Preface

Development strategy of NIPD-CTDR in the new era

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1. Foreword

Parasitic and tropical diseases have seriously endangered the health of the Chinese people in history, and affected economic and social development (Wang and Zhou, 2020). After the founding of the People's Republic of China in 1949, great efforts on control of parasitic and tropical diseases were deployed by the government of China by launching national disease control programmes. In the initial stage of the national parasitic disease control programme in the early 1950s, it was estimated that there were more than 10 million schistosomiasis patients, 30 million malaria cases annually, 30 million filariasis patients, 530,000 kala-azar patients and more than 200 million people infected with hookworm in China (Chen et al., 2018; Hu et al., 2016; Wu et al., 2018). Since the government attached great importance to those diseases of poverty, it implemented programmes to control those diseases and mobilized participation both by the public at community level as well as by health professionals who provided technical support to the programmes. Consequently, China has made remarkable achievements in the control of parasitic diseases over the last 7 decades. For example, lymphatic filariasis has been eliminated in the whole country in 2006 and this elimination was certified by the World Health Organization (WHO) in 2007, which has set an example for other countries and promoted the global filariasis elimination programme. The goal of no indigenous malaria cases was achieved in China and the country is currently working to obtain validation for this achievement from WHO in 2020. The criteria of transmission control for schistosomiasis were achieved in China in 2016, and transmission interruption is expected to be achieved by 2025.

The nationwide infection rate of soil-transmitted helminthiasis has dropped to 4.8% in China according to the third national survey completed in 2013, and the endemic situation of echinococcosis has been brought under control after the launch of special actions on echinococcosis control since 2016.

The National Institute of Parasitic Diseases at Chinese Center for Disease Control and Prevention (NIPD), and Chinese Center for Tropical Diseases Research (CTDR), is the only national-level research institution for control of parasitic and tropical diseases in China (Chen et al., 2020). Under the guidance of the National Health Commission and the Chinese Center for Disease Control and Prevention, NIPD-CTDR carried out disease prevention and control, scientific research, emergency response, global health cooperation, education and training, health promotion and other activities relevant to parasitic and tropical diseases.

The earliest precursor of NIPD-CTDR, the East China Branch of the National Institute of Health, was founded in Nanjing in November 1950. It was named as the Institute of Parasitic Diseases (IPD) under the Chinese Academy of Medical Sciences (CAMS) in 1956, and moved to Shanghai after having merged with the Hainan Anti-malaria Station of CAMS in 1957. In 1983, the Chinese Academy of Preventive Medicine (CAPM) was created by separating institutions from the CAMS and the IPD became part of it. In 2002, it was renamed as the National Institute of Parasitic Diseases (NIPD) under the Chinese Center for Disease Control and Prevention (China CDC), due to an institutional reform of CAPM that changed its name to China CDC (Zhou et al., 2005). An additional name, the 'Chinese Center for Tropical Diseases Research (CTDR)' was awarded by the central government of China in 2017. Moreover, in recognition of its importance both in disease control and research in the country, several titles have been granted to NIPD-CTDR by various departments of the government as well as international agencies, such as the *World Health Organization Collaborating Centre for Malaria, Schistosomiasis and Filariasis* awarded by WHO in 1980, which was renamed as the *World Health Organization Collaborating Centre for Tropical Diseases* in 2015 (Guan et al., 2020), the *Key Laboratory of Parasite and Vector Biology* by the Ministry of Health in 1992, the *National Center for Medical Malacology* awarded by the Ministry of Health in 1994, the *National Center for International Research for Tropical Diseases* awarded by the Ministry of Science and Technology in 2014, the *Center for Postdoctoral Programmes* awarded by the Shanghai Municipality Government in 2015, and the *National Parasitic Resources Center* awarded by the Ministry of Science and Technology in 2019.

In order to celebrate the 70th anniversary of the founding of the NIPD-CTDR, this special issue features 13 articles that summarize the historical achievements of the NIPD-CTDR over the last 7 decades, and put forward the key orientations for future development, so as to enhance contributions to control/elimination and scientific research of tropical diseases around the world.

