

Current Situation and Comparative Study of The Early Warning and Information Reporting System of Infectious Diseases in China --Introspection From COVID-19

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Abstract: The coronavirus disease is a public health emergency that has seriously affected a large number of patients and spread widely. Since the first case was discovered in Wuhan, Hubei, China's achievements in fighting against the pandemic have been highly praised all over the world. However, there are still some deficiencies in the early warning and information reporting system of infectious diseases. This paper makes a horizontal comparison between foreign legislation, measures and Chinese mode, traces back to the emergency response system of "SARS" in 2003, analyzes and discusses the advantages and disadvantages of the current early warning and information reporting system of infectious diseases in China, and puts forward my suggestions on its development prospects, hoping to promote further improvement of prevention and control system and comprehensive control ability of infectious disease. By using the method of comparative analysis, I focus on the reporting system of infectious disease information between Canada and China. I also adopt the analytical thinking of historical research, reviews the emergency measures against SARS, points out its limitations, and affirms the progress in prevention and control systems and the ability to deal with infectious diseases over the years. Based on systematic analysis, I come to the following conclusions. Firstly, China has established and improved the nationwide early warning and information reporting mechanism for infectious diseases. Secondly, compared today's specific measures with Canada and China during SARS period, the current early warning and information reporting system for infectious diseases is superior and progressive. Thirdly, there is sort of problem existed in relevant laws and regulations, such as confusion in responsibility entity, unclear responsibility, inadequate provisions and weak operability. For example, it takes much time and effort to report information layer by layer. Besides, CDC's power is limited, "whistleblowers" rights are not fully guaranteed, and the early warning timeliness is poor. Fourthly, we need to further advance the epidemic early warning system, clarify the functional position of CDC, rely on scientific and technological means to expand information channels, and optimize the reporting process of infectious disease cases.

1. Introduction

China's overall response to the coronavirus disease has shown that the government's ability to unify and coordinate is far better than that of most Western countries, with efficient construction of medical facilities, strong supply of materials, timely follow-up of support, and a dual approach to epidemic prevention and control and economic development. However, the remarkable achievements cannot conceal the shortcomings of the infectious disease prevention and control system. It is crucial to review the shortcomings revealed in the process of epidemic prevention and control governance and to take COVID-19 as an opportunity to explore the room for improvement to continue the modernization of the national governance system and governance capacity. The shortcomings of the infectious disease prevention and control system are mainly in the scope of the infectious disease early warning and information reporting system. Based on this, in the following lines, I will focus on the current situation of the early warning system and information reporting system of infectious diseases in China. In the

following paper, I will focus on the current situation of China's infectious disease early warning system and information reporting system, and start a comparative observation from two perspectives: foreign comparative method and the emergency prevention and control method of SARS in 2003, to grasp the advantages and shortcomings, progress and limitations of China's current infectious disease early warning and information reporting system as a whole.

2. Status of China's infectious disease warning and information reporting system

2.1 Overview of the current situation

After the outbreak of SARS in 2003, China spent \$730 million to establish a nationwide information system for monitoring infectious diseases and public health emergencies (referred to as the network direct reporting system.) In April 2008, 31 provinces (autonomous regions and municipalities directly under the Central Government) generally operated the national automatic early warning system for infectious diseases, establishing an automatic warning and response mechanism. To date, China has established and built a national infectious disease early warning system, a national infectious disease reporting information management system, a national infectious disease network direct reporting system (NNDRS), a four-level population health information platform, and its data exchange platform, and a hospital HIS system. It realizes the functions of automatic analysis of surveillance data, real-time identification of Spatio-temporal aggregation, sending of early warning signals, and real-time tracking of corresponding results for 39 infectious diseases, which is a leading position in the world.

Although the infectious disease early warning and reporting system has taken shape, it still appears to be somewhat overwhelmed and stretched when faced with the challenge of sudden major public health events. In practice, the aforementioned network direct reporting system for infectious diseases failed within the first 28 days after the outbreak - before the new function went online on January 24, reporting of outbreak information was mainly done verbally, by mail, and by phone. The root cause of the failure to report the true status of a large number of patients with unexplained pneumonia and the failure to report all suspected patients found in outpatient clinics was a loophole in the case reporting mechanism. The current early warning system is essentially a rule-based model that can only detect and warn of known diseases and is useless for new major infectious diseases.

