

Strategic Analysis on Responding Human Avian Flu and Flu Pandemic in China

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The 20th century has witnessed three global influenza pandemics attacking mankind, namely the 1918 Spanish pandemic (H1N1 subgroup), the 1957 Asian pandemic (H2N2 subgroup) and the 1968 Hong Kong pandemic (H3N2 subgroup). The first pandemic swept throughout the entire world within six to nine months, which affected 400 million people, accounting for 20% of the total world population, and 40 to 50 million deaths which were more than the total deaths in World War I, resulting the worst catastrophe in the history of human infectious diseases^[1]. At the moment, the world is threatened by an avian influenza pandemic and people are concerned about a potential worldwide human influenza pandemic.

I. ANALYSIS OF PROBABILITY OF GLOBAL INFLUENZA PANDEMIC

A global pandemic occurs under 4 conditions: a new subgroup produced by viral mutation or the reestablishment of a subgroup causing a pandemic, general vulnerability among mankind, rapid spread of the disease in populations and the lethal power of the virus on human beings. By now, we have seen none of the subgroups possessing all the four conditions, but the risk is rising constantly. For instance, there have been several massive outbreaks of avian flu in poultry and wild birds since spring 2005, which is a rare case in history. Furthermore, seasonal migration of wild birds has triggered a widespread prevalence of bird flu across the Asian and European Continents. In Asia, human avian influenza cases have been reported. Some are clusters of cases and new cases have recently been detected in Turkey. There is evidence that the flu virus is mutating at a higher rate, the risk of sudden emergence of a new subgroup increases, and some of the subgroup causing pandemics in the past also poses a threat.

Moreover, biological terrorism, either caused by accident or committed purposefully, is another capable trigger of a pandemic. The hazardous

misdelivery of flu virus samples by the American Pathologist Association to 5000 labs around the world in 2005 was an example, which fortunately did not result in a major disaster thanks to early detection and timely management^[2].

In a word, the risk of a flu pandemic to attack mankind increases. On the one hand, scholars believe that the fulfillment of all the conditions is only a matter of time, and it is wise to assume that the 'wolf' is on the way and preparation must be made as early as possible. On the other hand, although the number of human cases increases, there is no evidence that it transmits from human to human transmission. Further development of the virus needs close observation.

It is also possible to prevent and control the pandemic. Nevertheless, no one can assure that the 'wolf' would hit ruthlessly when we are worn out on alert and become absent-minded. Therefore, when a disease as influenza is capable of killing millions in a single pandemic, our alert must never be eased.

II. POTENTIAL THREAT OF INFLUENZA PANDEMIC TO CHINA

China has to be particularly on alert for the following reasons: high population density, long border lines, frequent domestic and international human communications, and existence of several cross-border migration routes of wild birds through the Chinese territory. No matter where the pandemic starts, it easily enters and rapidly spreads throughout the country. Additionally, China has a huge number of poultry, and an environment where human beings, land poultry (chicken, turkey), water fowls (duck, goose), and pigs coexist. This may help different flu viruses hybridize and recombine in human and various animals, producing a mutant to threaten human beings. Biologically, it cannot be ruled out that a new subgroup might first appear in China. Therefore, China must be on alert and get prepared as a frontline country for the global pandemic.

The present ecological environment in poultry

breeding should be improved. The breeding patterns should be reformed by implementing such measures as sorted and concentrated raising and slaughter of poultry (livestock). This also helps to prevent and manage other zoonoses.