2. Major achievements

Since its founding 70 years ago, the NIPD-CTDR has made great achievements in scientific research on epidemiology, surveillance and early warning, aetiology, diagnosis, drug development and vector control in the fields of schistosomiasis, malaria, echinococcosis, lymphatic filariasis, kala-azar and other protozoal blood infections, soil-transmitted helminthiasis, fascioliasis, angiostrongyliasis, taeniasis and cysticercosis, and intestinal protozoa infections. Those research achievements have been transferred to and applied in national parasitic diseases control programmes in China and have encouraged those programmes to move from control to elimination. They have also supported more innovation in China's medical parasitology and have boosted global health cooperation in tropical diseases. The major achievements are reflected in the following three aspects.

2.1 Promoting parasitic diseases from control to elimination

The NIPD-CTDR has completed three nationwide surveys on the endemic status of major parasitic diseases in humans, four nationwide surveys on the endemic status of schistosomiasis, and three national surveys on the prevalence of echinococcosis, so as to not only clearly understand the prevalence of parasitic diseases in different periods in China, but also to transfer the results of the surveys into policy making and the formulation of national workplans for the control programmes. The NIPD-CTDR has also contributed to national disease control programmes in the following aspects: (i) establishment of the national parasitic disease surveillance network, the diagnostic reference laboratory network and the control research base, together with the diseases endemic provinces; (ii) development of the national demonstration zone for the control of soil-transmitted and food-borne diseases and carrying out the pilot project on comprehensive control of echinococcosis in Shiqu County, Sichuan Province; (iii) participation in the formulation of national control plans, technical solutions and

standards for the prevention and control of major parasitic diseases, such as schistosomiasis, malaria and echinococcosis; (iv) putting forward integrated control strategies and technical measures for schistosomiasis and other parasitic diseases, that have contributed to moving forward from disease control to elimination; (v) development of new technologies and products for control and surveillance; (vi) organization of national training as well as related activities, e.g. national competition on specific technical skills of parasitic diseases; and (vii) efforts to solve the technical problems in programme implementation in the field. In addition, the NIPD-CTDR has established the surveillance, early warning and emergency response system for parasitic diseases, so as to effectively have information on emerging or re-emerging parasitic diseases, such as trypanosomiasis, fascioliasis, babesiosis and angiostrongyliasis (External Evaluation Committee, 2015).

2.2 Promoting technological innovation in national medical parasitology

The NIPD-CTDR has contributed to the development of human parasitology and medical entomology in China, and carried out operational research on epidemic characteristics, control strategies, surveillance and response, diagnostic techniques, vaccines and preventive drug development, health education and related fundamental research, so as to provide new approaches and technologies for the control and elimination of parasitic diseases in China. This has allowed NIPD-CTDR to play a leading role in the development of medical parasitology and tropical medicine in China (External Evaluation Committee, 2015). For example, NIPD-CTDR has won more than 80 science and technology awards, including 1 first-grade prize, 2 second-grade prizes and 2 third-grade prizes for the national scientific and technological awards, more than 30 patents, 2 new class-I drugs, and more than 20 diagnostics.

The project of the 'Research on Strategies and Technical Measures to Block the Transmission of Lymphatic Filariasis in China' has won the first prize for the national scientific and technological award, which has provided impetus for initiating the elimination of lymphatic filariasis around the world. The results of the 'Research on the Drugs for Treatment of Schistosomiasis', 'Countermeasures to Control and Block the Prevalence of Schistosomiasis in the Mountainous Regions', 'Application and Basic Research of Artemether in Prevention of Schistosomiasis japonica, Schistosomiasis mansoni and Schistosomiasis haematobia', 'Integrated

Control Strategies for Schistosomiasis with Emphasis on the Control of Infection Source', and 'Establishment and Application of the Surveillance and Early Warning System for Schistosomiasis in China' have provided the new approach and technologies for comprehensive control and elimination of schistosomiasis in China. The results of the 'First National Survey on the Distribution of Human Parasites', 'Comprehensive Prevention and Control Model of Parasitic Diseases in China', 'Epidemiological Characteristics and Surveillance Schemes in the Later Period of Malaria Control', and 'Control Strategies for Soil-transmitted and Food-borne Parasitic Diseases and Their Application Effectiveness' have promoted the national control programmes on parasitic diseases in China.