2.2 Loopholes in the current laws and regulations

(1) Confusing subjects and unclear responsibilities

The statutory subjects of the obligation to release epidemic information are not comprehensive. Both the Prevention and Control of Infectious Diseases Law and the Regulations on Emergency Response to Public Health Emergencies stipulate that the health administrative departments of the State Council and the health administrative departments of the people's governments of provinces, autonomous regions, and municipalities directly under the central government should publish information on epidemics and disclose information on emergencies, but they do not cover the governments of prefecture-level municipalities and provinces, autonomous regions and municipalities directly under the central government [1]. This creates a legislative loophole for local governments to rigidly interpret the law and shirk their responsibility to publish information.

The provisions on the subject of early warning are equally flawed. The Prevention and Control of Infectious Diseases Law defines the subjects of early warning as the National Health Commission and provincial governments, giving provincial governments the power to issue and publish early warnings. Article 43 of the Emergency Response Law authorizes "local people's governments at all levels above the county level" to "issue warnings at the appropriate level". This is in contradiction with the provisions of the Prevention and Control of Infectious Diseases Law. To resolve this contradiction, the principle of applying the new law over the old law must be adopted - the Emergency Response Law adopted in 2007 should take precedence over the Infectious Diseases Prevention and Control Law enacted in 2004 [2].

(2) Inadequate relevant provisions

The Law on Prevention and Control of Infectious Diseases, the Emergency Response Law, and other laws and regulations simply stipulate that the issuance of infectious disease warnings should be public and timely, and make macro planning for the institutional mechanism and system framework of early warning, but do not make detailed provisions for specific early warning procedures, methods, and operational processes, so there is more room for improvement and refinement. The National Public Emergency Response Plan is relatively complete, but it is an administrative rather than a legal document in nature [3]

Although there is no shortage of legal documents that provide for an early warning system for infectious diseases, they do not match each other well, were enacted at different times and for different legislative purposes, and are not fully consistent in some concepts, applicable subjects, and procedures. In addition, the relevant legal provisions are not sufficiently clear, operational, or detailed.

3. Epidemic Prevention and Control in the Perspective of Comparative Law

I have compared the reporting system of infectious disease information in Canada and China horizontally, and here is a brief introduction for readers.

3.1 Comparison of the reporting process

The legal subjects of responsible reporting under Chinese law include medical institutions at all levels, disease prevention and control institutions, blood collection institutions, etc. The responsible epidemic reporters include personnel performing duties and rural doctors, individual practitioners, etc. The responsible reporter should fill out the infectious disease report card immediately after the first diagnosis of an infectious disease patient and report the infectious disease report card directly through the network within 2 hours, then the information reported directly will be examined and verified by the designated professional institution and entered into the national database. If network direct reporting is not possible, the infectious disease report card should be sent within 2 hours to the local disease prevention and control agency at the appropriate level by the fastest means of communication (telephone, fax) and sent out within 2 hours. The health administrative department that receives the report of information related to public health emergencies should organize relevant experts to conduct an on-site investigation as soon as possible, and if it is confirmed that a public health emergency has occurred, it should organize corresponding measures promptly according to different levels and report to the people's government at this level within 2 hours, while reporting to the health administrative department of the people's government at the higher level. If the standard of public health emergencies has not yet been reached, the professional prevention and control institutions shall follow closely the development of the situation and report the changes at any time. The specific operational processes are shown in the following diagram (Figure 1).

Directly push infectious disease outbreak reporting process based on hospital electronic medical records

