R CENTER FOR HEALTH AND AGING Health Information Technology and Policy Lab

China Information System for Disease Control and Prevention (CISDCP)

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Summary

In the aftermath of the 2003 SARS outbreak, the Chinese government strengthened its public health disease surveillance system, taking advantage of modern information technology to build an integrated, effective, and reliable disease reporting system.



China's network-based infectious disease reporting system—coordinated by the Chinese CDC—has transformed how the country collects, analyzes, and reacts to disease information. A standardized platform throughout the entire nation gives healthcare systems the unprecedented ability to detect, analyze, prevent, and respond to any communicable disease outbreak in the country. There are also many unplanned benefits, such as increased transparency and empowerment of local medical institutions and personnel. The ability to harness technology and maximize the value of information is a critical milestone in the field of disease surveillance, and the system—assembled in less than two years across one of the largest countries in the world—provides a scalable model for safeguarding public health that could be applied to all nations.

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Reach

At the end of 2006, the Chinese CDC recorded 50,000 direct report entry points across China, including 94.9% of medical institutions at the national-level and above, 80% at the provincial level, and 70.3% of township hospitals and clinics.

Advantages

- Real-time data reporting and aggregation.
- National system structure and protocols eliminate issues of noncompatibility.
- The system's relational database enables local CDCs and other healthcare organizations to aggregate data in a number of ways at any time, and in any region.

Information

The disease surveillance system gathers epidemiologic information on 37 infectious diseases across every province from every hospital and clinic (see Table 1 in the Appendix for a breakdown of diseases).

People Served

The system serves all of China's 1.3 billion people by relying on direct reports from hospitals, clinics, local CDCs, and other medical institutions at all levels that feed into an expanded CDC network.

Funding

Both central and local treasury departments within the Chinese government provided construction funds for the system, totaling to 730 million RMB, including: 120 million RMB from the central government for the construction of the central system platform and the data center; 130 million RMB from the central government for the construction of the local networks; and 480 million RMB from the local governments for general construction.

Overall, the investment was about \$100 million, which primarily funded the system's hardware and software, as well as Internet access, training for personnel, and the salaries of a limited number of computer programmers.

Leadership

China's central (or "national-level") CDC works with the central government to coordinate the country's public health system at the provincial, municipal (prefecture), and county (district) levels. The government at all levels—including the Ministry of Health in the central government and departments of health of all other levels—ensures the availability of resources and collaboration from all healthcare institutions for this initiative.

China's information reporting system for infectious diseases vertically (e.g., hierarchically) covers all medical institutions at the national, provincial, prefectural, and county levels. The system also horizontally (e.g., where each institution has the same influence and decision-making power) covers CDCs and public health administration departments in all regions throughout China. One of the key reasons for the success of China's infectious diseases information reporting system is that this vertical and horizontal health infrastructure was already in place—the system simply connected each institution so that all healthcare organizations and agencies could communicate and coordinate. Without the vertical and horizontal infrastructure, the information system might not have been so transformational.



Key Technology

China's Web-based infectious disease surveillance system features a relational database that can process information from all medical institutions through a virtual private network (VPN) connection, using Java 2 Platform Enterprise Edition (J2EE standard) technology.

The system also uses a Web-based geographic information system (GIS) dynamic display feature for epidemic information, which illustrates case clusters, providing an early warning system for infectious disease outbreaks.

Figure 2: The System's Web-GIS Dynamic Disease Surveillance Capability Illustrates Disease Clusters at the Provincial, Municipal, and County Levels.



Data

Storage	Analysis
The Chinese CDC Data Center stores and processes all disease information in a central data warehouse.	Data reports can be tailored according to different analytical needs, including assessing local health conditions, investigating an outbreak, or presenting findings for publication (Figure 3). Modularized information analysis and retrieval features facilitate different types of data drill-down and aggregation.
Reporting	People Served
Daily and weekly reports, as well as a general analysis report, are distributed across the system to ensure appropriate attention and response.	Clear protocols and security clearance levels exist for entering and accessing certain data. This ensures that information is available to authorized individuals at a variety of healthcare organizations in all geographic locations and at all levels of the healthcare system.