The NIPD-CTDR started projects on the National Scientific and Technological Resource Sharing Service Platform and on the National Center for Pathogenic Microbial Species Preservation in 2004 and 2018, respectively, supported by the Ministry of Science and Technology, in cooperation with 10 other institutions and universities. With more than 10,000 specimens of parasites both from humans and animals being preserved in NIPD-CTDR, the Ministry of Science and Technology positively confirmed this platform as a 'National Resource Pool for Parasites' in 2019, one of 30 national resource centres in China. The NIPD-CTDR also contributed to information exchanges by creating national and international journals. For instance, the *Chinese Journal of Parasitology and Parasitic Diseases* was launched in 1983. This journal publishes in Chinese, with English abstract. *Infectious Diseases of Poverty* is an international journal, published by the publisher of BioMed Centre at Springer Nature in cooperation with Chinese Medical Journal Publisher, that was launched in 2012. Its current SCI impact factor is maintained above 3.0. Both journals have had great impact on national parasitology and international tropical medicine communities (Xia et al., 2013).

2.3 Promoting the disciplinary development in tropical medicine and global health

With the open-up policy and social economic development in China, more international cooperation opportunities have been provided in the fields of parasitology and tropical medicine. In order to take advantage of these developments, a Global Health Center was established in the NIPD-CTDR, which is in charge of all international activities and global health projects in the following five domains: (i) Under the 'Belt and Road' Initiative and China-Africa Cooperation Forum, the NIPD-CTDR has

taken the leadership in establishment of south–south co-operative networks, such as the Institution-based Network for China-Africa Cooperation on Elimination of Schistosomiasis (INCAS), the Asian Network on Schistosomiasis and other Helminthic Zoonoses (RNAS+), and the Asia-Pacific Network on Drugs and Diagnostics Innovation for Tropical Diseases (AP-NDI), etc. (Xu et al., 2016). (ii) The NIPD-CTDR carried out the China-Tanzania Demonstration Project on Malaria Control, that aims to tailor Chinese experiences to local settings in Tanzania in 4 communities covering 200,000 population. Another project, China-Australia-Papua New Guinea Trilateral Cooperation on Malaria Control Project, was carried out aiming to assist and strengthen the laboratory capacities on malaria control both at national and regional levels. (iii) The NIPD-CTDR has hosted 4 series of symposiums on surveillance-response systems leading to the elimination of tropical diseases, and organized more than a dozen of international training courses. (iv) The NIPD-CTDR recruited international postdoctoral fellows and young scientists from Asia and Africa and more than a dozen international postdoctoral fellows have completed their research projects in the NIPD-CTDR. (v) The NIPD-CTDR has signed more than a dozen of Memorandums of Understanding (MOUs) to cooperate with national and international institutions and universities in the field of global health. The School of Global Health was established in June 2019, jointly sponsored by the Chinese Center for Tropical Diseases Research and Shanghai Jiao Tong University School of Medicine. In summary, the NIPD-CTDR has carried out several projects in global health to cooperate with scientists from other developing countries, aiming to tailor Chinese knowledge and technologies to local settings with support from various sources, such as the International Development Research Centre of Canada, the Department for International Cooperation of UK, the National Institutes of Health of USA, the Bill & Melinda Gates Foundation, WHO, etc. (Chen et al., 2020; Wang et al., 2019).

3. Future orientations

With the rapid development of China's social economy and the trend of global economic integration, the Chinese population's mobility is much greater than before. As a result more imported, new and rare parasitic and tropical diseases have occurred year by year, posing also great challenges for the control and elimination of parasitic diseases in China, such as

schistosomiasis and malaria. Therefore, Chinese institutions like NIPD-CTDR will engage more in global control programmes of tropical diseases in collaboration with international communities. Meanwhile, parasitic and tropical diseases in western China are still important public health problems. For example, a total of 38.59 million people were infected with major parasites, the overall infection rate of helminthiasis was 5.1% as shown in the third national survey on major human parasitic diseases completed in 2013 (Wang and Zhou, 2020). In some local areas, the infection rate of soil-transmitted helminth infection was still more than 20% in some regions of western China. There are still nearly 12 million people infected with *Clonorchis sinensis*, and echinococcosis is still a serious burden on the health of people in Tibetan pastoral areas. Therefore, the NIPD-CTDR has to take the dual task of control and elimination of parasitic and tropical diseases both at the national and international level.

