PERSPECTIVES Exploring the Application of "Internet Medical" to **Epidemic Prevention and Control on Chinese** Campus in the Post-Epidemic Era

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Abstract: China has entered the post-epidemic era with the implementation of a general program for epidemic prevention and control of Category B infectious diseases. The number of sick people in the community will increase dramatically over a period of time, which will inevitably lead to a run on hospital medical resources. Schools, as one of the key institutions in epidemic disease prevention, will face a major test of their medical service system. The "Internet Medical" will be seen as a new way for students and teachers to access medical services, providing them with the convenience of remote consultation, interrogation, and treatment. However, there are many problems with its use on campus. In this regard, this paper aims to identify and evaluate the problems in the interface of the "Internet Medical" service model on campus, intending to improve the current level of medical services on campus and ensuring the safety of students and teachers on campus.

Keywords: post-epidemic era, campus, internet medical, disease prevention

Introduction

Since the outbreak of novel coronavirus pneumonia (hereafter referred to as NCP) at the end of 2019, the current medical system has been exposed to many problems, including insufficient medical resources, delayed detection, diagnosis, and treatment, and services that are not able to meet the needs of patients, with serious implications for life and economic development worldwide. Recently, National Health Commission of China issued a general plan for the implementation of the disease comes under Category B management.¹ From 8 January 2023, China will abolish the quarantine policy for people entering the country from abroad. People infected with COVID-19 will no longer be isolated.No longer determining close contacts.

No longer delineate high and low risk zones.² In the period following the implementation of the policy, the number of patients in the community is bound to increase dramatically, with fever clinics, hospital beds, and medical supplies unable to meet demand in some areas, and the risk of cross-infection between doctors and patients extremely high.³ As China enters the post-epidemic era, the COVID-19 pandemic will affect our living environment and order for a longer period of time, especially the management of campus epidemic prevention and control, which poses a huge challenge to the campus medical service system. Although the Internet Medical has played a positive role in epidemic prevention and control in society by providing convenient services such as remote consultation, interrogation, and treatment to the nation. However, there are many problems associated with its use on campus. The purpose of this paper is to identify and evaluate the problems of "Internet Medical" on campuses, how to effectively connect the "Internet Medical" service model to the campus service system, and how to form a "School and Medical Union" service system.⁴ Through big data prevention technology to minimize the risk of epidemic prevention and control on campus, and share the experience of Chinese medical services with the international community.

Key Findings and Discussions

In the Post-Epidemic Era, the COVID-19 Pandemic is Destined to Plague Campus Epidemic Prevention and Control for a Long Time

The COVID-19 Pandemic May Become One of the Most Serious Infectious Diseases in Human History

To date, there are 11 COVID-19 variants that have been named in the world. Four of these, Alpha, Beta, Gamma, and Delta, are the four COVID-19 pandemic that cause the most damage to humans. The Omicron variant was first detected in South Africa on 9 November 2021 and has since spread rapidly around the world. On 27 April 2022, the WHO weekly report on the COVID-19 pandemics showed that 99.7% of the more than 250,000 COVID-19 pandemic sequences uploaded to the Global Initiative of Sharing All Influenza Data in the past 30 days were Omicron, with an increased ability to spread compared to other variants.⁵ Currently, the Omicron variant has fully replaced the Delta variant as the dominant variant in the global pandemic due to its high transmission capacity, rapidity, and insidiousness.

Control Measures Against COVID-19 Pandemics Vary Across the Globe

In early 2020, in response to the spread of the epidemic in China, countries such as Russia, Japan, the United Kingdom, and the United States acted swiftly to implement foreign epidemic prevention and control policies by restricting entry, grounding flights, and withdrawing expatriates. Later, when the first confirmed cases of the COVID-19 pandemic emerged in countries around the world and a large-scale epidemic broke out, developed Occident countries did not respond strongly and thoroughly; countries such as Germany, the Czech Republic, China, and Austria responded to the epidemic with a more adequate nucleic acid test at the community level.⁶ Recently, the measures adopted by countries (regions) have been of varying degrees of leniency, with most countries (regions) choosing to gradually relax their epidemic prevention measures, basically ceasing nucleic acid tests within the country and starting to eliminate nucleic acid requirements or quarantine policies for people entering from abroad in their entry policies. In the coming period, the COVID-19 pandemic mutant strains will continue to spread in countries around the world, affecting their economies and people's lives. At the same time, the emergence of new mutant variants worldwide cannot be ruled out, leading to another pandemic.