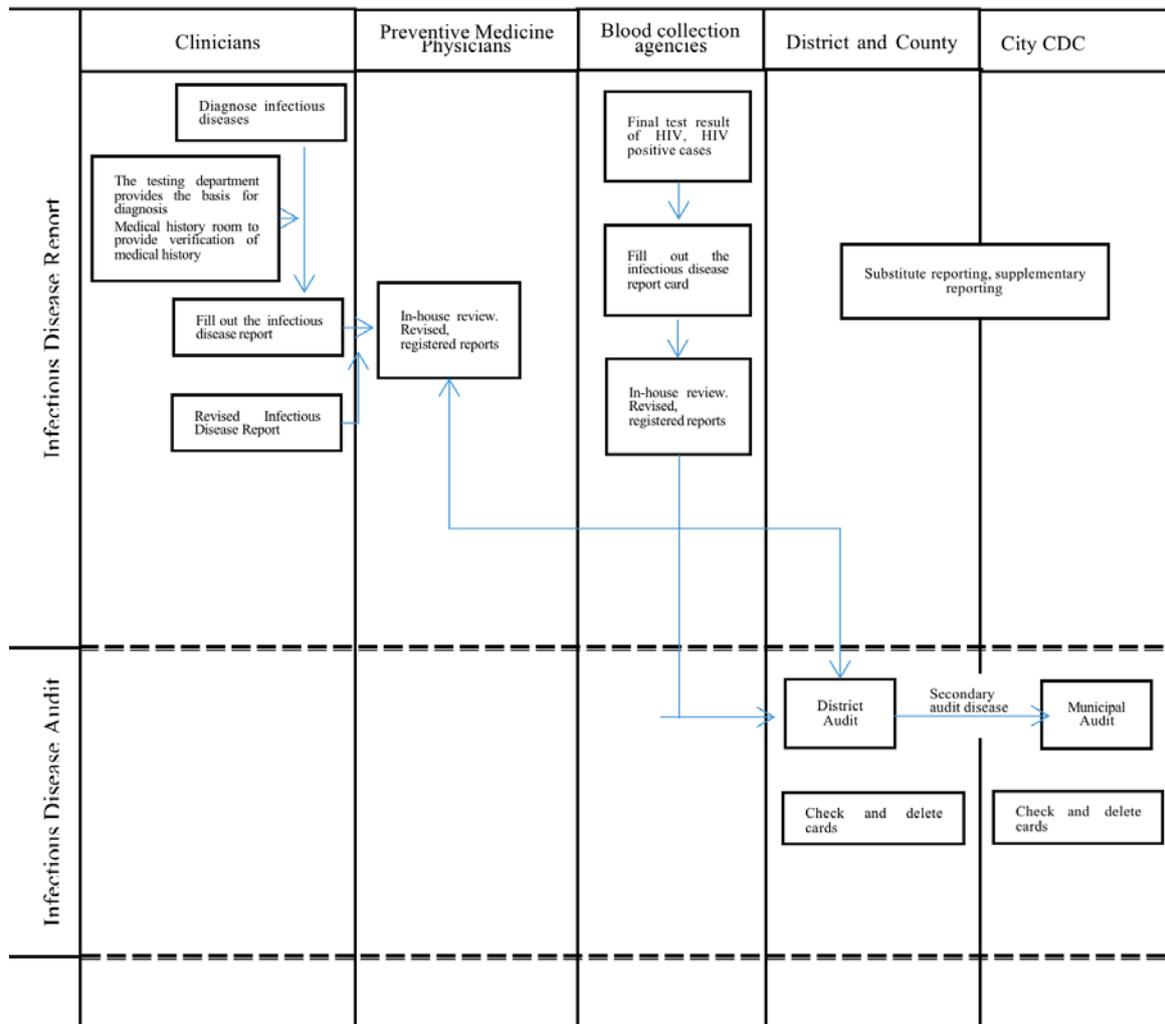


Figure. 1 Flow chart of direct reporting of infectious disease epidemic with the direct push of hospital electronic disease history

Canada also has an outbreak reporting system that involves a hierarchy of reporting and review at each level. The main official agencies involved in the reporting system at different levels are NFP, National Focal Point; NML, National Microbiology Laboratory; PAHO/WHO, Pan American Health Organization/World Health Organization; PHAC, Public Health Agency of Canada; Prov. lab, Provincial Laboratory. The specific operational processes are shown in Figure 2.

