



## The Pandemic and its Impacts

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## Abstract

The Pandemic has a long history, but the term itself is yet to be defined by many medical texts. There have been a number of significant pandemics recorded in human history where pandemic related crises have caused enormous negative impacts on health, economies, and even national security globally. This article will explore the literature for the concept and history of pandemics, providing a summary of key features with consequent discussion on the negative impacts on health, economy, social and global security yielded by pandemics and disease outbreaks.

**Keywords:** *Pandemic; Infectious Disease; Public Health, Impact*

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## I. Introduction

Pandemics are for the most part disease outbreaks that become widespread as a result of the spread of human-to-human infection. There have been many significant disease outbreaks and pandemics recorded in history, including Spanish Flu, Hong Kong Flu, SARS, H7N9, Ebola, Zika (WHO, 2011b) (Rewar, Mirdha, & Rewar, 2015) (Maurice, 2016). The term “pandemic” has not been defined by many medical texts, but there are some key features of a pandemic, including wide geographic extension, disease movement, novelty, severity, high attack rates and explosiveness, minimal population immunity, infectiousness and contagiousness, which help us to understand the concept better, if we examine similarities and differences among them. The pandemic related crises have been associated with enormous negative impacts on health, economy, society and security of national and global communities. As well, they have caused significant political and social disruption.

## II. The Definition of Pandemic

The word “Pandemic” comes from the originates from the Greek pan meaning “all” and demos “the people”, and The word is commonly taken to refer to a widespread epidemic of contagious disease throughout the whole of a country or one or more continents at the same time (Honigsbaum, 2009). Nevertheless in over the past 2 decades, the term has not been failed to be defined by many modern medical texts. Even authoritative texts about concerning pandemics do not list it in their indexes, including such resources as comprehensive histories of medicine, classic epidemiology textbooks, the Institute of Medicine’s influential 1992 report on emerging infections (Morens, Folkers, & Fauci, 2009).

The internationally accepted definition of a pandemic as it appears in the Dictionary of Epidemiology is straightforward and well-known: “an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people” (Harris, 2000). The classical definition, however, includes nothing about population immunity, virology or disease severity. By On the basis of this dictionary definition, pandemics can be said to occur annually in each of the temperate southern and northern hemispheres, given that the definition of the term is so wide. Seasonal epidemics cross international boundaries and affect a large number of people. However This said, seasonal epidemics are not considered pandemics. Modern definitions include “extensive epidemic”, “epidemic [...] over a very wide area and usually affecting a large proportion of the population”, and “distributed or occurring widely throughout a region, country, continent or globally”, among others (Morens et al., 2009). In the case of influenza, biologists also require that pandemic strains undergo key genomic mutations, known as antigenic shift. For WHO to pronounce a level six pandemic alert there has to be sustained transmission in at least two regions at the same time. WHO’s standard definition of pandemic influenza refers to a situation in which a new and highly pathogenic viral subtype, one to which no one (or few) in the human population has immunological resistance and which is easily transmissible between humans, establishes a foothold in the human population, at which point it rapidly spreads worldwide (WHO, 2011a).

### III. The Pandemic through History

There have been a number of significant pandemics recorded in human history, including smallpox, cholera, plague, dengue, AIDS, influenza, severe acute respiratory syndrome (SARS), West Nile disease and tuberculosis. Influenza pandemics are unpredictable but recurring events that can have severe consequences on societies worldwide. Influenza pandemics have struck about three times every century since the 1500s, or roughly every 10-50 years. In the 20th century, there were 3 influenza pandemics which were named "Spanish flu" in 1918-1919, "Asian flu" in 1957-1958, and "Hong Kong flu" in 1968-1969. Each pandemic harmed human life and economic development. For example, the influenza pandemic of 1918-1919, which killed more than 20 million people in the world and has been cited as the most devastating epidemic in recorded world history (WHO, 2011b).

Recent years have seen at least six large-scale outbreaks—hantavirus pulmonary syndrome, severe acute respiratory syndrome, H5N1 influenza, H1N1 influenza, Middle East respiratory syndrome, and Ebola virus disease epidemic (Gostin et al., 2016). The influenza H1N1 2009 virus (A/2009/H1N1) was the first pandemic influenza of the 21st century. It has affected the whole world and caused more than 18,000 deaths (Rewar et al., 2015). Ebola killed more than 11 000 people and cost the world more than USD \$2 billion, according to World Bank calculations (Maurice, 2016). Currently (2016) Zika virus continues to spread and consequently threatens the health of people in 34 countries (Troncoso, 2016). These outbreaks make scientists and governments worry about a repeat of the devastation of the Spanish flu of 1918 (Lin, McCloud, Bigman, & Viswanath, 2016).

