

The conclusions from COVID-19, The characteristics of the next pandemic and preventive measures

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Abstract. The COVID-19 pandemic has had a huge impact on people's lives, and as we come to the end of this pandemic, we have learned a lot from it. It is important to predict the characteristics of the next pandemic and take preventive measures, and we should take multiple measures to mitigate it.

Keywords: COVID-19, preventive measures, pandemic.

1. Introduction

Pandemic is an outbreak of a disease that occurs over a wide geographic area (such as multiple countries or continents) and typically causes a very large number of infections involving multiple epidemics occurring globally over a prolonged period (months to years). Historically, we have met several pandemic threats including plague, cholera and influenza. They all brought disaster to the population and caused huge death toll. In recent years, the sudden pandemic, COVID-19, has seriously affected the lives of people all over the world. It is a mild to severe respiratory illness that is caused by a coronavirus (Severe acute respiratory syndrome coronavirus 2 of the genus Betacoronavirus), is transmitted chiefly by contact with infectious material (such as respiratory droplets) or with objects or surfaces contaminated by the causative virus, and is characterized especially by fever, cough, and shortness of breath and may progress to pneumonia and respiratory failure. Home confinement due to the COVID-19-related restrictions had led to a variety of unhealthy behaviors, such as the adoption of unbalanced high-calorie diets, an increase in sedentary behavior with a reduction in physical activity, an elevated use of alcohol and tobacco as well as an increase in screen time causing impaired sleep patterns. All of these behaviors can interfere with immunity [1]. In addition to its toll on the physical and mental health of mankind, the pandemic also dealt a blow to the world economy. We do not know how much of an impact the next pandemic will have on us, but it is essential that we anticipate and prevent the next pandemic for the normal activities of the countries of the world, to reduce the rates of infection and death and to avoid a repeat of the tragedy. This article will discuss the following issues:

2. What we have learned from COVID-19

2.1. Firstly, the virus that caused COVID-19, SARS-Cov-2, is more transmissible than other ordinary influenza such as SARS-CoV-1, MERS, H5N1 and so on

Airborne transmission is the main form of SARS-CoV-2 transmission, it is of the explosively transmissible sort and spreads much more quickly and extensive. COVID-19 patients were found to emit millions of SARS-CoV-2 particles per hour, especially during the early stage of the disease [2]. SARS-CoV-2 can be released into the environment via various means such as exhalation, talking, coughing, or other, for example, directly into the air, onto surfaces, or into wastewater [3]. Those deposited on surfaces could be aerosolized into the air again upon evaporation and moving disturbance, while those in the water could also be re-aerosolized into the air, for example, during the toilet flushing process [4]. Its high infectivity makes COVID-19 inevitable.

2.2. Airborne transmission alone did not suffice for pandemic capability

Not like other influenza onward transmission occurring after onset of illness, SARS-CoV-2 infected patients are infectious to others before becoming ill. This made the spread of influenza more covert, and because international communication was very convenient, there were many flights every day from Wuhan, the birthplace of COVID-19, to all parts of the world, the spread of SARS-CoV-2 was even faster in the early stage of the epidemic. Most infected patients do not become ill or mildly so, who render a virus more likely to be transmitted and therefore be more dangerous to populations.

2.3. Low mortality garners little attention or tolerance of countermeasures, which pushes resistance to policies

Although several public health countermeasures had be implemented in nations, only some authoritarian governments managed to contain or keep COVID-19 at bay. In Western countries, some people will not wear masks for liberty, some people reject the vaccination. Therefore, the virus is more dangerous to populations, these factors and how we live made COVID-19 pandemic inevitable.

3. Predict the features of the next pandemic

3.1. Time Characteristics

According to the table of historic pandemic influenza information below, we can summarize that in the 18th and 19th centuries, the time interval between pandemics was about 60 years. However, as time goes on, the occurrence of pandemics has become more frequent and the interval has gradually shortened. In the 20th century, the interval was about 40 years. In the 21st century, the gap between SARS and COVID-19 is less than 20 years. Therefore, we can infer that with the development of transportation, communication and other technologies, countries in the world will communicate more and more frequently and the pandemic will occur more and more frequently. In 20-40 years, that is, in the middle of the 21st century, there may be a new pandemic.