The largest population means the most vulnerable people. Once a global pandemic breaks out, China may have the highest morbidity and mortality. Moreover, the logistic demands (vaccines, medications, medical equipment, masks, *etc.*) to address a flu pandemic are tremendous. The resource and financial pressures are huge. Shortly after the pandemic prevails, a large number of patients will emerge without effective precautions, which soon outnumbers the hospital capacity. After infection, the aged and those with chronic diseases and defected immunity easily turn into severe cases with a high mortality rate. Children are the most susceptible and have a long infective period and therefore are a significant infection source. Young and middle-aged people having frequent social activities, may account for the largest number of excess death. Some key sectors may not be able to function properly in a short period due to massive sick leave. For example, hospitals, systems for water and power supplies, transport, TV and radio, and material supply sectors may become disabled, which in turn paralyzes the normal activity of community. The development processes and severities of the above incidents should be fully considered in making emergency pre-document.

III. EFFECT OF POULTRY VACCINATION ON HUMAN AVIAN INFLUENZA

Prevention and treatment of avian flu epidemics are the first defense against flu pandemic, which has been initiated very early in China. In the past, surveillance, detection and slaughter began after avian flu epidemics in many countries. China has dealt with it in a different way by taking routine measures of vaccination, surveillance, detection and slaughter. The vaccination is additional. Currently, three domestically-developed vaccines are used in China to vaccinate the poultry on large- and medium-sized poultry farms.

China has more than 40% of the poultry raised in Asia. Thanks to vaccination, the number of avian flu outbreaks in China has been less than 2% of the total outbreaks in Asia during recent decades, indicating that the vaccination strategy is effective. Facts have shown that decreased epidemics of avian flu can lead to smaller chance of human avian influenza. This explains the fewer cases of human avian flu in China than in certain neighboring countries, under the

similar ecological circumstances.

The practice of vaccination for large- and medium-sized poultry farms has greatly reduced large avian flu epidemics. Instead, only sporadic cases of slow transmission has occurred on a small scale. The minor prevalence often takes place closely to the farmers. Since the number of sick or killed poultry is small, it is not typically detected or reported. In this way, the prevalence may last for days, weeks or even longer, exposing many people to the sick (dead) birds, which has become the main route of transmission from birds to humans. However, the transmission of bird flu among poultry populations is affected by the farm environment where the birds are kept, the extent of the prevalence may be limited and the prevalence may go out automatically. It happens that when there are human cases, agricultural authorities cannot find any dead birds or detect any virus in the poultry alive. Therefore, in terms of prevention and treatment strategy based on the development of the epidemic, vaccination should be strengthened for the poultry on backyard breeding, and surveillance strengthened for the sick (dead) poultry on backyard breeding, in order to put out the prevalence and reduce human cases.

As discussed above, making and implementing correct strategy and tactics, like commanding a battle, are essential for victory. In disease response, the most effective prevention requires a scientific strategy and cross-sectoral cooperation.

IV. STRATEGY ANALYSIS OF INFLUENZA VACCINATION AND ANTI-VIRAL MEDICATION IN RESPONSE TO INFLUENZA PANDEMIC

The most effective measures to prevent influenza and respond to a pandemic are flu vaccination and anti-viral medication, which are discussed in three aspects.

Firstly, the best choice is to use influenza vaccination as the major prevention measure if the vaccine is effective. Flu virus is a 'spear' while the vaccine is a 'shield'. The current vaccine research and development are targeted on the H5N1 subgroup because this subgroup is currently considered the most likely 'spear' to attack humans. The process of research and development also deepens our scientific understanding about the virus, which enriches the theory, experience and technique. If the developed vaccine is effective, we are ready for the attack.

Secondly, the future war between human beings and influenza still has many variables. As is well known, since flu virus mutates frequently, the vaccine developed now may fail to match the virus strain in the coming pandemic. It is also likely that the speed of our vaccine research and production is not able to

catch up with the virus' mutation rate, because it usually takes three to six months to develop a new vaccine after a new subgroup is detected, and even longer for further mass production. The 1918-1919 flu pandemic swept throughout the USA within three weeks^[3]. Once the new pandemic takes place at such a speed, there is definitely no time to develop, produce, and distribute the vaccine. Therefore, we must be well aware of this risk and not solely depend on vaccination. Otherwise, the dedicatedly developed vaccine may well become the Maginot line in the Second World War.

