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AIDS Research and Its Role in China's AIDS Prevention and Control Policies

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Abstract: By the end of 2005, the estimated number of HIV infected people in China was 650,000. The seriousness of the epidemic calls for effective control measures to tackle the problems in order to avoid the tragedy in Africa from happening in China. "Prevention First" is the cornerstone of the country's health policy. On 2003 World AIDS Day, Premier Jiabao Wen announced a new national AIDS control policy, "Four Frees and One Care". This policy clearly shows that the Chinese government has once again taken full responsibility to solve public health problems and has profound impact far beyond the AIDS field. In early 2006, the central government put scientific and technology innovation as a national priority and set the target to build an innovative China by year 2020. Since then, the government has been increasing investment in science and technology with major emphasis on both infectious diseases control and new drug research and development. For the first time, development of 100 new drugs and control of major infectious diseases (AIDS, HBV, TB and other emerging infectious diseases) have been selected as national key scientific projects. China's best minds in related fields will be pooled to work together in order to remove the technical barriers blocking efficient control of the major infectious disease in China. Knowledge on molecular epidemiology, immunology, pathogenesis, HAART, as well as HIVDR strains will certainly provide urgently needed scientific information for China's AIDS control program. Only evidence-based strategy from good research will provide long-term effective control of AIDS.

Key words: AIDS; Prevention; Control

AIDS SITUATION IN CHINA

HIV/AIDS was introduced to China in the mid 1980s by foreign travelers and blood products (12). The epidemic in China began at the end of the 1980s, when IDUs in Ruili, a small town bordering Myanmar in Yunnan province, were found to be infected by HIV. The initial epidemics were localized along China's southwest border regions, mostly in IDU populations (1, 5). By the mid 1990s, the HIV/AIDS epidemic was scaled-up by both further spread of drug abuse in other regions and blood contamination in the illegal plasma collection activities in central China (13,14).

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There- after, a steady increase via sexual transmission has been observed, indicating that the epidemic has entered the general population (6). By the end of 2005, the estimated number of HIV infected people in China was 650 000 (10). The seriousness of the epidemic calls for effective control measures to tackle the problems in order to avoid the tragedy in Africa from happening in China (8,11).

SCIENTIFIC RESEARCH IN INFECTIOUS DISEASE CONTROL IN CHINA

Since China was isolated in the 1960s and 1970s by both the eastern and western blocks, Chinese scientists had to develop health technology and scientific discoveries in an isolated environment. They succeeded and independently developed and produced key essential drugs, diagnostic reagents, blood products and vaccines for China's huge population. Chinese scientists made progress in technology innovation to reduce production costs as well as in discovering novel medicines and vaccines. Based on the experience of Chinese traditional medicine, Chinese scientists discovered the anti-malarial drug artemisinin in the 1970s and is still one of the best drugs for malaria treatment today. The Japanese encephalitis vaccine developed by Chinese scientists was the first and is still one of the best vaccines in the world. The Henta virus (causing hemorrhagic fever with renal syndrome) vaccine and the old small pox vaccines developed in China used better technology than many other countries.

Equally important to science and technology capacity building, China built the nationwide Health and Epidemic Prevention Stations (HEPS), a network composed of over 3,000 stations and more than 200,000 public health professionals at provincial, prefectural/city and county levels in the 1950s. The network was converted to the China CDC network in the early 21st century. This unique infrastructure provides nationwide public health services and ensures that health technology advancement can be delivered to all people, including rural and remote areas. The Chinese government put health high on the country's agenda.

Chinese government started to fund some projects in AIDS research in the early 1990s. 95% of the research projects were single projects with only one research team and small investments. The average budget was US $50,000 a year for 5 years for large grants and US $10,000 per year for 3 years for small grants. With the smaller funding, there was little or no collaboration between Chinese scientists or with international research communities. There was scarcely any multi-disciplinary or network research in China during that period. With the small funding available, there was not enough funding to build infrastructure, cores or platforms to support research. Most scarce resources have been used on applied research in epidemiology, diagnostics and treatment, and not much on basic research.

THE RE-ENFORCEMENT OF PUBLIC HEALTH AND PREVENTION RESEARCH

"Prevention First" is the cornerstone of the country's health policy. Combining government commitment, health research and a functioning delivery system, China accelerated efficient control of infectious diseases, resulting in greatly improved health for the world's most populous nation. The life expectancy of the Chinese population doubled from 35

years in 1949 to over 70 years by the early 1980s. Since the early 1980s, the Chinese economy has been converting from central planning to a socialist market economy. Healthcare in general came to be considered as a service industry and left to market mechanisms to self manage. The governmental health expenditures declined sharply from the early 1980s to the late 1990s. The emphasis has shifted from prevention to treatment and from public health to hospitals. Research on public health and disease prevention has decreased substantially. As a result, many previously controlled infectious diseases re-emerged and these infectious diseases spread rapidly in many regions of the country.