Table 1. Table of pandemic-related deaths worldwide

Year	Estimated worldwide pandemic-related deaths(millions)	Estimated world population(millions)
1729c	0.4	720
1781-82c	0.7	920
1830-33c	0.8	1150
1898-1900c	1.2	1630
1918-20c,d	20-50	1830
1857-58c	1	2860

3.2. Detailed characteristics

With the development of medical testing technology, influenza with obvious symptoms in infected people such as SARS will be quickly identified and its detailed characteristics will be studied and released to the world. Every country, every public health organization will immediately develop strategies and implement measures. The coronavirus pandemic isn't over yet, and a new epidemic, monkeypox, has emerged. Some experts claimed monkeypox would be the next pandemic. But monkeypox was first discovered in 1958, and the symptoms of monkeypox in humans are similar to those of smallpox but milder [5]. Although there is currently no proven safe treatment for monkeypox virus infection, studies have proved that drugs used to treat smallpox can treat monkeypox nonspecifically. Therefore, we have emergency measures to deal with the sudden outbreak of monkeypox. Monkeypox virus is known to be transmitted by contact with infected secretions or lesions such as sex, and there is no known natural reservoir for monkeypox. It's not as contagious as COVID-19, It's not as contagious as COVID-19, and must be spread through close contact rather than through the air, where it can easily be spread. Most of the reported cases have been in homosexual

men, supporting the hypothesis that the virus is sexually transmitted, especially in homosexuality [5]. WHO states that it is unlikely to become a pandemic [5]. On the base of smallpox research and experience, once monkeypox was identified as a pandemic, the world would take adequate measures to stop it.

3.3. Monkeypox

The next pandemic won't be monkeypox, it could be very similar to COVID-19. The virus is probably transmitted by aerosols, also its probable asymptomatic and low morbidity will drive infectiousness upward. As the greenhouse effect warms the planet, ancient viruses could be released from melting glaciers and cause the next pandemic. And the virus that causes the next pandemic is likely to be RNA rather than DNA. Since RNA is a single-stranded nucleic acid, its ability to self-check genes is poor and prone to mutation. RNA polymerases lack the sample-reading ability of DNA polymerases, making RNA viruses more plastic and mutable to their hosts. It has a greater error rate than double-stranded DNA, and its mutations are more likely to go uncorrected. The characteristics of the virus should also include mild virulence, a relatively low human mortality rate, the ability to survive in humans for a long time and infect more people, and the possibility of frequent outbreaks in human populations over several years. The next pandemic could have many characteristics similar to those of COVID-19, and some that are even better for spreading and infecting people. That's why we're calling COVID19 as Disease X No.1 and preparing for Disease X No.2. Research shows that overall species richness within order is the primary driver of pathogen richness among mammalian and bird reservoir hosts, rather than shared biological differences between the taxa within these two vertebrate classes. As such there may be greater homogeneity of zoonotic potential [6], the virus that causes the next pandemic could jump to humans via mammals and birds. We should pay particular concern to animals such as bats, which are natural reservoirs for several emerging viruses. Much evidence suggests that several known epidemics, such as SARS-CoV-2 and MERS-CoV, originated in bats [7].

4. What might be done to prevent or mitigate it as a pandemic event

4.1. WHO warning

Many world organizations and experts are monitoring the harbingers of the next pandemic, with each Public Health Emergency of International Concern (PHEIC), the WHO advises governments on how to deal with the emergency [8]. Although the WHO's guideline on COVID-19 countermeasures were released two months after the outbreak of the virus, which is behind time, countries should improve their countermeasures according to their national conditions instead of blindly ignoring and denying the emerge of the pandemic. For example, last January, WHO director-general Tedros Adhanom Ghebreyesus said of the COVID-19 outbreak, "It is still possible to interrupt virus spread, provided that countries put in place strong measures to detect disease early, isolate and treat cases, trace contacts and promote social-distancing measures." [8] However, some countries blindly avoid causing public panic, or even do not believe the WHO's information, and do not take enough action. As a result, although China has taken sufficient action to contain the spread of the virus and has alerted the world, the COVID-19 pandemic has spread around the world. World organizations such as the WHO should come up with countermeasures to persuade countries to heed its messages and warnings about the pandemic. Tedros has suggested adding a gradient of warnings to the PHEIC, coded by colour. The colours could separate emergencies that might evolve into a pandemic from those that are serious but won't affect nations across the globe. Countries with outbreaks might more willingly share information if there were a low-grade alarm that was less likely to result in disruptions to people's livelihoods or the economy [8].

