

What Is a Pandemic?

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The sudden emergence and rapid global spread of a novel H1N1 influenza virus in early 2009 [1] has caused confusion about the meaning of the word “pandemic” and how to recognize pandemics when they occur. Any assumption that the term pandemic had an agreed-upon meaning was quickly undermined by debates and discussions about the term in the popular media and in scientific publications [2–5]. Uses of the term by official health agencies, scientists, and the media often seemed to be at odds. For example, some argued that a level of explosive transmissibility was sufficient to declare a pandemic, whereas others maintained that severity of infection should also be considered [2–5].

Commentators questioned whether we could effectively deal with a pandemic when we could not agree on what a pandemic is or whether we were experiencing one. Amid this discussion, a *New York Times* commentary, published 8 June 2009, struck at the heart of the problem with its challenging headline, “Is This a Pandemic? Define ‘Pandemic’” [5]. Three days later, the World Health Organization (WHO) announced that the pandemic

alert for the 2009 H1N1 influenza virus had been raised to its highest level, “phase 6.”

Because it is generally agreed that we are currently in the midst of a global influenza pandemic caused by the novel H1N1 2009 influenza virus, it may now be a good time to ask again: what is a pandemic? Modern definitions include “extensively epidemic” [6], “epidemic... over a very wide area and usually affecting a large proportion of the population” [7, p. 94], and “distributed or occurring widely throughout a region, country, continent or globally” [8], among others. Although they convey the intuitive idea that a pandemic is a very large epidemic, such definitions still seem vague. Although there seems to be little disagreement that a pandemic is a large epidemic, the question arises whether pandemics must be new, explosive, or severe. Must they be infectious at all? And what if they rapidly spread globally without causing high attack rates? In short, how do we know a pandemic when we see one?

In the 17th and 18th centuries, the terms epidemic and pandemic were used vaguely and often interchangeably in various social and medical contexts. The first known use of the word pandemic, in 1666, referred to “a *Pandemick*, or *Endemick*, or rather a *Vernacular Disease (a disease always reigning in a Country)*” [9, p. 3]. Two centuries later, in 1828, epidemiologist and lexicographer Noah Webster’s first edition of *Webster’s Dictionary* listed epidemic and pandemic as synonymous terms [10]. Webster, who had

lived through the influenza pandemic of 1789–1790, which was the only major American influenza event of his adult lifetime, refers in his dictionary only to epidemic influenza and not to pandemic influenza [10]. Thus, by the early 19th century, the term epidemic, when used as a noun, had become the accepted term for what we would call today both an epidemic and a pandemic, with the term pandemic falling into increasing disuse.

However, as societies were evolving, so too were disease patterns and scientific understanding of how diseases spread. The industrial revolution brought millions of people into urban centers, while clipper ships and steam locomotives dispersed ever-increasing numbers of individuals widely, and even globally. The 1831–1832 cholera pandemic represented the first time that the global spread of an infectious disease was plotted extensively in the popular press, day by day, for more than a year as it progressed inexorably from Asia toward Europe via travel and trade routes. Discovery of the microbial causes of diseases led to vaccines and antisera against them and to widely distributed diagnostic tests to study and monitor diseases at their sources. Under the umbrella of epidemics, the idea of a pandemic thus began to take shape before any specific meaning of the languishing term had become associated with it. When the 1889 influenza pandemic appeared, the concept of a pandemic already existed. The previously vague, imprecise, and infrequently used term was for some reason—perhaps because of influenza’s remarkable explosive-

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ness and the precise tracking of its rapid global spread in 1889 [11]—rescued from near-obscurity and attached to the remarkable global emergence of influenza. Soon thereafter, the term pandemic entered into general use; by 1918, it had become virtually a household word.

The 1889 and 1918 influenza pandemics may have temporarily codified the meaning of the word pandemic, but it soon drifted into looseness and imprecision as it began to be used popularly to denote large-scale occurrences of noninfluenza infections and chronic and lifestyle-associated diseases; it thereby returned to a status similar to its former one, denoting almost anything that increased in and appeared to spread within or among groups of people, such as smoking, traffic accidents, factory closings, and even fear [12]. Moreover, with better modern control of such major pandemic diseases as cholera and plague, the term pandemic became closely associated with historical, rather than contemporary, events. In the past 2 decades, many modern medical texts have not even defined the term. Even authoritative texts about pandemics do not list it in their indexes, including such resources as comprehensive histories of medicine [13, 14], classic epidemiology textbooks [15, 16], the Institute of Medicine's influential 1992 report on emerging infections [17], and acclaimed works about pandemics [18–20].

