

Building and Promoting the System of Chinese Food Security and Public Health: A Study on System Challenge as the H7N9 Virus Booming in China

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Abstract. Food security paid great attention in all countries all over the world to supervise and manage the food. The State Council of People's Republic of China issued "The Decision of Further Strengthening Food Security" instantly after the H7N9 virus was first discovered at Shanghai, China. The food security involves in many sectors, levels and segments. China should build the system of law; unify the system of adjustment and clarify the inspection system of authority and responsibility; establish the system of emergency; promote the criterion and inspection system of food security; establish the systems of risk evaluation and information; And setup research institutes in order to improve the level of food security and public health as soon as possible. Besides, in this paper, it's most interesting that a U-curve trend has been discovered about the connection between food security and human death during the past fifteen years. There are some complicated reasons for this worrisome trend. In the end, the authors summarize the lessons we should learn from the H7N9 virus outbreak in China and point out the possibly directions in the future.

Keywords: Food Security, public health, Avian Influenza A (H7N9) Virus, live poultry market, system

1. Introduction

Four years after the global pandemic of H1N1 influenza, a new type of avian influenza, H7N9, is emerging in mainland China. The avian influenza A (H7N9) virus, a phylogenetic patch work of viruses from Chinese ducks, chickens and brambling birds, appeared around February 2013 in humans in China, infected about 126 and killed 24 individuals up-to-date, with the international medical community, food security community and public health community being quickly and seriously on alert.

2. Data Collection and Analysis

On March 29, 2013, the Chinese Centre for Disease Control and Prevention completed laboratory confirmation of three human infections with an avian influenza A (H7N9) virus not previously reported in humans [1]. These infections were reported to the World Health Organization (WHO) on March 31, 2013, in accordance with International Health Regulations. The cases involved two adults in Shanghai and one in Anhui Province. All three patients had severe pneumonia, developed acute respiratory distress syndrome (ARDS), and died from their illness [2]. The cases were not epidemiologically linked. The detection of these cases initiated a cascade of activities in China, including investigations to identify the sources of infection.

As of April 29, 2013, China had reported 126 confirmed H7N9 infections in humans, among whom 24 (19%) died [1]. Cases have been confirmed in eight contiguous provinces in eastern China (Anhui, Fujian, Henan, Hunan, Jiangsu, Jiangxi, Shandong, and Zhejiang), two municipalities (Beijing and Shanghai), and Taiwan (Fig. 1). Illness onset of confirmed cases occurred during February 19–April 29 (Fig. 2). The source

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of the human infections remains under investigation. Almost all confirmed cases have been sporadic, with no epidemiologic link to other human cases, and are presumed to have resulted from exposure to infected birds [3], [4]. Among 82 confirmed cases for which exposure information is available, 63 (77%) involved reported exposure to live animals, primarily chickens (76%) and ducks (20%) [3], no matter they are alive in poultry markets or are raised at home.

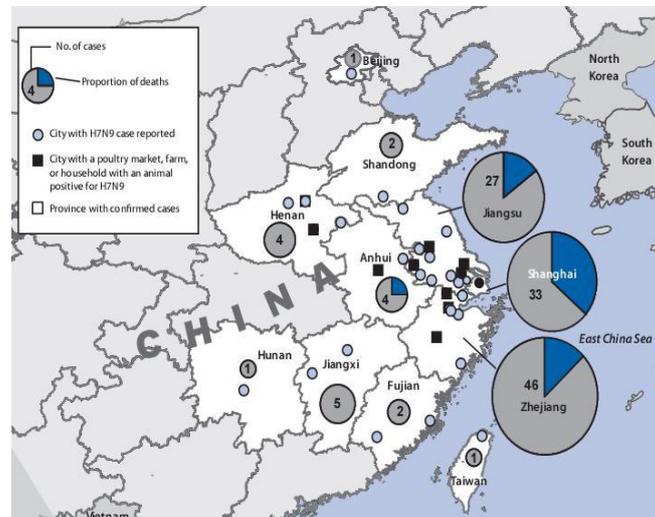


Fig. 1: Location of confirmed cases of human infection (n=126) with avian influenza A (H7N9) virus and deaths (n=24) — China, February 19 – April 29, 2013 [5]