#### Features of a pandemic

Although the term "pandemic" has not been defined by many medical texts, there are some key features of a pandemic, which help us to understand the concept better, if we examine similarities and differences among them:

- **Wide geographic extension** - The term pandemic usually refers 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, pandemics were categorized as trans-regional and global (Taubenberger & Morens, 2009). There were 178 countries involved during the H1N1 outbreak in 2009 (Rewar et al., 2015).
- **Disease movement** - In addition to geographic extension, most uses of the term pandemic imply unexpected disease movement or spread via transmission that can be traced from place to place (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 cholera*, or by vectors, such as dengue. In the case of pandemic influenza A (H1N1), there was widespread transmission in both hemispheres between April and September 2009, that is early in the influenza season in the temperate southern hemisphere but out of season in the northern hemisphere (Barrelet, Bourrier, Burton-Jeangros, & Schindler, 2013). This out-of-season transmission is what characterizes an influenza pandemic.
- **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" (Morens et al., 2009). In the 21st century, SARS and avian influenza are two newly emerged infections with pandemic potential that have arisen from Asia. .

- **Severity** - 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. “Global pandemics with high mortality and morbidity occur when a virulent new viral strain emerges, against which the human population has no immunity” (Rewar et al., 2015). Severity is estimated by the case fatality ratio (Donaldson et al., 2009). “In contrast with Ebola, most cases die within 10 days of their initial infection, with the disease having a mortality rate of 50–90%” (WHO 2003). The outbreak of H7N9 has caused more than 600 human infections, with nearly 30% mortality (Su & He, 2015).
- **High attack rates and explosiveness** - Pandemics are characterised by high rates of attack and by explosive spread. Examples are influenza H1N1 or Ebola. However, if the transmission is non-explosive, even if it is widespread, this is not classified as a pandemic. For example, West Nile virus spread to the Middle East and Russia, and the Western Hemisphere in 1999, but the transmission was slow and the attack rate was low, so it is not classified as a pandemic. Diseases with low rates of transmission or low rates of symptomatic disease are rarely classified as pandemics, even when they spread widely. However, diseases of low or moderate severity, such as Acute Hemorrhagic Conjunctivitis (AHC) in 1981, and cyclic global recurrences of scabies also have been called pandemic when they exhibit explosive (AHC) or widespread and recurrent geographic spread (Donaldson et al., 2009).
- **Minimal population immunity** – Although pandemics often have been described in partly immune populations, it is clear that in limiting microbial infection and transmission, population immunity can be a powerful anti-pandemic force (Taubenberger & Morens, 2009). Pandemics are characterised by almost population immunity (Fangriya, 2015; WHO, 2013). So it is easy for a large part of population to be infected. For example, since H7N9 was a new variant of the influenza virus, the population had no immunity, so there were many cases worldwide in a short time (Wildoner, 2016).
- **Infectiousness and contagiousness** - The term pandemic has less commonly been used to describe presumably non-infectious diseases, such as obesity, or risk behaviors, such as cigarette smoking, that are geographically extensive and may be rising in global incidence but are not transmissible. Pandemic diseases are infectious, so they are transmitted from one person to another person. This transmission can be direct (person to person) or indirect (person to vector to person) (Morens et al., 2009). For example, the SARS virus was transmitted from person to person by persons in close quarters, while H7N9 was often spread through contact with living poultry (Su & He, 2015). The significance to human health of this avian-influenza strain lies in its potential to mutate into a form capable of sustained person-to-person transmission.

#### IV. Pandemic Impact

Infectious disease outbreaks can easily cross borders to threaten economic and regional stability, as has been demonstrated by the HIV, H1N1, H5N1, and SARS epidemics and pandemics (Verikios, Sullivan, Stojanovski, Giesecke, & Woo, 2015). Beyond the debilitating, sometimes fatal, consequences for those directly affected, pandemics have a range of negative social, economic and political consequences (Davies, 2013a). As an example, “The impact of pandemic influenza ie. H1N1 in 2009 was not just on mortality, but also on health-care systems, animal health, agriculture, education, transport, tourism and the financial sector. In short, a pandemic event threatens all aspects of the economic and social fabric” (Drake, Chalabi, & Coker, 2012). For another example, the SARS in 2003 and the Ebola pandemics, in 2013 and 2015 respectively, disrupted the economies and social order in China and West Africa as well as causing death and illness. Ebola and other pandemics have reduced the life quality of families and communities, and Ebola has disrupted essential services such as education, transport, and tourism, reduced the West African economies and isolated populations, which had impacts beyond Africa too due to the global effort of containing the outbreak (Nabarro & Wannous, 2016).

