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Mini Review

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Strategies for cultivating public health professionals to address biosafety challenges of Hainan Free Trade Port

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ABSTRACT

Efficient prevention and control of biosafety risks is a critical guarantee for implementing the Hainan Free Trade Port construction strategy, and also the primary task for Hainan public health development. The unique natural environment, global flow of people and goods, and local weak public health foundation make the Free Trade Port face challenges of potential biosecurity crises, especially outbreaks of imported emerging infectious diseases at any time. The COVID-19 pandemic has promoted the innovation of global public health concepts. The Hainan provincial authorities attach great importance to the role of the One Health concept in construction of public health systems. The present article analyzes the biosafety risk factors of the Free Trade Port, the demand for public health talents, the research and development of One Health in universities, the advantages and disadvantages of talent cultivation, and proposes a public health talent cultivation approach that meets needs of Hainan Free Trade Port construction.

KEYWORDS: Free Trade Port; Bio-safety; Emerging infectious diseases; Public health; One Health

1. Introduction

Although the peak of COVID-19 epidemic has passed, the huge harm caused by the COVID-19 pandemic to human health and socio-economic development has left a painful memory for the world[1,2]. Biosafety, especially the prevention and control of emerging infectious disease outbreaks, has once again become a major challenge of high concern to governments, public health governance departments, and academic organizations around the world[3,4]. Given the increased demand for public health work during the COVID-19 pandemic, it has become significant to expand the proportion of the workforce with formal public health training[5]. China's public health talent education faces significant challenges, particularly in cultivating highly qualified professionals. Only 7% of personnel in disease control and prevention institutions hold a master's degree or higher[6].

The Hainan Free Trade Port construction is a major strategic initiative in China. However, the tropical natural environment, rapidly growing population and logistics, and weak public health infrasrtucture have raised significant concerns reagrding the biosecurity of the Free Trade Port. Compared to other cities and regions, the higher proportion of older adults and ethnic minorities in Hainan poses significant challenges to achieving equalization in the efficiency of essential public health services[7]. Analyzing the biosafety risks, influencing factors, and the demand for public health talents, as well as identifying the current challenges and gaps in talent cultivation in Hainan, is essential. Exploring strategies for training public health professionals to meet the needs for the implementation of this national strategy and for ensuring social prosperity and stability.

2. Biosafety risks in the Free Trade Port

Hainan province is a tropical island region with a wide variety of infectious pathogens and vector species. With the development of global trade, tourism, and healthcare industries, the flow of people and goods has been markedly enhancing, and risks of imported and transmitted infectious diseases has been rising[8,9]. The public health system in Hainan is weak, and the hardware facilities, talent team,

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professional skills, and management capabilities for responding to the biosafety crisis need to be improved. Hainan is located at the forefront of the South China Sea strategy, and the threat of bioterrorism cannot be ignored. After the closure operation, the outbreak of imported new infectious diseases should be the focus of biosecurity risk prevention in the Free Trade Port.

According to the source of the pathogen, future epidemics can be divided into endogenous epidemics and imported epidemics. Although Hainan was once a severely affected area by tropical infectious diseases in history, after years of prevention and control since the founding of the People's Republic of China, traditional infectious diseases such as malaria and leprosy in such tropical region as Hainan have been eliminated or controlled in a low prevalence state. Certain new infectious diseases such as dengue fever and melioidosis are prevalent[10,11]. With the Free Trade Port closure operation in 2025, the flow of people and goods from around the world will converge or transit in Hainan, and the risk of imported epidemics, especially new infectious disease outbreaks, will sharply increase. How to accurately prevent and control possible new infectious disease outbreaks from around the world has become the main public health challenge faced by Hainan Free Trade Port.

3. Free Trade Port demands for public health talents in biosafety

To strengthen public health governance, especially the capability of prevention and response to biosafety crises in free trade ports, it is significant to enhance the pathogen inspection and quarantine capabilities of customs, disease control and prevention centers, and animal disease control and prevention centers. They need more molecular epidemiology talents with the ability to isolate and cultivate new pathogens, amplify and sequence genes, analyze biological information, and identify pathogens at the genetic level. The healthcare sector requires composite talents who possess both clinical and public health theories and skills[12,13]. The health management department needs health management talents with knowledge of infectious disease epidemiology. Medical universities have a unique responsibility and mission in the public health system of Hainan, which includes not only the cultivation of technical talents, but also innovation, bottleneck breakthrough, experimental platform support, and offering the core theories and technologies for public health governance in the government epidemic prevention and control intelligence, especially biosafety prevention and control. In order to fulfill its mission, universities first need to establish a public health faculty team that can be based on the academic forefront of infectious disease prevention and control, making them leading talents in the prevention and control of biological crises in the Free Trade Port.

4. Advantages and disadvantages of Hainan public health talent cultivation

Hainan Medical University is the only public medical college in the province, and its School of Public Health trains undergraduate students majoring in preventive medicine and biostatistics, as well as master's students majoring in public health. The graduates mainly work in disease control and prevention centers, hospitals, customs, and health management departments. The Hainan Provincial authorities have attached great importance to the construction of the public health system in Hainan, including the Public Health School and disciplines at Hainan Medical University. Hainan Province has provided policy and manpower support for introduction of talents and construction of laboratory platforms in universities. The environment for talent cultivation in the schools has developed rapidly, and the cultivation and introduction of high-level teaching staff have achieved expected results. The potential for talent cultivation has been significantly improved.