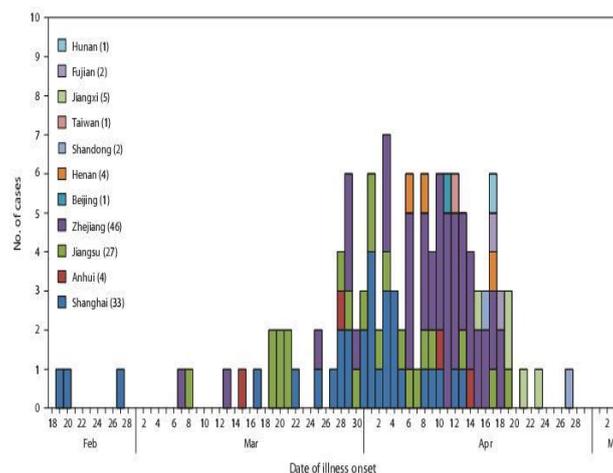


Fig. 2: Number of confirmed cases of human infection with avian influenza A (H7N9) virus (N=126), by date of onset of illness and province, municipality, or area – China, February 19 – April 29, 2013 [5]

Chinese public health officials have investigated human contacts of patients with confirmed H7N9. In a detailed report of a follow-up investigation of 1,689 contacts of 82 infected persons, including health-care workers who cared for those patients, no transmission to close contacts of confirmed cases was reported, although investigations including serologic studies are ongoing [3]. It was proved in another way experts were always arguing about that the H7N9 viruses were contained only in live animals (especially birds and poultry) or their meat for food that was not fried or roasted in high temperature or long enough.

As of April 26, reports from the China Ministry of Agriculture indicate that 68,060 bird (including wild and farm birds) have been tested, 46 (0.07%) were confirmed H7N9-positive by culture [6]. The H7N9 virus has been confirmed by using capture and recapture method in chickens, ducks, pigeons (feral and captive), and environmental samples in four of the eight provinces and in Shanghai municipality (Fig. 1). As of April 17, approximately 4,150 swine and environmental samples from farms and slaughterhouses were reported to have been tested; all swine samples were negative. The China Ministry of Agriculture is jointly engaged with the National Health and Family Planning Commission in conducting animal sampling to assist in ascertaining the extent of the animal reservoir of the H7N9 virus. Sampling of animals is concentrated in the

provinces and cities where human cases have been reported. Poultry markets in Shanghai and other affected areas have been temporarily closed, and some markets might remain closed [5]. Foods that made of chickens, ducks, pigeons or all kinds of birds and poultries have been forced off the supermarkets' food shelves as well.

3. Connection between Live Poultries and Human Infection with H7N9

In order to specify the connection between live poultries and influenza A (H7N9), randomly cases were selected (n=12) from all H7N9 patients. As of 10 May 2013, twelve influenza A (H7N9) cases (four were male and eight were female) were confirmed (Table 1). As of 30 April, two of them had died, four had recovered fully, two were recovering and the other four remained critically ill (Fig. 3).

Nine of the 12 cases had visited nearby live poultry markets at least once (range: 1–10 times) during the 10 days before symptom onset without any other chance to contact with other bird (Table 1). Of these nine cases, four (Cases 4, 5, 6, and 8) had had direct contact with live poultry with H7N9 virus during this time. Although three patients had not directly visited poultry markets, they all had a history of direct contact with live poultry during the 10 days before symptom onset. Case 7 was exposed to live poultry as part of a government campaign to cull poultry at live poultry markets (That's why the results listed the date of his visit at the Table 1). Case 9 and her neighbour had purchased 12 chickens from a chicken vendor and had raised them in the same courtyard for about 20 days. Case 9 killed her seven chickens when she found that one of them had become ill. For Case 11, her husband purchased four live chickens from a market on 8 April and raised them at home. On 10 April, because the chickens developed an acute illness, the patient gave them antibiotics.