## Health effects

Pandemics have infected millions of people, causing wide-spread serious illness in a large population and thousands of deaths. For example, in 14th century, the ‘Black Death’ plague killed the half population of Europe (A. G. P. Ross, Ross, Olveda, & Yuesheng, 2014). In the 20th century, there were three major pandemic: 1) Spanish flu in 1919-1920, which caused 20-40 million deaths (Taubenberger & Morens, 2009); 2) Asian flu in 1957-1958 which caused about 2 million deaths, 3) Hong Kong flu in 1968-1969 which caused 1 million deaths (Landis, 2007; Wildoner, 2016).

Infectious disease disasters, including pandemics and emerging infectious disease outbreaks, have the potential to cause high morbidity and mortality in the world, and in fact they may account for a quarter to a third of global mortality (Verikios et al., 2015). In developing countries, both pandemics and infectious diseases have the potential to kill claim many peopllivese, and the likelihood of deaths is within the range of 5 to 10 percent (Kern, 2016). During the SARS outbreak in 2003, there were more than 8000 infected individuals, with over 700 deaths (almost 9% )worldwide in just 6 months (Wong & Leung, 2007).

Influenza is one of the most serious pandemic diseases. Influenza outbreaks can result in considerable morbidity and mortality. Influenza pandemics are characterised by a high incidence and fatality rate with 250,000–500,000 people deaths each year, rapid and wide-spread transmission (WHO 2004). Recent influenza pandemics have killed significant numbers of people worldwide, and contributed to an estimated 8,870–18,300 deaths in 2009–2010 (Prager, Wei, & Rose, 2016). For example, May 2009 saw the emergence from Mexico of a new H1N1 virus capable of human-to-human transmission (Verikios et al., 2015). WHO reported 182,166 laboratory confirmed cases of influenza A/H1N1, with 1799 deaths in 178 countries up to August 13, 2009 (Rewar et al., 2015). In the U.S.A, “The US Centers for Disease Control and Prevention (CDC) estimates that the peak H1N1 season (April 2009 to April 2010) in the United States resulted in 43–89 million cases, 195–403 thousand hospitalizations, and 8,870–18,300 deaths” (Bhandari, Hartley, Lindsley, Fisher, & Palmer, 2013).

Over the past several years, the threat of a human influenza pandemic has greatly increased. For example, H5N1 has repeatedly managed to infect humans in several Asian and European countries (Fangriya, 2015). There had been 387 confirmed cases of human H5N1 infection across 15 countries since from late 2003 to late 2008, including 245 deaths, with an average case-fatality rate of around 63% globally. (Enemark, 2009). The H5N1 could easily become another major pandemic. With the emergence of the zoonotic influenza A (H7N9) virus in China, there have also been renewed concerns about the potential for a pandemic to arise from an avian influenza strain. The outbreak of H7N9 viruses has caused more than 600 human infections, with nearly 30% mortality (Su & He, 2015), and the H7N9 virus is considered to have pandemic potential (Tanner, TOOTH, & Gundlapalli, 2015).

Other major treats in recent times have been pandemics of Dengue and Ebola. The incidence of the severe and fatal form of the Dengue has increased dramatically in developing countries. The 2015–2016 dengue epidemics were the worst in the history of Latin America. The first cases were recorded in Brazil in May 2015 and caused more than 1.5 million cases up to December 2015. At least 34 countries were involved in March 2016 (Troncoso, 2016).

The Ebola outbreak in West Africa was an unprecedented public health emergency of international concern. In October 2015, WHO reported that there were 28,581 Ebola Virus Disease (EVD) confirmed, probable and suspected cases, with 11,299 deaths in West African countries (Liberia, Guinea, Sierra Leone). The estimated case fatality proportion was 40% (Nabarro & Wannous, 2016). More than 11,000 people died in nine countries as the response to the Ebola zoonotic ‘spillover’ was delayed (A. G. Ross, Crowe, & Tyndall, 2015).

## The economic impacts

Pandemic influenza represents a serious threat not only to the population of the world, but also to its economy. The impact of economic loss can result in instability of the economy. The impact is through direct costs, long term burden, and indirect costs.