In 2010, the NIPD-CTDR had implemented its first medium and long-term development strategy with the vision of 'leading in China, first-class in Asia and advanced in the world'. The strategic plan consists of two rounds of the 5-year plans, that has led to two great achievements during the past decades. One is the fact that NIPD-CTDR provided strong technical support for the national parasitic diseases control programmes in China which made the programmes shifting from control to elimination in China. The other one is the fact that NIPD-CTDR has launched global health programmes which promotes the institute's capacity on global health security and development, and strengthens the staff's knowledge, approaches and policy on global health. The NIPD-CTDR has now initiated the proposed development of a roadmap for the control of parasitic diseases in China from 2020 to 2030. An 'enhanced development strategy' for the NIPD-CTDR has been conceptualized and another medium and long-term development strategy will soon be completed and implemented in the institute from 2021 onwards. Its principal strategy will be to build the institute as an international advanced tropical disease research centre, to fully integrate scientific research, disease control and emergency response, education and training, information exchange and global health by 2030. It is expected that through another two rounds of 5-year development plans, the NIPD-CTDR will significantly contribute to promoting the construction of a 'Healthy China 2030', transform scientific and technological innovation of parasitic and tropical diseases, and deepen global health cooperation.

In order to achieve the goal of promoting health services for people in China and around the world in the new development era,

the NIPD-CTDR has been recommended to maintain the high-quality and high-level development trend with the following three aspects:

(i) *Contribute more to the construction of* 'Healthy China 2030': According to the 'Healthy China 2030' planning outline: by 2030, 'all endemic counties in China will meet the standard of schistosomiasis elimination. Continue to consolidate the efforts of national malaria elimination … all endemic counties in China will basically control the prevalence of echinococcosis and other major parasitic diseases'. In order to achieve this, the NIPD-CTDR will provide technical support, organize the formulation of technical programmes and guidelines for the control of parasitic diseases, and carry out technical guidance and assessment activities for the control of parasitic diseases in China, organize the national surveillance activities and improve the surveillance programmes, and strengthen the operation and management of surveillance systems, information building and analysis of surveillance data. We also need to train ourselves to carry out emergency response to outbreaks in major epidemic diseases and public health emergencies, improve the national laboratory testing and diagnosis network for parasitic and tropical diseases, and provide diagnostic reference and consultation on diagnosis and treatment. These important activities will provide evidence-based references to formulation of national policies, workplans and standards for the control and elimination of parasitic and tropical diseases.

(ii) *Strengthening transformation of scientific and technological innovation in parasitic and tropical diseases*: Establish the biological technology, species resource, large population-based cohort platform, AI decision-making and other research and development platforms; carry out basic research on multi-disciplinary issues such as epidemiology, pathogen and vector biology, pathology, immunology, molecular biology, biochemistry, pharmacy and pharmacology, as well as applied research on disease prevention and control, immunologic diagnosis, detection and testing, and vaccines and drug development; put forward theoretical innovation especially in the pathogenic mechanism, pathogenic mutation and vector control and realize technical innovation especially in the diagnosis, vaccine, drug targets and early warning, so as to strive to build a 'national key laboratory'; build pilot and demonstration areas for the transformation of achievements, so as to promote the application and industrial transformation of technological achievements in the detection and surveillance of important parasitic and tropical diseases, drugs for parasites and vectors, and prevention and control.

(iii) *Strengthening global health cooperation*: Since China has rich experience and mature approaches and technologies in the control and elimination of tropical diseases, the WHO expects China to transfer its experience and technology to Africa and the developing world as a leading force. With the aim to build the world-class global health discipline, the NIPD-CTDR will carry out the following important activities: (a) in capacity strengthening, more technical training, health education and public information exchanges on the control and elimination of parasitic and tropical diseases based on the concept of One Health will be performed, so as to cultivate global leading health talents; (b) in engagement in global health, more cooperation with international institutions, particularly from developing countries, will be carried out with the aim to help other developing countries to control and eliminate schistosomiasis, malaria and other tropical diseases which finally will contribute to achieving the UN 2030 agenda of sustainable development goals (SDGs) (Wang and Zhou, 2020; Engels and Zhou, 2020), and to promote the 'Belt and Road' Initiative and China-Africa Cooperation Forum; (c) in transferring Chinese approaches and technologies, more activities on transferring Chinese approach or technologies to other developing countries in the local disease control programmes. These actions will not only support China's participation in global health governance, but also realize the basic principles of equitable development and healthy poverty alleviation advocated by the UN agenda for SDGs (Engels and Zhou, 2020), and advance the building of an international community with a shared future for mankind.

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