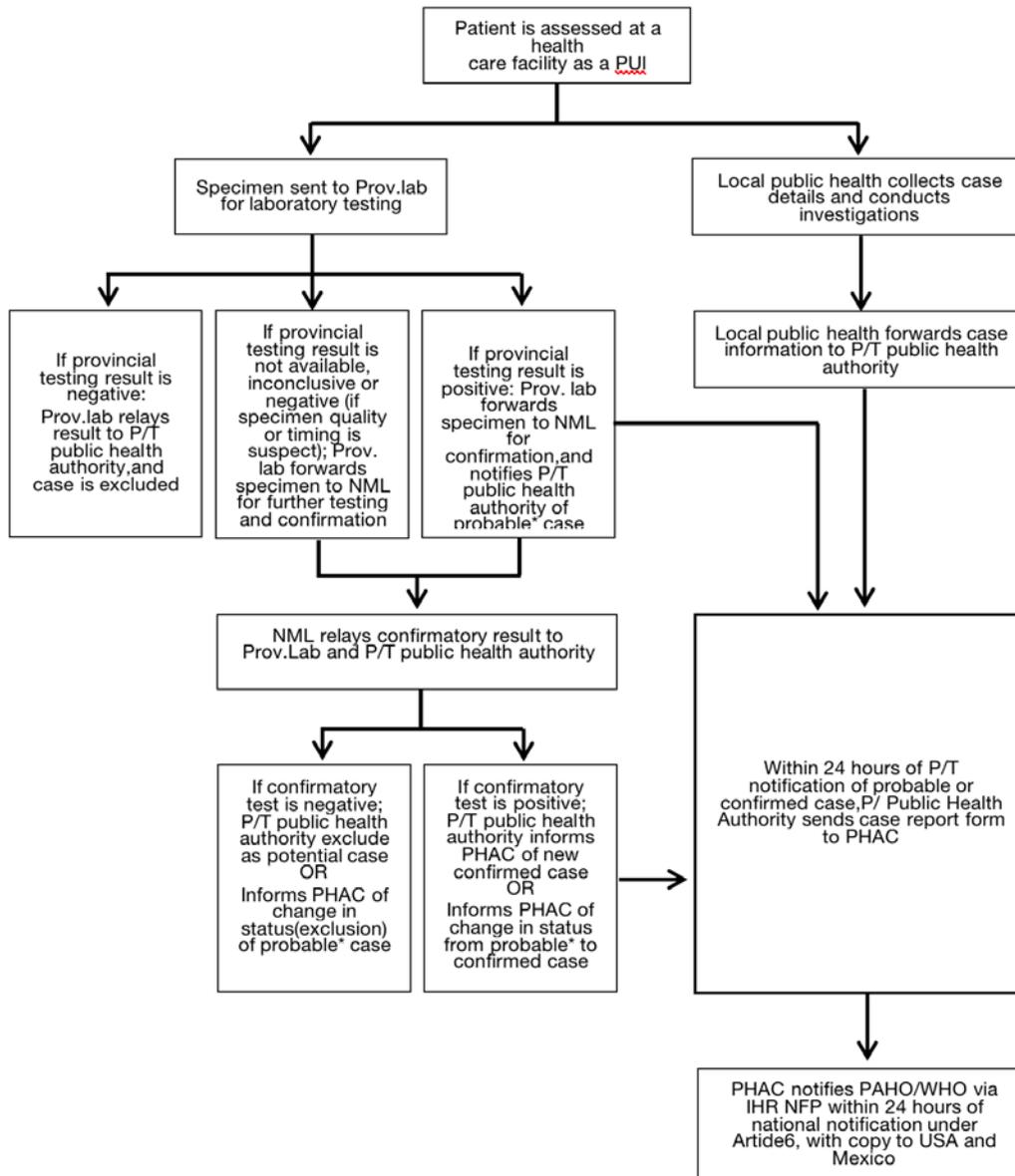


Figure. 2 Flow chart for reporting information on outbreak cases in Canada

Subjects are uniformly tested at the provincial laboratory, and whether the test results are negative or positive, the provincial laboratory will send the results back to the provincial public health agency. Suspected patients will be sent to the national microbiology laboratory for further confirmation and the final diagnosis will be reported to the national public health agency as the basis for increasing or decreasing the number of suspected cases. At the same time, the local public health center collects details of the case and investigates it (until the suspected symptoms are eliminated), and submits the information collected to the provincial public health authority. Within 24 hours after receiving information on a suspected or confirmed case, the provincial public health authority is required to report the case to the national public health agency. According to international health regulations, the National Public Health Agency of Canada should submit written notification documentation to PAHO and the WTO through the National Contact Point, and forwards copies to the United States and Mexico.

