical ethics that relate to public health and epidemiology.