4.2. Improve the corresponding equipment

As COVID-19 has been effectively controlled, countries should timely summarize experience and lessons, develop and improve corresponding equipment according to their national conditions. Developing countries in Asia, in particular, have high population densities, relatively poor access to diagnosis per citizen, and weak health care and testing systems, contributing to the high mortality rates in these countries during the pandemic. But countries should also learn from the very effective public health measures of many developing countries, such as compulsory masking in public; lockdown non-essential businesses, schools, any large public gathering; shelter-in-place orders for the general public, curfews; testing, tracing and isolation of the infected and their contacts. These measures have effectively protected the national population. The pandemic has clearly catapulted genomic surveillance to center stage. Genomic sequencing has been embraced as part of the essential public health toolbox, driving massive investments in further development of sequencing capacity [9]. Currently, pathogen specific options are developed, developing countries can use country-specific pathogen data for some public health management and develop specific regional programmes. Countries should enable the social and political dimensions to positively influence the public health response. Political ideology is a driver of population risk of COVID infection. Take the United States as an example. Contemporary American society is politically polarized. People of Republican Party have an inherent resistance to government authority, They deny that science/the scientific method is objective truth. In addition, there are religious belief, world view and other factors, These themes cause people to decline a widely available, free, safe, and life-saving vaccination. Hence mortality rates are higher in these areas. It may be a good way to take advantage of the media to actively promote the science popularization, publicize the results of the epidemic prevention and control measures, and show the intuitive data and results after the implementation countermeasures. Countries should maintain close communication and actively share data. The next pandemic may be caused by a completely different pathogen, and it is essential to use a widely watched platform to target all potential infectious agents. There is an increasing call for open sharing of data for the research community, and the European Commission has invested in the European Open Science cloud, building on the long-established infrastructures for biodata [9]. Countries should intensify discussions to resolve issues such as inconsistent data sharing standards as soon as possible and develop a longer-term data sharing strategy. We can also improve the environment, wildlife and vector surveillance. Similarly, there are examples of regional initiatives and projects targeting mosquitos and ticks for surveillance of specific vector borne diseases. Such initiatives could be expanded to not only focus on a single disease, but for detection of a combination of infectious agents of importance and agnostic metagenomics [9].

4.3. Enterprise innovation technology

Each enterprise should continuously improve and innovate its own equipment and technology, so as to timely analyze and research the virus, and produce relevant drugs and vaccines. Every citizen should trust his country, abide by its policies and pay attention to personal health monitoring. Scientists should pay more attention to virus spillovers and virus evolution in animals, especially animals like bats that harbor more zoonotic viruses. This is how the new coronavirus started. The research of Virologist Shi proves parts of the virus spillover hypothesis, dozens bat-borne coronaviruses belong to the same group as SARS. They can infect human lung cells in a petri dish and cause SARS-like diseases in mice [10]. Scientists should further track the dynamics of viruses carried by wild animal populations, derive characteristics of the virome, mutations and data such as metagenomes, and translate sequence data from novel viruses into risk-based assessments to quantify zoonotic potential and facilitate public health actions [7]. So that when the next pandemic emerges, scientists can quickly locate the natural host of the new virus, combine the data from previous studies, make appropriate policies based on its characteristics, and quickly develop corresponding drugs and vaccines.

5. Conclusion

The next pandemic is unknown to us, but when we look at the characteristics of past pandemics, it is easy to see that they are different but have many things in common. We already know a lot about SARS-CoV-2 and the characteristics of the epidemic. All this information can help us predict the characteristics of the next pandemic, and even accurately predict when it will emerge. At the same time, countries should learn from their experiences, pay attention to the world Organization's announcements, take preventive measures, and actively share data to minimize the impact of a pandemic when it arrives. The world will survive the pandemic only if everyone pulls together.

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