3.2 Comparison of reporting contents

According to the notice of the Ministry of Health on the issuance of the "National Information Reporting Management Standard for Public Health Emergencies (for Trial Implementation)", the

reporting of infectious disease information includes two aspects, that is, event information and information on the occurrence, development and control process of the event. The information report mainly includes the name of the event, the type of event, the time of occurrence, location, the geographical area involved, the number of people, the main symptoms and signs, the possible causes, the measures taken, the development trend of the event, the next work plan, etc. Information on the occurrence, development, and control process of the incident is divided into the initial report, process report, and closure report. The initial report should specify the name of the event, the preliminary determination of the type and nature of the event, the location, time of occurrence, the number of morbidities, the number of deaths, the main clinical symptoms, possible causes, the measures taken, the reporting unit, the reporting personnel, and communication methods, etc. The process report covers the development and change of the incident, the disposal process, the diagnosis and causes or possible factors of the incident, the assessment of the situation, and the control measures. Process reports are made at least daily for major and especially major public health emergencies. The closure report is a summary of the occurrence and handling of the incident within 2 weeks after the termination of the incident is confirmed, including an analysis of its causes and influencing factors, and recommendations for future prevention and countermeasures of similar incidents.

Canada requires the following data elements to be included in the reported information: province/territory; surveillance case classification (confirmed vs. probable); case details (age, sex, occupation); symptoms (including date of symptom onset); pre-existing conditions and risk factors; clinical information, including clinical course and outcome (e.g., hospitalization, ICU admission, death). Exposure history (including travel, patient contact, and animal contact within 14 days before symptom onset); laboratory information (including date and type of specimen collection, test methods, and results).

4. Comparison between the past and present: Back to the "SARS" period

To learn from history, we can face the future. The direct reporting system of the infectious disease network was built in 2004, a year just out of the disaster. How were the early warning and information reporting mechanisms for infectious diseases in China during the SARS period? What role did it play in the fight against SARS? In the fight against COVID-19 today, the important role of re-examing the 2002-2003 infectious disease governance system in China still cannot be underestimated.

4.1 The disadvantages of the SARS emergency management measures

(1) Warning is quite late

The first SARS case appeared in Foshan, Guangdong on November 16, 2002, but until early February 2003, after the peak of the disease in Guangdong, the pathogen identification was still unclear, and medical institutions argued about whether the pathogen was Chlamydia, and the phenomenon of collective infection of family members and health care workers was still frequent [4]

(2) Closed and non-transparent information

At a press conference held at the State Council Information Office in the afternoon of April 3, 2003, then Health Minister Zhang Wenkang stated that "as of March 31," "there were 12 cases and 3 deaths in Beijing," and that localized atypical pneumonia in China "has been effectively controlled." But that is not the reality. As of April 18, 339 cases of SARS had been confirmed in Beijing, drifting up nearly tenfold from the 37 cases announced by the health authorities on April 14. This shows that there was a serious problem of under-reporting of cases.

(3) Narrow information collection channels

Information collection channels were narrow, small in scope, and inefficient. This was caused by the complex hospital system at that time and the progressiveness of recognizing new infectious diseases.

(4) Slow operation of infectious disease surveillance system

The epidemic reporting process at that time was as follows: after diagnosing the infectious disease cases, doctors filled out paper infectious disease report cards and submitted them to the health care

section of the hospital. The health care department mailed them to the district and county health epidemic prevention stations where they were located. The district and county health epidemic prevention stations reviewed and summarized the reports and reported them to the local and municipal health epidemic prevention stations. The local municipal health epidemic prevention stations will summarize the statistics and report to the provincial health epidemic prevention station once every ten days. The provincial health epidemic prevention station then summarizes the statistics and reports to the Chinese Academy of Preventive Medicine (predecessor of the CDC) and the Ministry of Health once a month. It takes at least 5 days from the time a doctor makes a diagnosis of an infectious disease to the time the information is made known to the national policy-making authorities.

4.2 Progress made

The National Center for Disease Control and Prevention (NCDC) published an article on March 16, 2012, entitled "This is how to report infectious disease information directly on the Internet", summarizing the progress made by the direct reporting system for infectious diseases in the past 8 years. In general, China's infectious disease information reporting system has shown a gradual improvement in development.

First of all, there is a large amount of case information reporting acceptance. The network direct reporting system can receive more than 20,000 cases of infectious diseases and public health emergencies every day, an average of 15 cases every minute. This case information can be downloaded at any time and can also be queried and analyzed on demand, which is clear and concise at a glance.