Effective COVID-19 Vaccine Development Requires Long-Term Validation

At present, the best hope for epidemic prevention and control is the vaccine, as no specific drug for COVID-19 has been found worldwide. The main directions in the development of vaccines against COVID-19 are live attenuated vaccines, inactivated vaccines, recombinant vector vaccines, and nucleic acid vaccines.⁷ Each type of vaccine has its advantages and disadvantages. However, COVID-19 is a single-stranded RNA virus with a large number of glycosylation sites, which is difficult to find the right site and easily mutated,⁸ making vaccine development very difficult. Although every country has accelerated the process of developing new vaccines for COVID-19, breakthroughs have been made in different types of vaccines, the vaccine development process needs a long time to verify its effectiveness, safety, and other fundamental issues, and in the future, it also needs to consider its economic cost, and storage and transportation feasibility.⁷ Even if a COVID-19 vaccine is developed successfully, it will only reduce the risk of infection in the population, not achieve a cure. Therefore, there is no way that humans can achieve the possibility of eliminating COVID-19 in the short term. At a time when the COVID-19 pandemic is not yet over, countries have begun to relax their epidemic prevention policies, which will certainly pose serious challenges to public health management in special places such as campuses.

Introduction to Internet Medical

"Internet Medical" is a new application of the Internet in the medical service industry. At present, it is possible to use the most advanced Internet of Things, big data, cloud computing, and AI-assisted diagnostic technology to achieve intelligent collection, conversion, storage, transmission, and the back-end processing of medical information, and to realize the service mode of interaction between patients and medical personnel, medical institutions, and medical equipment, reflecting "intelligent medical". It provides various forms of medical services such as medical information, electronic health records, disease risk assessment, online disease consultation, electronic prescriptions, online drug purchase, remote consultation, and treatment through an integrated information system. It focuses on the articulation

of all relevant links into the network and big data analysis. The platform can collect patients' body data promptly through wearable devices, and doctors can provide medical consultation and treatment, and other services to individual patients when necessary based on real-time dynamic monitoring of data, breaking the time and space boundary between doctors and patients, realizing health management after a full day, and enhancing the relevance, dynamism, and accuracy of medical services. It allows patients to enjoy safe, convenient, and quality medical services.

Since the outbreak of the COVID-19 pandemic, each city has implemented strict travel management and other epidemic prevention measures, the consultation process, patients have difficulty obtaining convenient treatment and face the difficult problem of easy cross-infection risk.⁹ Internet Medical improves the efficiency of consultation, break time and space, reduce cross-infection, and many other advantages demonstrated. According to the 2022 China Internet Hospital Industry Report released by the independent research institute "Yi Guan Qian Fan", in 2022, there will be more than 1700 Internet hospitals nationwide and 300 million online medical users for the first time, compared with only 100 Internet hospitals in December 2018.¹⁰ In terms of national policies, the National Health Commission has issued documents such as the Notice on Doing a Good Job of Internet Medical Services in Epidemic to Meet the Basic Medical Needs of the Public, and the Notice on Doing a Good Job of Internet Medical Services for COVID-19, fully encouraging and guiding Internet Medical care to play an important role in assisting epidemic research and diagnosis, innovating treatment models, and improving service efficiency and other important roles.¹¹

Problems in Epidemic Prevention and Control on the "Internet Medical"

With the rapid development of Internet of Things technology and the increasing concept of health care, "Internet Medical" service model has become a major trend.¹² However, we have to admit that at this stage, the "Internet Medical" still faces a series of challenges such as the lack of talents and the lack of legal supervision.