The direct costs of dealing with the disease outbreak can be very high. For example, the Ebola outbreak has seriously undermined the economics throughout West Africa. The Ebola outbreak in Sierra Leone in 2015 cost USD 6 billion in direct costs (hospitals, staff, medication), and the direct costs alone amount to 3 years of funding for WHO, and are well over 20 times the cost of WHO's emergency response cuts in its 2014–15 budget (Gostin & Friedman, 2015). It has been calculated that there was an economic loss of USD 1.6 billion for the three countries compared with the economic growth in the previous year 2014 (Kern, 2016). The Global Health Risk Framework for the Future (GHRF) Commission estimates that every year on average infectious disease outbreaks cost the world about USD 60 billion in direct costs (Maurice, 2016).

The long term burden is also severe. One of the main burdens is from the loss of earnings of those who have died. Prager, Wei et al (2016) have estimated that economic losses from a pandemic influenza in the USA would be USD 90 – 220 billion, and of that, 80% would come from the value of expected future lifetime earnings of those who would die (Prager et al., 2016). McKibben and Sidorenko (2006) estimated that the economic cost of an influenza pandemic range from USD 374 billion for a mild pandemic to USD 7.3 trillion for a severe pandemic (MacKellarSource:, 2007). The mathematical models indicate that a future influenza pandemic could have total costs USD 71-166 (Rebmann, 2010). “Recent years have seen at least six large-scale outbreaks—hantavirus pulmonary syndrome, severe acute respiratory syndrome, H5N1 influenza, H1N1 influenza, Middle East respiratory syndrome, and Ebola virus disease, which cost the world more than \$2 billion, according to World Bank calculations” (Maurice, 2016).

Indirect costs are also very heavy. They include everything that contributes to a decline in GDP. The example of SARS, especially its impacts on the region affected the 2003 annual GDP of China decreased by 1% and the GDP of Southeast Asia also declined by 0.5% (MacKellar, 2007). Lee and McKibbin (2004) estimated income loss ranges from USD 12.3-28.4 billion for East and Southeast Asia in the SARS outbreak in 2003 (Fan, 2003). “In New Zealand, Treasury examined a pandemic with a 40 percent attack rate and a 2 percent case-fatality rate, concluding that GDP in the year of the event would be reduced by 5-10%” (MacKellarSource:, 2007). Some sectors of economy may be more heavily affected than others. For instance, Prager Wei et al (2016) estimate that the air transport industry would suffer a loss of almost 20% or USD 7.9 billion, if US residents cut down on travel. Thus, pandemics have both immediate and long-term effects that can damage the economic life of a nation for many years to come (Prager et al., 2016). The psychological and economic impacts of ineffective screening at airports were substantial affecting directly airport business in the 2003 SARS outbreak (Chung, 2015).

## Social impacts

The social impacts of pandemics were severe, include travel was strictly limited, and schools closing, markets and sporting were closed. All these are a likely reality should a pandemic with true potential for high morbidity and mortality emerge.

Population mobility is also a key factor. Movement was difficult and the travel including visiting families, carrying goods to markets were restricted by military check points. The closure of airports and cancellation of flights affected many people's travel, livelihood, and family life. With the rapid development in worldwide aviation over the last two decades, the risk of global pandemics has escalated with increased passenger traffic. With modern and efficient air travel, SARS, which originated from southern China was rapidly transmitted to more than 30 countries in early 2003 (Wong & Leung, 2007). Closing the airports harmed the economy of the affected regions.

School closure is often considered the first non-pharmaceutical intervention for implementation in a pandemic, as students are effective in spreading the virus. Timely school closure and cancellation of public gatherings was significantly associated with reduced mortality related to influenza epidemics during the 1918 influenza epidemic in

the United States (Chen, Huang, Chuang, Chiu, & Kuo, 2011). More than 1,300 public, charter, and private schools in 240 communities across the United States closed during the spring wave of the 2009 pA(H1N1) pandemic (Navarro, Kohl, Cetron, & Markel, 2016). School closure also raises a range of ethical and social issues, particularly since families from underprivileged backgrounds are likely to be disproportionately affected by the intervention (Cauchemez et al., 2009).

Closing markets has been tried for some outbreaks, especially for zoonotic diseases. Closure of wholesale and retail live poultry markets was associated with cessation of zoonotic outbreaks of H5N1 and H7N9 (Peiris, Cowling, Wu, & Feng, 2016). This caused disruption of food supply in the cities. People cannot find necessary food and living things because market and shop were closed. This also caused a long-lasting change in people's diet. After the occurrence of avian influenza, the consumption of poultry products fell by more than 80% on average in the market of Jilin province in China (Zhang & Liu, 2016), and affected the income of many farm workers.