DESCRIBING PANDEMICS

Even if there is no single accepted definition of the term pandemic, it may still be fruitful to consider diseases commonly said to be pandemic and to try to understand them better by examining similarities and differences among them. Diseases that we might consider—chosen empirically to reflect a spectrum of etiologies, mechanisms of spread, and eras of emergence—include acute hemorrhagic conjunctivitis (AHC), AIDS, cholera, dengue, influenza, plague, severe acute respiratory syndrome (SARS), scabies, West Nile disease, and obesity. In what basic aspects are

such pandemic diseases alike and different, and is it possible to identify key features that apply to all or almost all of them?

Wide geographic extension. Almost all uses of the term pandemic refer to diseases that extend over large geographic areas—for example, the 14th-century plague (the Black Death), cholera, influenza, and human immunodeficiency virus (HIV)/AIDS. In a recent review of the history of pandemic influenza coauthored by one of us (D.M.M.), pandemics were categorized as transregional (≥ 2 adjacent regions of the world), interregional (≥ 2 nonadjacent regions), and global [21].

Disease movement. In addition to geographic extension, most uses of the term pandemic imply disease movement or spread via transmission that can be traced from place to place, as has been done historically for centuries (eg, the Black Death). Examples of disease movement include widespread person-to-person spread of diseases caused by respiratory viruses, such as influenza and SARS, or enteric organisms, such as *Vibrio cholerae*, or the spread of dengue associated with the extension of the geographic range of vectors, such as *Aedes albopictus* mosquitoes.

High attack rates and explosiveness. Diseases with indolent rates of transmission or low rates of symptomatic disease are rarely classified as pandemics, even when they spread widely. West Nile virus infection spread from the Middle East to both Russia and the Western hemisphere in 1999; however, this disease spread has not generally been called a pandemic, presumably because attack rates have been moderate and symptomatic cases have been relatively few. Notorious pandemics have tended to exhibit not only high attack rates but also “explosive” spread—that is, multiple cases appearing within a short time. This epidemiologic feature typifies both common-source acquisition and highly contagious diseases of short incubation periods—for example, the 14th-

century plague, cholera in 1831–1832, and influenza on many occasions.

Minimal population immunity. Although pandemics often have been described in partly immune populations (eg, evidence for a modest degree of protection in persons >60 years of age in the 1918 influenza pandemic [21]), it is obvious that in limiting microbial infection and transmission, population immunity can be a powerful antipandemic force. However, immunity is a relative concept that does not necessarily imply full protection from infection [22], as is the case for pandemic diseases as different as cholera and influenza associated with new subtypes or drifted strains [1].

Novelty. The term pandemic has been used most commonly to describe diseases that are new, or at least associated with novel variants of existing organisms—for example, antigenic shifts occurring in influenza viruses, the emergence of HIV/AIDS when it was recognized in the early 1980s, and historical epidemics of diseases, such as plague. Novelty is a relative concept, however. There have been 7 cholera pandemics during the past 200 years, presumably all caused by variants of the same organism; usage clearly dictates that when pandemics come and then disappear for long periods, they are still pandemics when they return. Indeed, pandemicity can be said to be a characteristic feature of certain repeatedly reemerging diseases, such as cholera and influenza.

Infectiousness. The term pandemic has less commonly been used to describe presumably noninfectious diseases, such as obesity [23], or risk behaviors, such as cigarette smoking [24], that are geographically extensive and may be rising in global incidence but are not transmissible. Such uses of the term generally appear less in scientific discussions than they do in public health communication and education, suggesting an intention to stress the importance of the health problem by using the term pandemic in a colloquial rather than scientific sense.

Contagiousness. Many, if not most,

infectious diseases considered to be pandemic by public health officials are contagious from person to person, such as influenza. Other diseases have multiple means of transmission, including those that are occasionally contagious but more commonly transmitted by different mechanisms, such as plague (by fleas) and cholera (by water).