Inadequate Policies and Protection Systems

In terms of medical industry legislation, China has developed specific laws and regulations that set out standards and norms for the medical service industry. As of 2022, it is about 200 laws and regulations related to the medical industry in China, and only 8 laws and official institutional documents related to Internet Medical and in forced.¹³ Including qualification access, business development norms, medical information security, and other aspects, the legal system of the Internet Medical service industry has initially formed. However, Guo Xiaolin¹⁴ argue that China's Internet Medical currently suffers from a lack of regulatory standards, inconsistent infrastructure construction standards and online medical insurance settlement has not yet been liberalized. According to Luan¹⁵ risks in the Internet+ medical sector mainly lie in the lack of laws and regulations, unregulated technical operations, ineffective supervision, and inaccurate scope of business activities. The current legal system is inadequate to address many of the problems in the Internet Medical services industry.

Lack of Information Sharing and Violation of Territoriality Principle

In the field of medicine, doctors are the core resource, and renowned doctors are particularly scarce. The Law for Licensing Medical Practitioners clarifies that physicians can practice at multiple points, and also requires that if a physician practices regularly in more than two medical and health institutions, one medical and health institution should be the main one, and the relevant procedures should be carried out by the relevant national regulations.¹⁶ As in the public medical service industry, doctors need to sign contracts with local hospitals to practice and rely on the contracted hospitals to exercise their right to practice, and are generally not allowed to exercise their practice of medicine; moreover, most of their doctors are unit people with establishment status, and their online "sharing" may mean offline". Therefore, the public medical staff is not very motivated to participate in Internet medical.¹⁷ At present, most of the practitioners of "Internet Medical" are in private hospitals or private clinics, and they are limited by their professional level, which makes it difficult for them to provide relatively satisfactory medical services to patients. Moreover, the existing online medical platforms are all corporate and lack authority, which makes it difficult to gain the public's trust in them and directly affects their development.

The Rural-Urban Divide in Health Services Remains, with Less Impact in Rural Areas

According to the characteristics of the local epidemic scope, population and region in the initial and subsequent outbreaks, the epidemic occurred and spread mostly in cities. Until the beginning of 2021, the outbreaks in Shijiazhuang and Xingtai of Hebei Province were characterized by the fact that rural areas had become the "hardest areas" of the virus.^{18,19} The epidemic was characterized by a long duration, a wide range of cases, rapid transmission, older patients, and a high proportion of rural patients.²⁰ In the past two years, the epidemic situation in China has shifted from developed towns to remote rural mountainous areas. Due to the weak medical resources in rural areas of China, traditional medical services cannot meet the current epidemic prevention and control requirements.²¹ China has a vast territory, uncoordinated and unbalanced economic development, and great differences in population quality among regions. Coupled with medical funds, talent shortages and imperfect infrastructure, Internet health care has little influence in rural areas, limiting its role in epidemic prevention and control in rural areas.

Lack of Information Sharing and Violation of Territoriality Principle

As with traditional medicine, there are companies, hospitals, and other non-profit organizations that implement "Internet Medical", and there is competition between them, leading to a lack of sharing of information between doctors and patients and a strong information barrier. Secondly, there is a lack of recognition of project data, leading to repeated screening and treatment of a disease, which increases the financial pressure on patients. Furthermore, the quality of current Internet Medical practitioners is generally low, and there is an off-site medical practice, meaning that the place of registration of practicing doctors, Internet hospitals, and the place where patients seek medical treatment may belong to different administrative regions. Inevitably, this leads to the possibility that practicing physicians and their medical business activities belong to different regions. The territoriality principle refers to the legal supervision and management responsibility of the administrative authorities where the practicing physician is located. If the territoriality principle is followed, it is not possible to determine which health administrative department is responsible for supervision.¹³ Adding to the problem of safety of practice in internet medical.