The SARS epidemic in 2003 was a wake-up call for the Chinese government. It has now been recognized that health is not merely a medical issue but also a social security issue, affecting economic growth and social stability. On 2003 World AIDS Day, Premier Jiabao Wen announced a new national AIDS control policy, "Four Frees and One Care" (free antiviral treatment, free testing, free PMTCT for PLWHA, free schooling for AIDS orphans, and the provision of social relief for HIV patients). This policy clearly shows that the Chinese government has once again taken full responsibility to solve public health problems and has profound impact far beyond the AIDS field. In less than 5 years, the central government increased the annual AIDS control budget from 100 million yuan to 1.3 billion yuan and invested multi-billion yuan to strengthen the CDC system. The indirect national infectious disease reporting system has been updated to an electronic direct reporting system linked to all CDCs and over 95% of the hospitals in China.

In early 2006, the central government put scientific and technology innovation as a national priority and set the target to build an innovative China by year 2020. Since then, the government has been increasing investment in science and technology with major emphasis on both infectious diseases control and new drug research and development. For the first time, development of 100 new drugs and control of major infectious diseases (AIDS, HBV, TB and other emerging infectious diseases) have been selected as national key scientific projects. China's best minds in related fields will be pooled to work together in order to remove the technical barriers blocking efficient control of the major infectious disease in China.

AIDS VACCINE RESEARCH IN CHINA

Vaccines are the most effective and economic way to control infectious diseases. An AIDS vaccine is the final weapon for mankind to ultimately conquer this deadly disease. To develop an effective HIV-1 vaccine has been an unprecedented challenge for the entire scientific community. Much research has been conducted in this field and various types of vaccine candidates have been developed, including subunit vaccines, nucleic acid vaccines and recombinant vector vaccines of various forms (2, 3, 4, 6). The two Phase III trials of gp120 vaccines and one Phase IIb trial of an adeno5 based vaccine conducted so far have all failed. These failures make the scientific community reevaluate their current research and think harder to carefully design a new generation of HIV vaccines.

AIDS vaccine research in China is based on careful selection of the most prevalent circulating HIV-1 strains in China. The molecular epidemiology study

by the China CDC indicated that the CRF07 is the most rapidly spreading HIV strain in China with an annual incidence of 8.8% in the IDU population. Several candidate vaccines have been constructed based on this HIV-1 strain. One vaccine of DNA and MVA developed by Johns Hopkins University and a Chinese pharmaceutical company finished its phase I clinical trial in 2006. Another vaccine based on China's small pox vaccine vector in combination with a DNA vaccine developed by the China CDC has been approved by the Chinese State Food and Drug Administration for a phase I clinical trial. This trial will start soon. Another China CDC HIV vaccine project, using a non-replicating form of the Tiantan small pox vector and a 2nd generation DNA vaccine, has finished all preclinical studies and GMP production. The vaccine is expected to begin its Phase I clinical trial in late 2008. Other HIV research involves almost all approaches, including subunit vaccines, viral vectors (Sandai virus, AAV, etc.) and bacterial vector vaccines. They are under various stages of preclinical studies. Recently, Chinese AIDS vaccine researchers gathered under the National Key project to form the China AIDS Vaccine Consortium. These efforts will not only have a positive impact on China's AIDS vaccines, but will also strengthen collaborations with large international AIDS vaccine programs, such as the Global HIV Vaccine Enterprise, HVTN, and Eurovac.

CONCLUSION

This special AIDS issue of the Journal of Virology has presented some of the AIDS research conducted by Chinese scientists and in collaboration with foreign scientists. The research covers a wide range of areas from epidemiology, virology, immunology, anti-viral drug discovery to vaccine development. This issue also includes several commentary articles on China's government-led HIV programs and China's approaches to HIV treatment and prevention, from which the Chinese government's full commitment to AIDS prevention and control can be recognized. Most of the research presented here has limitations. The sample size is not very large and the research results are preliminary. Since it is a new research venture, this effort should receive more support from both the funding agency and the scientific community. Knowledge on molecular epidemiology, immunology, pathogenesis, HAART, as well as HIVDR strains will certainly provide urgently needed scientific information for China's AIDS control program. Only evidence-based strategy from good research will provide long-term effective control of AIDS.

From these research papers, one can conclude that Chinese researchers have actively engaged in various fields of HIV research. We believe that with greater support from the Chinese government, especially the national key projects, and close collaboration with international and domestic researchers, Chinese scientists can not only make progress in AIDS research, but also can provide evidence-based scientific strategies and technical support to help control HIV/AIDS in the world's largest country.

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