However, similar to many regions inside and outside China, the Hainan Free Trade Port also faces a shortage of public health personnel[7]. For example, in some cities and counties, less than half of the public health professionals have a bachelor's degree in local centers for disease control and prevention. Meanwhile, Hainan universities currently lack the qualifications to cultivate doctoral talents in public health disciplines, and among the high-level talents introduced, there are relatively few public health talents. The quantity of locally trained and introduced talents are unable to meet the biosecurity needs of the Free Trade Port. The lack of public health knowledge, on-site practical skills, and laboratory molecular medicine techniques among medical and health personnel in epidemic prevention and control were commonly shown in various regions[14,15], and also exists in Hainan. This issue needs to be highly valued in the reform of education and teaching in Hainan.

In addition, the experience in the prevention and control of COVID-19 indicates that traditional public health concepts and strategies are insufficient to deal with emerging infectious diseases caused by unknown pathogens. One Health adheres to the core concept that human, animal, and enviromental health are interdependent and closely linked to the health of the ecosystem they inhabit[16]. It advocates for interdisciplinary, cross departmental, and cross regional collaboration, addressing various aspects of health determinants to take joint action, including disease monitoring and risk assessment, prediction and early warning, enhancing the global ability to respond to new infectious diseases, and jointly building a community of shared future for human health[17].

The One Health concept of preventing and treating new infectious diseases caused by zoonotic diseases is consistent with the core idea of the Central Committee of the Communist Party of China's "prevention of human diseases by management of animals, moving the checkpoint forward" and the concept of a human health community[18]. Hainan universities have successively established the Hainan Medical University One Health Research Center, the Hainan Key Novel Thinktank, launched the *Journal One Health Bulletin*, and the compilation of graduate comprehensive health series textbooks, held multiple national and even global academic conferences on One Health, and obtained approval for the World Bank-funded One Health project. These have played an important leading and promoting role in the development of this innovative concept of public health, and have established a theoretical foundation and

advantages for cultivating innovative talents in Hainan's public health in the new era.

Meanwhile, it is necessary to recognize that the application of the One Health concept in public health teaching practice is still insufficient, and it has not been fully reflected in the training plans and teaching syllabi of clinical and preventive medicine majors. Moreover, the teaching content and hours related to infectious disease prevention and control in clinical medicine and preventive medicine majors are relatively limited, resulting in insufficient competence and practical skills of talents in infectious disease prevention and control positions. The talent cultivation system needs to deepen reform from the perspective of public health concepts to meet the needs of infectious disease public health governance in the new era[12–15].

5. Reform of public health talent training

To meet the demands for public health talents in the governance of the Free Trade Port, especially in response to biosafety crises such as emerging infectious diseases outbreaks, the reform of public health talent cultivation should encompass, but not be limited to the following aspects:

Firstly, during the critical period of customs operations, strengthen the introduction and cultivation of molecular medical talents for the prevention and control of infectious diseases. In establishing public health talent teams of various fields, the construction of talent teams for infectious disease prevention and control is the primary task.

The second is to enhance the level of public health talent cultivation in Hainan universities, support the construction of doctoral programs and post-doctoral mobile stations in public health disciplines, and list them as specific measures to support the training of public health talents and the improvement of governance capabilities in Hainan Free Trade Port.

The third is to strengthen research on detection and monitoring technologies for infectious diseases, especially emerging or potential unknown-pathogen infectious diseases and construction of related experimental platforms in Hainan. Utilizing big data and artificial intelligence technologies, the construction of a multi-point triggered prediction and early warning system should be expolred.

Fourthly, as a pilot of education and teaching reform and opening up, based on the local foundation and advantages in the One Health field, integrating cutting-edge research results in public health globally. Comprehensive revision to training plans, teaching syllabi, and quality control standards for undergraduate and graduate students majoring in clinical and preventive medicine should be taken. Additionally, education and training on new public health concepts should be provided for teachers, clinical doctors, and health management personnel. Public awareness of infectious disease prevention and control should be promoted to comprehensively enhance the capability of the Free Trade Port in responding to biosafety crises.

6. Summary

Prevention and control of the biosafety risks are the primary tasks for the development of Hainan public health during the construction of the Free Trade Port. The unique natural environment, socio-economic activities, and relatively weak public health infrastructure pose significant challenges from imported unknown pathogens and emerging infectious disease outbreaks. Recent practices with managing infectious diseases have exposed the limitations of traditional public health strategies while driving developments of innovative health concepts. During this extraordinary period, public health disciplines in Hainan universities have gained advantages in research on the concepts on prevention and control of infectious diseases, but the application and transformation of the new concepts in talent cultivation are insufficient. In the future, efforts should be made to promote cultivation of high-level public health professionals in infectious disease prevention and control, integrate the One Health concept, big data, and artificial intelligence technology into training of medical and health personnel, strengthen researches on pathogen detection, monitoring, prediction, and early warning technology for newly emerging infectious diseases, and build efficient public health systems to strengthen the capacity of the Free Trade Port to respond to biosafety crises.

Conflict of interest statement

The authors declare that there is no conflict of interest.

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Data availability statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Authors' contributions

Zhang RG completed the literature review and wrote the manuscript. Liang WJ, Huang HR, Long WF and Liu YR reviewed this manuscript, performed edition and gave scientific ideas. Lu JH provided funding, supervision and reviewed this manuscript.

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