The Advantages of Integrating "Internet Medical" into the Campus Medical Service System

The Patient's Perspective: The Pursuit of Personalized, Diversified Medical

University students are the most active and highly intelligent intellectual group in society and are the quickest to accept new things, and they have a strong desire to learn, are energetic, and pursue individuality.^{22,23} Internet Medical breaks the traditional medical service model by relying on mobile devices to make online appointments, mobile payments, inspection reports, personal information inquiries, and other operations, extending medical services from in-hospital to out-of-hospital, resulting in a significant reduction in treatment time and more reasonable treatment items, and enhancing the actual patient experience. The intelligent platform can integrate existing medical resources, analyze patient health data and assist doctors in achieving accurate diagnosis and treatment, and importantly, provide patients with personalized services such as disease prevention, health management, and rehabilitation treatment. These features are fully in line with the medical experience needs of university students in the new era.

The Medical Worker's Perspectives: reflecting Intelligence, Efficiency, and User-Friendliness

Internet technology has effectively linked all the links together to make the treatment process paperless, which not only reduces the flow of procedures across hospitals and departments in the medical business, reduces the work intensity of medical staff, improves the speed of treatment, but also makes treatment more accurate. In the future, if the government can break through the barriers of medical information, integrate the data information institution of the national medical system, share medical information and data across the country, exchange experiences, and form complementary technology and personnel resources, our overall medical standard will usher in a trans-generational development.

The Medical Provider's Perspective: Reflecting the Advantages of Low Operating Costs and Enhanced Supervision

The operation of the platform can remove all kinds of duplication in medical services, reducing the operating costs of the university hospital while also improving operational and regulatory efficiency. Through the analysis of data records in the university's information system, real-time monitoring of each doctor's visits, the use of medication and tests by doctors, and the use of medical insurance can be achieved, making real-time monitoring of large prescriptions and indiscriminate tests a reality.

Gaps in Public Health Protection on Campus

Public Health and Disease Prevention and Control System Construction Problems are Foreground

Weaknesses in overall public health planning, resource reserves, and conditions on Chinese campuses are common. In the early days of the epidemic, some campuses, especially universities, had inadequate collaboration mechanisms between public health and disease prevention and control institutions, insufficient sharing of medical resources, and separation between prevention and control and treatment. Most campuses across the country have a low investment in public health software and hardware, and there is a serious drain of public health personnel. Most of them lack professional and efficient public health teams that can conduct detailed epidemiological investigations and make timely diagnoses and referrals.

Lack of Emergency Medical Services Staff on Campus

School hospitals are healthcare institutions in the field of education in China, and their functions have certain special requirements. The Regulations on School Health Work and the Regulations on the Work of Medical Institutions in Higher Education stipulate that the main tasks of school medical institutions are: monitoring the health status of the school population; carrying out school health education; strengthening the prevention and treatment of infectious diseases and common diseases among students, and implementing medical supervision of harmful factors affecting the health of the school population.^{24,25} Since the pandemic outbreak, campus medical duty functions have been weakened by epidemic prevention and control in the early stages as hospitals at all levels have assumed primary responsibility for treatment, resulting in a general lack of training orientation in infectious diseases among campus medical service personnel. The scale of campus medical institutions is generally low, the level of medical services is not high, and the funding budget, health staff, and medical equipment and instruments are insufficient to meet the requirements of campus prevention and control in the post-epidemic era.²⁶

Insufficient Awareness of Strategic Material Reserves

School hospitals are generally integrated into the management of the logistics department and have limited financial input. School hospitals are inherently welfare-oriented and public-spirited, and this characteristic also makes the school's investment in drugs and equipment more uncertain.²⁷ In response to sudden outbreaks of mega infectious disease epidemics, the construction and capacity of existing infected ward facilities on campus are often unable to provide perfect emergency treatment services. The shortage of medical supplies such as masks, goggles, and protective clothing in some universities reflects the significant shortcomings of university campuses in terms of public health emergency investment and related strategic reserves.