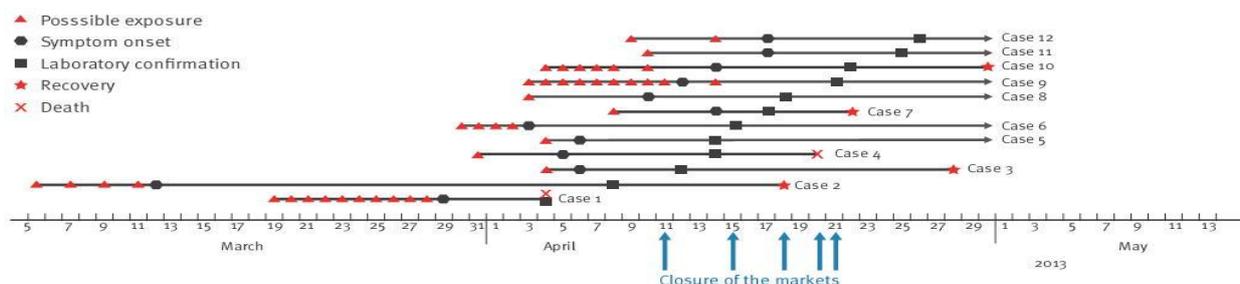


Fig. 3: Timeline of laboratory-confirmed influenza A (H7N9) cases, China, February 19 – April 29, 2013 (n=12)

Table 1: Demographic and Exposure Information of Influenza A (H7N9) Confirmed Cases, China, 2013 (n=12)

Case number	Sex	Age (years)	Visits to live poultry markets during 10 days before symptom onset	
			Date of last visit (2013)	Number of visits
1	Male	64	NA	10
2	Female	50	NA	4
3	Female	54	NA	1
4	Female	61	31 March	1
5	Female	64	4 Apr	4
6	Female	66	30 March	4
7	Male	41	8 April	0
8	Female	66	3 April	1
9	Female	81	None	0
10	Male	32	NA	6
11	Female	60	None	0
12	Male	38	NA	2
Total	–	–	–	33

Experts [7] present solid evidence that the human infecting H7N9 viruses are directly from the live free markets, where some patients visited before falling ill. In accordance with a report in The Lancet [8], the work also shows the avian-signature sequences from the environment where chickens are kept in the free market and human-signature sequences in the patients, implying the in-vivo micro-evolution and host adaptation during the outbreak and infection.

Table 2: Serious Influenza A (H7N9) Cases Reported in Six Provinces of Mainland China, and Corresponding Population Denominators, China, February 19 – April 29, 2013 (Population Sizes Obtained from the 2010 Population Census of the People’s Republic of China, Published on the Official Website of National Bureau of Statistics of China [9].)

Province-type	Age group (years)						
	0-14	15-24	25-34	35-44	45-54	55-64	≥65
Number of serious influenza A(H7N9) cases							
Anhui-urban	0	0	0	1	0	2	0
Beijing-urban	1	0	0	0	0	0	0
Henan-rural	0	0	1	1	0	0	1
Jiangsu-urban	0	1	3	1	3	4	6
Jiangsu-rural	0	0	1	0	1	0	2
Shanghai-urban	2	0	1	1	5	5	19
Zhejiang-urban	0	0	0	5	2	6	11
Zhejiang-rural	0	0	0	1	1	3	7
Population size							
Anhui-urban	1,617,392	2,299,994	1,965,849	2,512,466	1,671,583	1,135,834	979,469
Beijing-urban	1,311,411	2,968,261	3,513,686	2,657,513	2,278,771	1,485,603	1,347,970
Henan-rural	13,341,020	9,674,352	6,711,837	9,040,458	7,264,034	6,516,703	5,261,768
Jiangsu-urban	3,390,036	6,004,427	5,389,879	5,658,879	4,150,560	3,042,830	2,529,855
Jiangsu-rural	4,421,789	4,517,515	3,459,924	5,406,568	4,789,994	4,443,849	4,249,814
Shanghai-urban	1,483,687	2,821,598	3,660,496	2,797,231	2,809,896	2,267,794	1,800,140
Zhejiang-urban	2,449,320	4,004,494	4,044,383	4,062,503	2,768,791	1,707,271	1,349,532
Zhejiang-rural	2,888,769	2,448,074	2,676,907	3,835,297	3,477,935	2,840,965	2,708,735

About half of the infected people are above 65 years old (Table 2). This may be the proper reason to explain why most of the infected people are more than sixty. A non-governmental investigation showed that more than 50% of old women and men prefer to buy live chickens, ducks and pigeons for their daily meal while it’s only 5% for youth. One of the reasons is for the low price while the other reason is about fresh and reliable ingredients in their own minds. Some of these aged infected even went to live poultry market five to six times a day.

