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How telemedicine integrated into China's anti-COVID-19 strategies: case from a National Referral Center

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ABSTRACT

Introduction We present the integration of telemedicine into the healthcare system of West China Hospital of Sichuan University (WCH), one of the largest hospitals in the world with 4300 inpatient beds, as a means for maximising the efficiency of healthcare delivery during the COVID-19 pandemic.

Methods Implemented on 22 January 2020, the telemedicine technology allowed WCH providers to conduct teleconsultations, telerounds, teleradiology and tele-intensive care unit, which in culmination provided screening, triage and treatment for COVID-19 and other illnesses. To encourage its adoption, the government and the hospital publicised the platform on social media and waived fees.

Discussion From 1 February to 1 April 2020, 10557 online COVID-19 consultations were conducted for 6662 individuals; meanwhile, 32676 patients without COVID completed virtual follow-ups. We discuss that high-quality, secure, affordable and user-friendly telemedical platforms should be integrated into global healthcare systems to help decrease the transmission of the virus and protect healthcare providers from infection.

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INTRODUCTION

The spread of the coronavirus disease (COVID-19) has caused an unprecedented demand for medical services, illuminating the worldwide inefficiencies of the current healthcare systems. Without a known cure for the disease, it became necessary for affected countries to maximise the efficiency of their healthcare delivery methods. To optimise their current systems, Chinese public officials ordered the integration of telemedical infrastructure into hospital systems as a part of the anti-COVID-19 response strategy.[1] This report aims to present the framework for which the integration of telemedicine technology occurred at the West China Hospital of Sichuan University (WCH).

WCH is one of the largest single-site hospitals in the world and a leading medical centre in China. It is a tertiary public hospital located in Western China with more than 4300 inpatient beds, 3 fever tents and outpatient clinics that can accommodate over 20000 patients per day. The centre has more than 5000 healthcare professionals whose specialties span over 40 departments, including internal medicine, respiratory, paediatrics, radiology and laboratory medicine.

The imbalance in high-quality healthcare services between urban and rural areas still persists in China, especially in western provinces.[2] To increase access to high-quality medical care and providers, WCH acts as the hub organisation and provides long-distance medical education and consultations to subordinate medical institutions, or spoke hospitals[3] (660 spoke hospitals in 183 cities throughout western China). We present the utilisation of telemedicine technology in the specific context of the COVID-19 pandemic and postulate takeaways for global healthcare systems.

METHODS

On 21 January 2020, the government of Sichuan Province launched the first-level emergency response to COVID-19 and designated WCH as an emergency response hospital. On 22 January 2020, an eHealth emergency committee was established at WCH to plan, guide and coordinate the transferring of in-person healthcare services to Huayitong, a telemedicine mobile application created by WCH in 2015. WCH quickly assembled a team of clinical experts (named the 'COVID-19 online team') from the respiratory, intensive care unit (ICU), nephrology, endocrinology, infection, cardiology, gastroenterology and radiology departments to further develop the mobile application.

One week later, the updated app was launched, synergising online consultations and e-prescription delivery. To encourage its adoption, the government and the hospital publicised the app on social media and

waived consultation fees for all users. On 24 February 2020, a 5G dual gigabit network was established in WCH, covering all connected spoke hospitals designated for COVID-19. Additionally, technology specialists at WCH were employed to coordinate scheduling for teleconsultation appointments and the departments of Information Technology and Management set clinical guidelines for accommodating physicians to the online platform.

Through utilising the updated version of Huayitong on 1 February 2020, WCH began virtually providing triage, consultations (consultations scheduled through appointments and emergency consultations performed within 24 hours of request), education, rounds, CT scanning, treatment and follow-ups.

This research obtained approval from the Institutional Review Board of WCH.

RESULTS

Triaging patients with COVID-19

The telemedicine delivery method for triaging COVID-19 was as follows: individuals installed Huayitong on their smart devices (supported by both Android and iOS) and received a free online COVID-19 consultation with a physician from WCH. They first completed a screening questionnaire about their demographic information, current temperature, epidemiological history and symptoms. Then, a video assessment was performed by physicians from WCH within 24 hours of completing the questionnaire to inspect the patient's breathing, general appearance and any other concerning symptoms.

Individuals who had potentially been exposed to COVID-19 and exhibited symptoms, such as fever (axillary temperature of 37.5°C or higher), cough and expectoration, myalgia or fatigue, were directed to get a nucleic acid detection, whereas others were instructed to quarantine at home and, if necessary, receive a follow-up assessment. Additionally, free 24/7 mental health consultation was provided through the app to support individuals psychologically affected by the global health crisis and lockdown.

From 1 February to 1 April 2020, a total of 10 557 online COVID-19 consultations were conducted for 6662 individuals, among whom 487 individuals (7.3%) were suspected cases with a mean age of about 33.5 (SD=13) years. These individuals were referred to nearby medical institutions for comprehensive testing. Among them, there were four confirmed cases (0.82%, 4/487).

Services for patients without COVID-19

The Huayitong platform was also used for patients without COVID-19 and with chronic diseases. Chronically ill patients were able to schedule follow-up visits via the app and enter a virtual chat room to discuss their condition with physicians from WCH. If needed, electronic prescriptions were sent to pharmacies and the prescribed medications were delivered to patients by priority mail services. As of 1 April 2020, 32 676 patients completed follow-up

visits and received 10 981 e-prescriptions through the app. From 1 February to 1 April 2020, the monthly average of patients receiving online follow-ups increased by nearly fivefold, from 3400 to 16 338, and continues to grow.

