Description of an internet hospital, China

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China has a three-tier health-care system; primary health-care facilities are expected to provide affordable first-contact care, while secondary and tertiary care facilities provide specialist referral services. However, with no gatekeeping in the primary health-care system, patients can freely choose their provider at any health facility, and many routinely use hospital outpatient services for first-contact care. Primary health care in China faces several challenges, including overprescribing of profitable drugs and diagnostic tests (leading to waste of health resources), competition for patients where there is fee-for-service,[1,2] and increasing health-care demand, especially considering China's ageing population.

The Chinese government now views digital medicine as a solution to address these challenges. China's fast increase in internet users (from 22.7% in 2008 to 59.6% in 2018)[3] provides an opportunity for the development of digital medicine platforms. Using digital medicine to deliver and strengthen primary health-care has great potential, but challenges remain. Here, we describe an online platform model of a hospital in Guangdong province, the challenges the platform faces to develop further and the potential role that digital medicine can play as a provider of primary care.

The Guangdong Second Provincial General Hospital public tertiary hospital is leading the platform – also known as internet hospital. This digital hospital was founded in 2012 and has been accredited by the Health Commission of Guangdong Province as the first internet hospital in China. In 2018 an average of 33 000 people sought health care every day through the community-based providers connected to the internet hospital. The platform now has around 700 licensed physicians or assistant physicians from the Guangdong Second Provincial General Hospital as well as from 19 county-level hospitals. These physicians have been re-trained and accredited through a general practitioner training programme. The physicians provide online video consultations for 13 987 community-based health providers, including community health centres, village clinics, university health services and pharmacies in Guangdong. Community-based providers are motivated to connect to the internet hospital, because this enables easier access to health professionals and technology in higher-level hospitals that are more attractive to patients. Only patients who use these community-based providers have access to the internet hospital.

The online platform supports the primary health-care provider at the community level in diagnosis and treatment decisions. The provider can link the patient directly to the platform for a video consultation with a physician. If no diagnosis can be made, the patient is referred to hospitals associated to the platform (Fig. 1). The platform is expected to strengthen primary health-care and create a local gatekeeping mechanism. Inspired by the Guangdong experiences, the Chinese State Council issued the first national directive on developing digital medicine in April 2018.[4] The directive encourages hospitals to provide primary health care, with a backup referral system, via the parallel online platforms of the hospitals. The new policy encourages hospitals to use such platforms to provide primary health care for patients with common conditions and chronic diseases. This approach also acts as a triage system for hospital services.[4]

To address concerns about misdiagnosis, mechanisms have been built into the online platform. First, practitioners using the platform can only deal with 98 listed conditions. Second, if a patient's symptoms or conditions are excluded from the list, the platform's algorithm system directly suggests that the physician refer the patient to a hospital. Third, all consultations are video recorded, allowing for quality control on randomly selected consultations. Since its establishment, the platform has dealt with over 8 million patient encounters, demonstrating the fast development and potential for digital medicine in the country.

However, challenges exist. First, in China, primary health-care providers do not serve a gatekeeping role and patients can freely seek specialist care. Many tertiary hospitals provide online appointment services directly to service users, which allows patients to easily bypass primary health-care providers. Thus, finding ways to develop some form of gatekeeping within the digital medicine system is critical to maximizing its efficiency. The gatekeeping role may empower primary health-care providers in the interaction between patients and the health-care system. The platform should also facilitate online communications between primary health-care providers and hospital physicians, allowing for more efficient triage than when patients self-refer. However, it is not yet clear whether this model can improve coordination of services, reduce pressure on secondary and tertiary hospitals and maximize efficiency.