This raises the possibility of zoonotic H7N9 virus transmission from healthy-appearing bird or poultry to humans through direct or close contact or through exposure to environments that are contaminated with infected bird or poultry. For example, visiting a live poultry market, where avian influenza A (H7N9) viruses can be maintained and amplified.

The avian influenza A (H7N9) virus can survive a long period in cool and wet condition as the live poultry markets provide. The secretions and faeces is with infectious H7N9 virus which can be maintained for up to 30-50 days at 4°C. It will shorten to about seven days surviving as the environment changes to 20°C and at most one minute if the temperature raises to 100°C.

A preventive campaign has already been initiated by the Chinese government by closing poultry markets and by covering public spaces with image-rich posters passing on the message to stay away from poultry and how to wash your hands correctly before each meal.

4. Discussions

The State Council of People’s Republic of China issued “The Decision of Further Strengthening Food Security” instantly after the H7N9 virus was first discovered at Shanghai, China. According to avian influenza A (H7N9) outbreak in China, we notified that the food security is still a big problem the government should focus on and need to be improved seriously in some important aspects.

4.1. Establish and Improve the Legal System of Food Security

The content of the legal system of food security still need to be improved. It hasn’t covered on most of the problems that resulted from economic, social and technological development in the new situation and emergency environment. Compared to the developed countries, China is lack of a series of important rules in food security systems, such as food security emergency response mechanism, food security risk evaluation system and food security information release system.

4.2. Establish and Improve the Management and Supervision System of Food Security

The system structure could be changed. Firstly, it's considerable to make a breakthrough to the management structure about inter-ministerial coordination meeting of the food security. Establishment of the State Council Food Security Commission can be one of the possible solutions. The organization is supervised by the central government so as to coordinate and manage the relevant administrative departments. The State Council Food Security Commission will be directly held by the Prime Minister or the Deputy Director of the Prime Minister and made up of several important departments, such as the Ministry of Agriculture, the National Health and Family Planning Commission, the State Food and Drug Administration. The main responsibilities of the State Council Food Security Commission will be: (a). to consider food security regulations or rules; (b). to revise identified food security policy; (c). to consider the general plan of national food security development; (d). to identify the major issues need to be reported to the State Council; (e). to coordinate departments to establish and implement food security quality management; (f). to guide departments, regions and the whole community to support and participate in food security promotion. In addition, provinces and autonomous regions and municipalities shall establish a local Food Security Commission with the corresponding institutions.

4.3. Establish a More Comprehensive Food Security Emergency Response System

The advantage of centralized system is easy to show instructions and response quickly while accident happens, but that's not enough. At present, it is necessary to establish a more comprehensive food security emergency response system on China's food security supervision. It didn't mean to hold a joint meeting to determine the emergency treatment plan as what we did now. The process of food security emergency management consists of three stages: the stage before the accident, the stage during the accident and the stage after the accident. We need to establish the appropriate system for each different stage. The establishment of systems for emergency management shall be carried out around several keys: emergency information collection, emergency prevention, emergency preparedness, emergency drills, damage control and the subsequent recovery. According to these keys, we need to establish emergency planning system, emergency training system, emergency sensing system, Emergency Command Centre (including policy makers and think tanks, emergency response teams and emergency response specialists), emergency monitoring system and emergency resource management system. The management objective of the first stage before the accident is to eliminate the potential risk ahead of its outbreak. To the second stage, which occur during the accident, the main purpose is to control the calamity to the minimum range. At last, subsequent recovery and psychological reconstruction are two important tasks the system mainly focuses on of the third stage after the accident.