Secondly, the timeliness of infectious disease reporting has greatly improved. The World Health Organization has said this about our direct reporting system for infectious disease networks: "The scale, dissemination of information, and display use coverage are unique in the world." By the end of 2011, the system has covered 100% of the country's CDC institutions, 98% of medical and health institutions at the county level and above, and 88% of township health centers, with direct reporting users amounting to 68,000. Medical and health institutions directly fill in the information on epidemics and public health emergencies, and decision-making departments can grasp the epidemic information in their jurisdictions at the first time, conduct daily analysis of infectious disease epidemic reports and case management of major infectious diseases, which is becoming increasingly standardized.

5. Development Prospects

Based on an in-depth understanding of the strengths and weaknesses of China's infectious disease early warning and information reporting system, I make the following suggestions for its future development path.

5.1 Improve the epidemic early warning system

Establish a full-cycle prevention and control mechanism from prevention to response, improve epidemic information reporting and release procedures, improve the direct network reporting system, further clarify the right to release epidemic information, and improve legal liability provisions. Song Hualin, a professor at Nankai University Law School, believes that it is necessary to clarify the content of infectious disease warnings and clearly publish the content of epidemic information. I strongly agree with this. At present, Chapter 3 of the Prevention and Control of Infectious Diseases Act only provides for the administrative system of internal information reporting, dissemination and sharing, which alone is not enough. It should also give the provincial health administrative departments, provincial disease prevention and control agencies to the community to publish information on infectious diseases in the administrative region, refine the conditions and circumstances of the "external warning" issued.

5.2 Clarify the functional positioning of the CDC

Zhong Nanshan said that "the status of the CDC should be improved, and it has certain administrative powers." The U.S. CDC is directly connected to the central and does not have to report at each level, by contrast, China's CDC's special status has not received sufficient attention - long-term

financial investment is not enough, functional positioning and responsibilities are not clear, and layers of approval are so time-consuming and laborious that it's likely to miss the best warning time.

5.3 Use of technology

Give full play to the role of information technology, big data, and artificial intelligence in the epidemic notification, clarify the legal status of the infectious disease surveillance and reporting system and strengthen the role of specialized disease prevention and control agencies at all levels in information collection and dissemination. Make full use of the currently available public health data exchange platform to form a real-time automated data exchange system to achieve synchronized sharing of infectious disease reporting data.

5.4 Diversification of information source channels

We should not rely solely on official channels of infectious disease information sources but also play the power of informal channels to collect and integrate information, establish diversified, multi-level, and multi-angle information sources. Improve the system of "whistleblowers" and reward professionals who have a keen sense of smell and dare to report. Instead of relying entirely on the national infectious disease early warning system, we shall establish a four-tier blockchain automated data synchronization network at the district, city, provincial and national levels, and give full play to the role of the CDC in the four-tier network.

5.5 Optimize the process of reporting epidemic information

Appropriately expand the authority of initial reporting of infectious diseases, so that doctors and primary medical institutions can directly make initial reporting, and change the current one-way tandem process of filling, supplementing, verifying, approving, and reporting infectious disease report cards to a two-line asynchronous parallel process of initial registration and reporting of infectious disease report cards and manual verification and post-facto supplementation; increase the collection of data on risky symptoms of infectious diseases, such as fever, chest X-ray description, cough, biochemical indicators, etc.

6. Conclusion

In summary, China has built complete infectious disease surveillance, early warning, and information reporting network consisting of the national infectious disease early warning system, infectious disease reporting information management system, network direct reporting system, and hospital HIS system, and the level of infectious disease prevention and control is among the highest in the world. Whether compared horizontally with developed countries such as Canada or vertically with China's emergency response capacity during the SARS outbreak in 2003, the strengths of today's infectious disease early warning and information reporting system can be shown. However, the relevant laws and regulations still have certain limitations, mainly in terms of inadequate provisions and weak operability; in the specific practice of epidemic prevention and control, there are also layers of inefficient reporting, insufficient and unresponsive release of information, limited powers of the National Center for Disease Control and Prevention, poor protection of the "whistleblower", etc. Therefore, improving the epidemic warning system, clarifying the functional positioning of the NCDC, developing and taking advantage of science and technology, broadening information sources, and optimizing the reporting process of infectious disease information is the only way to further improve China's infectious disease warning and information reporting system and to comprehensively improve infectious disease prevention and control capabilities. The infectious disease early warning and information reporting system should and will play a greater role in responding to public health emergencies, and act as a solid force to protect people's lives and health, resolve global medical and health risks, and demonstrate China's humanitarian spirit and power status.

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