Second, the mean age of village doctors, the main primary health-care providers in rural areas, is now 49.3 years, and retiring doctors are hard to replace.[5] Village doctors also lack training opportunities.[6] Digital medicine could help to improve health-care access for the rural population. Fifty-five village doctors in Guangdong are now connected to the internet hospital and are pre-testing the platform. Village doctors can consult hospital physicians about patient conditions and/or let patients talk to physicians through the platform.[7] The provincial government intends to roll

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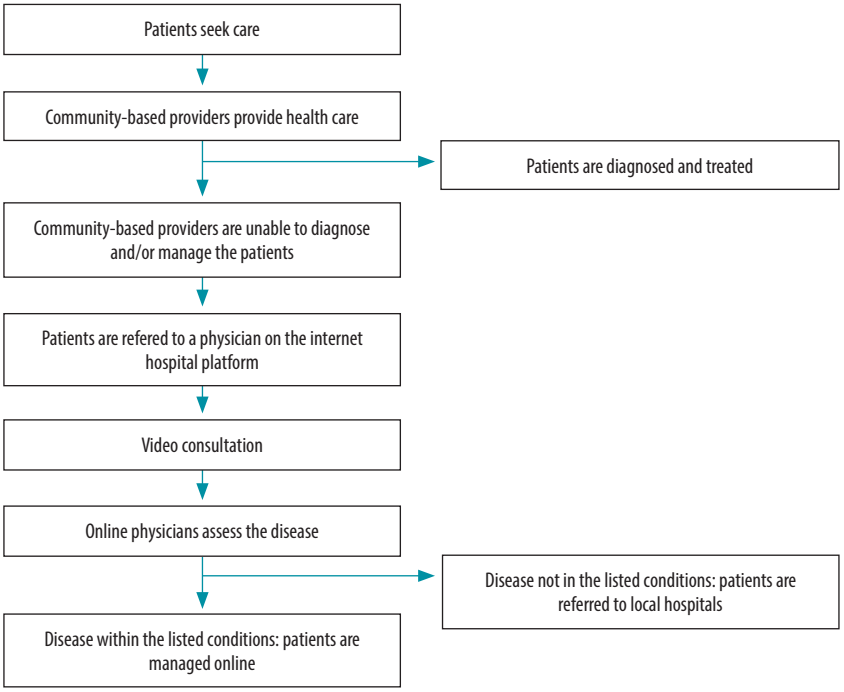
(*Submitted: 15 November 2018 – Revised version received: 20 March 2019 – Accepted: 12 April 2019 – Published online: 3 June 2019*)

First Proof – 18.226936

Fig. 1. **Medical consultation process for an internet hospital, China**



out this platform to 2277 clinics in poor villages in Guangdong, with a further financial injection of 30 million Chinese Yuan (about 4.5 million United States dollars). This roll-out will be especially valuable in villages that have a shortage of doctors.

Third, a major challenge for China's health system is the financial dependence of health facilities on drug revenues.[1] Physicians using the platform are disincentivized to overprescribe, with patients having to purchase drugs at local clinics or pharmacies, where the average cost for purchasing different drugs is 75% cheaper than the cost per prescription in the provincial capital, Guangzhou. A potential consequence of fewer unnecessary prescriptions, however, is decreased drug-related income for community-based providers, which may disincentivize these providers from using the platform. Therefore, innovative incentive structure design may be necessary to retain engagement.

Last, online consultations are currently not covered by health insurance plans. Funding sources for the model have included government grants, the hospital's funds, and the only available medical technology company, causing concerns about the financial sustainability of the platform. In response, in June 2018, Guangdong province passed an action plan to ensure that primary health care provided through digital platforms will be covered by insurance schemes, with implementation in the near future.[8]

Digital medicine is developing fast, though with large variation across provinces and regions in China. However, the role of digital medicine in strengthening the primary health-care system is unclear. Digital medicine in China faces similar challenges to those found in other countries, including patient safety, data security and lack of surveillance and evaluation frameworks.[9] The Guangdong digital medicine model may provide an opportunity for the underutilized community-based primary health-care system in China.[10] Policy-makers can seize this opportunity to facilitate primary health-care development, and to incentivize and empower primary health-care providers as gatekeepers for accessing online hospital physician services. Therefore, this model could improve quality health care in remote rural areas, while ensuring health insurance coverage of primary health-care services provided through the platform. The digital medicine model needs close monitoring of implementation as well as evaluation of service coverage, use and quality, which are all essential to advance the development and consolidation of the platform. ■

Funding: We received support from Information Commission of Guangdong Province, Department of Finance of Guangdong Province, and Science and Technology Planning Project of Guangdong Province (2017B020210002).

Competing interests: None declared.

First Proof – 18.226936

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First Proof – 18.226936