4.4. Increase Input of Research and Application on Food Inspection

Food inspection should follow the improvement of the revised testing standards no matter in the farm or on the table. As an important method for both internal self-monitoring and external supervision, food inspection can exert an influence on food quality and safety. The demands on detection techniques will grow with increasingly undetected viruses. It should be high-tech, high-speed, portable and information-sharing. In the past ten years, the government has put a certain amount of spending on food inspection and testing equipments. We should continuously increase input of research and application on food inspection, especially for the research on high-speed equipments as it is widely used nowadays.

4.5. Establish and Improve Food Security Risk Evaluation System

Food security risk evaluation has an important significance in food security research, supervision and management. It has been a long time that legislation of our food security supervision is based on unsafe food. These traditional practices are lack of preventive measures so that we cannot make timely and rapid control to the existing and possible risks on food security. China must establish a set of evaluation system to decrease the possibility of disease outbreaks by food and strengthen the risk evaluation of food-related chemical, microbiological and new food-related technique so as to gradually build our own food security evaluation system.

4.6. Establish Food Security Information Monitoring and Reporting System

After a series of serious food security accidents in recent years, the government has realized the importance of food security information monitoring, collection, use and reporting. It has been decided by the government to speed up the construction of food security informatization and strengthen the food security information management and utilization. Therefore, we should build the interdepartmental communication platform as soon as possible to realize interaction and information-sharing. It's also very important to establish a smooth flow of information and communication network to gradually form unified and scientific food security information evaluating and warning system. It can help to make early detection, prevention, remediation and settlement to the food security issues for the government at the first time.

4.7. Connection between Food Security and Human Death

The total number of people died for food (including virus food, poisonous food, fake food, excessive food and food allergy, etc.) is reported by Chinese government annually from 1992 to 2006 (Fig. 4). We can easily discover the high-low-high U-curve in the past fifteen years and forecast the trend of explosion numbers in the future from the figure. This figure shows the number of reported accidents of food death has been obviously doubled in 2003, which was mainly due to the depressed trend of food security situation since 2002. There are some complicated reasons for this worrisome trend, such as the exceeding expansion of the food industry, changes in market vicious competition, changes in food policies in different periods and so on, which are not our main topics here while we would probably discuss in another paper.

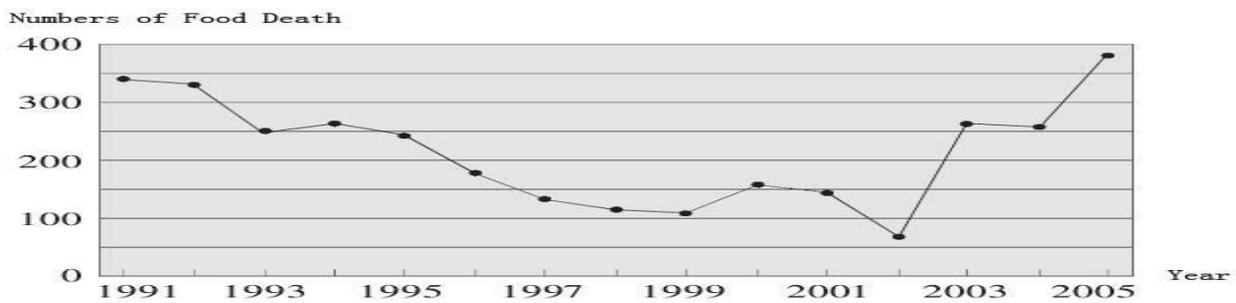


Fig. 4: U-curve Trend: This figure is made of investigation results from “China Health Statistical Yearbook” (1992 – 2006). The yearbooks have contained figures from 1992 to 2006 while the government would not officially release these figures annually any more since 2007

5. Conclusion

China is once again back in the spotlight with the H7N9 virus outbreak, which will be a test not only for its health system, but also for its food and agricultural systems. H7N9 presents China with the opportunity to prove its openness and ability to rapidly share information from its well-developed surveillance capacity and food security system, although it's not strong enough and still have a lot to be improved.

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