Impact and Achievements

Since its early operation, the Web-based reporting system has played an unparalleled role in discovering and containing infectious diseases in a timely fashion and protecting the lives and health of the entire population by reducing the financial and human impact of diseases on society as a whole. This system is currently the largest in the world for reporting infectious disease cases. System impact and achievements include:

- *Increase in the Timeliness and Accuracy of Data.* In this working model, the pre-2004 aggregated monthly reports for infectious disease are replaced by real-time, case-specific direct reports. As of 2004, the system can boast a tenfold increase in overall reporting speed and a 33% increase in the number of complete reports. This working model gave rise to a material leap in the infectious disease surveillance and public health information management in China. "Missing reports" have been greatly reduced with the transition to real-time, Web-based reporting.
- *Early Health.* More accurate, timely disease reporting has lead to the early detection and containment of outbreaks, which not only protects the public from illness but also mitigates other potential negative impacts (e.g., economic, social) associated with the spread of disease. The system maximizes the efficiency of outbreak response efforts by mobilizing professional forces quickly and appropriately, thereby minimizing the hazards of a serious infectious disease outbreak.
- *An Accurate Picture of Disease Prevalence.* After the completion of the Web-based system, the number of disease cases increased. This increase reflects more accurate, frequent reporting rather than an actual increase in infection. Figure 4 in the Appendix illustrates the reporting of tuberculosis cases; similar examples abound of other diseases where reporting levels are sometimes at double their previous rates. The system also facilitates the investigation of cases where a diagnosis may be uncertain or the cause of death unknown. Piecing together these unexplained cases can lead to the early detection of new diseases or outbreaks (see Figure 3 in Appendix).

- *An Affordable, Easy-to-Use Standardized Platform.* Epidemic disease surveillance has become standardized across institutions, facilitating communication and efficiency. Costs are low, deployment is easy, and information is timely and valid. Additionally, modularized information analysis and retrieving features are easy to operate.
- *Improvements in Health Infrastructure*. The implementation of the Web-based system has paved the way for improvements in infrastructural networks for local medical institutions and increased the computer proficiency of healthcare personnel.

Challenges

China's infectious disease surveillance system has come online quickly and made significant progress over the past two years. Its structure allows cases to be entered throughout the reporting chain, which means that the system effectively covers the entire population. Yet, as with all such systems, challenges remain, and the Chinese central government and CDC are continuously working to further improve the system.

Hardware Infrastructure

Some localities lack the necessary infrastructure to take full advantage of the disease surveillance system. For example, some remote areas in rural China do not have a sufficient number of computers. Internet access can also be a challenge. As a result, 5% of county level hospitals and 29% of township-level hospitals and clinics must phone in their cases to another institution that has Internet access.

Cross-Institutional Cooperation and Information-Sharing

Within the healthcare system, crossorganizational collaboration (between public health, clinics, and hospitals) has been very efficient; however, informationsharing between healthcare organizations and non-health departments, such as the government's agriculture department, has not been extensive. Animal and human health disease surveillance databases are not currently linked.

Future Direction

The Chinese government is considering a system expansion whereby the infectious disease reporting system would link to animal health surveillance systems throughout the country. Additionally, the government is exploring the possibility of expanding the disease surveillance infrastructure to include chronic disease data, with links to different cancer and other non-communicable disease registries.

Appendix

Table 1: Priority Diseases for the China Information
System for Disease Control and Prevention

Group A(2)	• Cholera	• Plague	
Group B(25)	 Anthrax Bacillary & amebic dysentery Brucellosis Dengue fever Diphtheria Gonorrhea Hemorrhagic fever with renal syndrome High pathogenicity avian influenza 	 HIV/AIDS Japanese encephalitis Leptospirosis Malaria Measles Meningococcal meningitis Neonatal tetanus Pertussis Poliomyelitis Rabies 	 SARS Scarlet fever Schistosomiasis Syphilis Tuberculosis Typhoid/ Paratyphoid fever Viral hepatitis
Group C(10)	 Acute hemorrhagic conjunctivitis Echinococcosis Epidemic typhus/ Endemic typhus Filariasis 	Infectious diarrheaInfluenzaLeprosyKala-azar	MumpsRubella

Figure 3: Surveillance Results of Mysterious Pneumonia 2005–2006