Lastly, use of vaccine is different from its research and development. Successful development of a new vaccine means one more weapon at hand, but how to use it should be decided based on the epidemic information and the situation of the threatened populations. The principle is to achieve the highest group prevention and control effect at the lowest cost. In another word, research relies on sciences while good use depends on wisdom.

Of all anti-flu drugs, Tamiflu exerts its most protective effect if taken within 48 hours following contact^[4]. Every country should have its stockpiles in place and China needs a lot. However, another big problem is to ensure the vast number of people who receive the medication within 48 hours after contact, which will limit efficacy after the deadline. Compared with the total global demand, the current production capacity of Tamiflu is inadequate. Moreover, drug resistance of Tamiflu has been reported in foreign countries^[5], and its effectiveness on the future epidemic strain is unpredictable. China needs to take rapid steps to research and develop more effective anti-viral drugs. Traditional Chinese medicine may also play a greater role.

V. COMPREHENSIVE RESPONSE TO ISOLATION IN FOCUS AS BASIC PREVENTION AND CONTROL STRATEGY

Comprehensive response to isolation in focus refers to a set of measures including isolating the infection source, opening windows for ventilation and improving health in case of an epidemic outbreak, as well as closing schools, shutting down factories, companies and quarantining communities when necessary. It is the only immediate measure available against a pandemic. In fact, this approach has many advantages: such as no funding, readily available at any time, immediate effect, and never out of date. Even if only 50% of the infected individuals are isolated, it can effectively delay and suppress the epidemic peak, slow down the transmission and reduce the mortality by over 80%. This method not

only helps family members with the mutual care between patients, but also relieves hospitals from the difficulties caused by highly concentrated services. More importantly, it buys the precious time for preparation of the entire population. It gives time for organizing and mobilizing the community, and makes it possible to produce more vaccines and anti-viral drugs. It may even cut the chain of transmission. It seems the most likely major measure China should take in early response to a pandemic. For good practice, the lessons learnt during the 2003 SARS outbreak are worth noting.

VI. LEARNING FROM LESSONS DURING SARS RESPONSE IN CHINA

Compared with SARS, influenza has much stronger infectiveness. Flu pandemic is mainly carried by aerosol with a greater risk than the droplet route of SARS transmission. SARS infectivity concentrates on the phase of severe symptoms and is easily affected during stays in hospital but its transmission in community is difficult. In contrast, influenza is infectious during both the latent and onset phases, which makes outbreak of epidemics highly in families, workplaces, schools, kindergartens, nursing homes as well as hospitals. For the response to flu pandemic, the success stories and lessons learnt during the SARS outbreak in China should be referred to in establishment of a prevention and control mechanism mobilizing the entire community and multi-sectoral coordination under government leadership. There must be a consistent, timely and transparent epidemic forecast. Information system and education and training should be widely provided. Rigorous isolation should be implemented in case of early detection. The intimate contacts should be under close observation and prophylactic medications should be administered early for the contacts if available. In case of further prevalence, decisive actions must be taken to shut down schools, companies and factories. If necessary, hospitals should classify patients according to their severity, focus resources on caring for severe cases and hospital infection must be prevented. If resources are available, families should set up a home ward to isolate the infected individual immediately^[6].

Experience tells us that flu pandemic is an international issue. Now China has strengthened its cooperation with WHO and pays special attention to the global influenza surveillance. We must collect the information on global epidemics timely and improve our analysis and interpretation of epidemic data. Once when virus mutation and human-to-human transmission are confirmed anywhere around the

world, our strategy and preventive measure should be adjusted and improved accordingly. China is ready to offer a helpful hand to those countries in need and to accept necessary international assistance.

Because of the uncertainty in the time, location and transmission characteristics of the future pandemic, we must keep the pre-document updated.

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