The public games including sporting cancelled because public gatherings. Enforced dose contact at work and household crowding were related to a higher incidence of self-reported influenza-like illness in the 2009 H1N1 pandemic (Kumar, Quinn, Kim, Daniel, & Freimuth, 2012). "In some areas, fear produced an eerie quiet in usually bustling neighborhoods during Ebola crisis in West Africa (Folayan & Brown, 2015). The disease may leave long-term physiological effects on people, which affect their ability to earn a living. Zika virus in Brazil leaves a generation of children born with neurological disorders that may impose severe lifelong limitations (Ribeiro & Kitron, 2016). Tradeoff between the social costs of interventions and the cost of uncontrolled spread of the virus were involved in the decisions to mitigate influenza outbreaks in Ebola outbreak (Prieto & Das, 2016).

### **Security impacts**

A security threat of pandemic influenza as is not a recent phenomenon. Global security is threatened from pandemics, in terms of lives and economic stability (Maurice, 2016). Pandemics are no longer simply the domain of public health and clinical medicine, but are a social issue, a development issue, and a global security issue (Castillo-Chavez et al., 2015). The commission on a Global Health Risk Framework for the Future (GHRF) published a book at the beginning of 2016 under the title: "The Neglected Dimension of Global Security – A Framework to Counter Infectious Diseases Crises". A key statement sounds like that: "Pandemics cause devastation to human lives and livelihoods much as do wars, financial crises. Pandemic prevention and response, therefore, should be treated as an essential tenet of both national and global security – not just as a matter of health" (Kern, 2016).

Bioterrorism including biological weapons and bioterrorist attacks, are often come from the 'naturally occurring' emerging and re-emerging infectious disease outbreaks, as the practice and discipline of security has changed markedly over the past two decades, which the 'threats' range from the more traditional (largely military) security.

Military readiness of the impact of influenza epidemics and pandemics have been paid close attention by Governments since at least 1782 (Hirsch 1883, Parsons 1891), while the influenza pandemic of 1918 was erroneously named the 'Spanish Flu' because of fears over signalling military weakness. A 'war disease' reputation was also attracted by influenza in the aftermath of the 1918 Spanish Flu pandemic (Francis 1947). Arriving as it did at the end of the First World War, the pandemic irrevocably linked those two catastrophes. It demonstrated that virulent influenza may be more devastating to human life than war itself (Beveridge, 1977; Potter 1991).

The key trading routes of regions has already proven to be a hot spot for novel infectious diseases SARS, Dengue Haemorrhagic Fever, severe complications from enterovirus and influenza strains such as H5N1 and H7N9, has multiple states in political transition, civil unrest, dormant and active armed conflicts, and has a number of states recovering from armed conflict (Davies, 2013b). Police brutally attacking the public for breaching curfews was appeared in news media during the Ebola virus disease outbreak. Invoking arguments of global health security might



further encourage this kind of violent response (Horton & Das, 2015). The UN Security Council passed an unprecedented resolution calling Ebola a threat to international peace and security, urging an escalated response and an end to travel restrictions, which several states had enacted (Gostin & Friedman, 2015).

## V. Discussion

There have been many significant pandemics recorded in human history, and the pandemic related crises have caused enormous negative impacts on health, economies, and even national security in the world. However the term “pandemic” has a long history, it is still not been defined by many medical texts, and the conception is still changing. But there are some key features of a pandemic, including wide geographic extension, disease movement, novelty, severity, high attack rates and explosiveness, minimal population immunity, infectiousness and contagiousness, which help us to understand what pandemics are.

The negative impacts of pandemic are serious. Pandemics have infected millions of people, causing widespread serious illness in a large population and thousands of deaths. It represents a serious threat not only to the population of the world, but also to its economy. The impact of economic loss can result in instability of the economy, which is through direct costs, long term burden, and indirect costs. The social impacts of pandemics were severe, include travel was strictly limited, and schools closing, markets and sporting were closed. All these are a likely reality should a pandemic with true potential for high morbidity and mortality emerge. A security threat of pandemic influenza as is not a recent phenomenon. Global security is threatened from pandemics, in terms of lives and economic stability

An effective and efficient emergency response can reduce avoidable mortality and morbidity and reduce the types of economic and social impacts. How to have an effective and efficient emergency management will be a critical task of governments to deal effectively with disease outbreak and a pandemic now and future.

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