Severity. Although disease severity has not been a conventional pandemic criterion [25], the term pandemic has been applied to severe or fatal diseases (eg, the Black Death, HIV/AIDS, and SARS) much more commonly than it has been applied to mild diseases. Diseases of low or moderate severity, such as AHC in 1981, and cyclic global recurrences of scabies (an infestation, not an infection), also have been called pandemic when they exhibit explosive (AHC) or widespread and recurrent (scabies) geographic spread.

CONCLUSIONS

The examples given above suggest that the pandemic concept, as applied to important global events spanning many centuries, includes diseases of very different etiologies that exhibit a variety of epidemiologic features. There seems to be only 1 invariable common denominator: widespread geographic extension. However, most of the other epidemiologic features noted are common—for example, movement and high attack rates—whereas other variable features, such as noninfectiousness and severity, seem generally out of place. It should not be surprising that, in coming to terms with a new pandemic in 2009, different observers would invoke and emphasize different aspects of older pandemics with which they were familiar.

It is ironic that part of the recent problem with pandemic terminology arose not because of inherent vagueness but because of well-meaning attempts to eliminate ambiguities. Decades ago, influenza virologists began to use a highly restricted definition of pandemic that accepted only the introduction and global spread of novel hemagglutinin (HA) subtypes [1]. Even

before the 2009 H1N1 infection pandemic, this definition had come largely undone because of increasingly documented global epidemics caused by viruses with HAs of the same subtype, acquired either by reassortment with viruses from a different clade or by antigenic drift [1] (eg, in 2003–2004). Such events cannot, by this definition, be considered to be pandemic, even if they spread just as widely as pandemics associated with new HA subtypes and are just as fatal.

When epizootic circulation of a highly pathogenic avian H5N1 virus led, in 2003, to occasional human “spillover” cases associated with 60% fatality [21], the WHO developed a pandemic preparedness plan stipulating, in reference to influenza, that a pandemic agent must be infectious, must be new, must spread easily, and must cause serious illness [26]. In 2005, the WHO further introduced a 6-stage prepandemic/pandemic staging system to address influenza [27]. Pandemic “phases” were for the purpose of informing and communicating with the public and ministers of health and triggering public health responses. Indeed, for the past several years, the global health community was tracking the frequently fatal but poorly transmissible H5N1 influenza A virus in anticipation of a pandemic outbreak. Thus, when a relatively nonsevere novel H1N1 virus appeared in April 2009 and then spread widely, many thought that use of the term pandemic—by then, unfortunately associated with a single deadly but nonpandemic virus (H5N1)—was tantamount to triggering a state of alarm not commensurate with the seriousness of the situation. The WHO pointed out that the pandemic influenza phases emphasized geographic distribution of disease caused by the emergent virus, not its severity, but also moved to quell confusion by introducing discussions of severity in briefings and official documents. Unfortunately, clarity was hard to achieve against the backdrop of long-standing ambiguity.

Outside of taxonomic considerations, scientific terminology often arises by habit

and usage rather than by choice. Once we have a term, changing it may be difficult, and there is no consensus process for doing so. What are the implications of using a flexible and subjective term that means different things to different observers and varies when applied to different diseases? We note that, during the ongoing H1N1 pandemic, there rarely has been confusion among scientists and public health officials themselves. Problems arose mainly in the translation of complex scientific ideas into publicly comprehensible language, a process that frequently introduces scientific terminology without the caveats and complications that otherwise accompany them. Influencing the public vocabulary regarding scientific concepts remains a formidable task against the backdrop of widespread scientific illiteracy.

In summary, simply defining a pandemic as a large epidemic may make ultimate sense in terms of comprehensibility and consistency. We also suggest that use of the term is best reserved for infectious diseases that share many of the same epidemiologic features discussed above. With respect to influenza, the “rules” of pandemicity are again being extensively rewritten and are likely to be modified further in coming months. This may ultimately be a good thing; we expect that improved understanding of the science of influenza—among the most important of the endemic, epidemic, and pandemic diseases—will lead to more-precise and better-understood terminology, as well as to clearer communication.

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