The Concept of "Internet Medical" in Campus Response to Epidemic Prevention and Control

Policy and Legislation Precede the Implementation of "Internet Medical" on Campus

In the context of the current institutional system in China, the introduction of a new technological initiative in public health care requires, first of all, the necessary support in terms of national policy. In April 2018, the State Council issued the Opinions on Promoting the Development of "Internet + Medical Health", clearly stating the need to develop the "Internet + Medical Health" service system, emphasizing the need to strengthen industry supervision and safety

protection.²⁸ The second is the repositioning of the role, nature, and status of school hospitals by the government and school units. At present, the threshold for access to "Internet healthcare" is relatively low. Under strict conditions of the approval process, different levels of medical institutions (including school hospitals) are allowed to develop Internet Medical within their medical capacity and level of care by implementing graded review and supervision standards according to different entry threshold requirements and service scope.²⁹

In the Post-Pandemic Era, a "School-Medical Association" System is Needed

In the process of epidemic prevention and control, the traditional mode of medical treatment has been changed, and Internet Medical care has shown its unique advantages, with many hospitals actively developing Internet Medical services and achieving great success. According to the Plan, patients should be treated in a graded and categorized manner; schools, pre-schools, large enterprises, and other key institutions where people gather should be monitored for health.¹ School hospitals should also adjust their management concepts, improve their services, and make use of the "Internet Medical" services to actively integrate with the medical associations set up by local general hospitals,³⁰ forming a "school-medical association" medical service system. In the integration into the regional medical service system, for the emergence of COVID-19 infection patients on campus, the graded treatment after the trial implementation of the university hospital's first consultation system, the process can be used to form a three-level linkage of the university, community, and city medical service system with the help of remote consultation, while opening a green channel for medical treatment and diagnosis of seriously ill patients to facilitate the timely treatment and rescue of individual critical patients in the campus epidemic.

Good Articulation at the Technical Level to Enhance Students' Sense of Identity

Internet Medical now gradually becoming familiar and accepted by the public and will become a part of our lives in the future. With the gradual upgrading of the Internet Medical service system and the gradual improvement of the project, the technical requirements for the use of the patient group will also increase. Although university students are at the forefront of accepting new things and have strong cognitive and learning abilities, to quickly promote the "Internet Medical" service on campus, schools need to co-ordinate the acquisition, technical training, and promotion of the service, to technically solve the students' problems with the use, promote the use of mobile devices, and improve their understanding of the Internet Medical service on campus. This will help to address students' concerns about the use of technology, promote the use of mobile devices, and raise their awareness of the role of Internet Medical in epidemic prevention and control on campus.

In terms of mobile medical technology, if campuses achieve full coverage of the use of student medical wearable devices, this will be very useful for campus epidemic prevention and control. For example, if student A in one of the dormitories on campus has a suspected fever, the device transmits this information to the platform for big data analysis and conducts an online diagnosis along with home health observations. The early warning system quickly uses the trajectory data to analyze possible transmission pathways and high-risk groups, and then issues an alert to the person concerned and guides them through health monitoring. Once this model is put into practice, it can be used to identify potentially at-risk populations and intervene in the event of a cluster of infections.³¹ The integration of "Internet Medical" into the campus does allow for information sharing, data analysis, synchronization of diagnosis and treatment, and global command, which not only simplifies the work and saves a lot of human and material resources, but also quickly and effectively prevents the further escalation of public health emergencies.

Conclusion

"Internet Medical" is a new medical service paradigm that has significant advantages in terms of enhancing medical effectiveness and lowering medical expenditures. In particular, it plays an important role in epidemic prevention and control. The promotion of "Internet Medical" on campus is in line with the basic national conditions and social needs of China. It is hoped that soon, the medical system can be improved to meet the complex needs of society in the post-epidemic era and to be well-prepared for future public health emergencies.

Funding

This study was supported by the Guangdong Provincial Education Science "13th Five-Year Plan" Project[Grant No. 2020GXJK062].

Disclosure

The authors report no conflicts of interest for this work.

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