Collaborations between WCH and other hospitals

The telemedicine platform also supported subordinate hospitals via teleround, teleradiology and tele-ICU to guide less experienced physicians through caring for critically ill patients with COVID-19. On average, the distance between WCH and spoke hospitals was 319 km, ranging from 20 to 1191 km.

CT played a critical role in both diagnosing and categorising patients with COVID-19 based on case definitions issued by the WHO and the treatment guidelines from the National Health Commission. To compensate for the shortage of experienced radiologists in rural areas, WCH conducted remote CT scans for patients with COVID-19. Specifically, radiologists at WCH controlled CT equipment at spoke hospitals while viewing and analysing CT scans in real time. As of 1 April 2020, 152 patients have undergone remote CT scanning.

Moreover, inpatient wards and ICUs were particularly impacted by the pandemic. In these facilities, physicians faced high exposure to the virus and patients were in need of extensive care to treat multiple organ dysfunction. Given the urgency of the pandemic, physicians and nurses without extensive experience were given the difficult task of caring for patients with COVID-19. Therefore, telemedicine technology was used to support these frontline physicians. Specifically, through teleround and tele-ICU, clinical data and access to electronic medical records (EMRs) were interfaced with WCH, while the bedside physicians delivered the real-time condition of the patient via the advanced audiovisual technology. From this, a multidisciplinary team of WCH providers was able to guide less experienced physicians at subordinate medical institutions through treating critically ill patients with COVID-19 while maintaining a high level of care for patients and minimised infection risk for physicians.

In total, 338 joint teleconsultations for 150 infected inpatients were conducted via the platform. Of the 150 critically ill patients, 3 died, whereas the other 147 recovered and were discharged. With the help of the telemedicine platform, quality of care was improved at subordinate hospitals, which likely improved health outcomes for these patients in rural areas during the pandemic.

DISCUSSION

Through this analysis, it is apparent that telemedicine technologies are a legitimate mechanism for screening, triaging and treating patients with COVID-19. As echoed by other reports,[4] the online platform has reduced the number of in-person visits to WCH, thereby minimising face-to-face contact among patients and clinicians and decreasing the transmission of the virus. Furthermore, limiting in-person visits reduced the scarcity of medical

resources, such as personal protective equipment, which benefitted both patients and physicians.

Though there was a significant decrease (46%) in in-person visits to WCH compared with 1 February–1 April 1, 2019, we cannot assume that this was a direct consequence of telemedicine as it is expected that patients may choose to not seek medical attention for non-critical health conditions during a pandemic. However, the monthly average of online non-COVID-19 visits increased nearly fivefold, from 3400 to 16 338 during this 2-month period, indicating that patients are switching from in-person visits to telemedicine services at increasing rates.

Across the globe, the acceptance of telemedicine as a safe, convenient, time-saving, labor-saving and cost-saving healthcare delivery method has risen, and, accordingly, medical institutions have increased its availability, allowing more care to be provided to patients at a distance.[5 6] Nevertheless, when discussing the integration of telemedicine into healthcare systems, it is important to consider the barriers that may prevent successful adoption.[7–13]

First, only 8.1% (447 of 5517) of physicians at WCH used the telemedicine platform. A recent physician survey at WCH identified the following potential challenges: lack of time, insufficient authenticity and reliability and underdeveloped policies.[9] Considering that respiratory, infectious disease, intensive care and emergency medicine providers already have heavy workloads, incentives may be necessary to encourage physicians' engagement. Furthermore, more training programmes and further development of guidelines may be integral in facilitating physicians' transition to online healthcare delivery methods.[9 14]

Second, patients play a key role in the effectiveness of their telemedical care. Therefore, hospital adoption strategies must prioritise the user-friendliness of their platforms. This can be achieved through involving and communicating with patients during the platform's development process, which unfortunately did not occur for Huayitong. Furthermore, older patients, while most reliant on healthcare services, are less likely to use telemedical applications.[8] Therefore, hospitals must ensure that access to online assistance is available for patients, such as those from older cohorts, that lack technological proficiency, in order to successfully care for patients from all demographics. Along with prioritising user-friendliness and providing access to technical assistance, it is compulsory that patients are well aware that online healthcare services exist. Therefore, advertising for platforms must be done through mediums that will reach all age groups and demographics, not just social media.

Finally, as telemedicine grows in popularity, it is paramount that data safety and privacy are ensured.[15] Security, ownership, storage and traceability of patient data must be deliberated, especially for newly built online platforms that were implemented quickly due to the urgency of COVID-19. In the case of WCH, when patients registered in Huayitong, they signed a consent form that indicated that all the data would be stored at WCH and used only

for medical purposes. Moreover, collaboration with regulatory agencies and government remains vital. For WCH, telemedicine services have been connected with and supervised by the provincial medical supervision system since 2019, which has helped protect the security of data.

Additionally, further technical issues remain restricting the use of telemedicine, including lack of data synchronicity and interoperability due to the heterogeneity of EMRs system for each hospital. Thus, generalisable methods for securely interoperating data from EMRs and patient report outcomes need rigorous exploration.[16–20] Moreover, in accordance with the suggestions of prior research, evaluation methods must be established for telemedicine technologies so that high standards of care are upheld.[21]

This study presents the extent to which telemedicine technology was used by a national referral centre during a pandemic. This paper addresses how both patients with COVID-19 and without COVID-19 can benefit from the use of telemedicine and highlights important concerns regarding data security and interoperability. Through this information, global healthcare systems, especially in low-income and middle-income countries, can be introduced to the breadth of capabilities of telemedical technology and begin to implement and further develop these practices.

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