

Preparing and responding to 2019 novel coronavirus with simulation and technology-enhanced learning for healthcare professionals: challenges and opportunities in China

Li Li ^{1,2}, Minjie Lin,³ Xifu Wang,^{2,4} Pinhong Bao,⁵ Ying Li^{3,6}

INTRODUCTION

In December 2019, a novel coronavirus disease (COVID-19) was first recognised in Wuhan, Hubei Province in China, and rapidly spread to other domestic areas in China and internationally.^{1 2} Similar to other severe infectious disease outbreaks including severe acute respiratory syndrome (SARS), Ebola and even influenza, the COVID-19 could lead to high morbidity and mortality.³ Attention has been aroused and measures have been taken by countries around the world in dealing with the situation. Education and training initiatives, especially in China, have been undertaken to address the issue.

Previous infectious disease outbreaks or pandemics have had negative impacts on healthcare education and training. And there is no exception this time. The overall impact of COVID-19 on education and training of medical students and healthcare workers (HCWs) in China includes:

1. Temporary regulations to restrict personal contact for the sake of infection control that leads to reduced accessibility of face-to-face teaching and learning across the medical education continuum.

2. Postponement of the semester start date by the Chinese Ministry of Education (MOE) as the outbreak took place during the winter break of the Spring Festival.⁴
3. Sudden increase of workload among HCWs in different hospitals with over-stretched working hours that result in reduced time for clinical teaching.
4. HCWs being called to the frontline to reinforce the continuously reducing local medical care resources of the outbreak (as part of the national response) as few instructors are available to provide clinical teaching and feedback for students and residents.
5. Suspension of activities that grant continue medical education (CME) units by the Chinese National Health Commission (NHC).

Despite these reductions, there is a need to provide training responding to COVID-19. Deploying appropriate personal protection has been prioritised as human-to-human transmission has been reported. With the improved understanding of the virus, especially its contagion and increased reports on HCWs being infected, many HCWs have expressed concern and the need to have more knowledge to protect themselves. And thus, the role of training on the use of personal protective equipment (PPE) becomes apparent.

Although donning and doffing of gowns are existing training modules in medical and nursing undergraduate curricula, little awareness was drawn to the repeated practice as a refreshment of such rapid-degrading procedural skills for the general HCWs. Further training needs are also being identified gradually as more clinical features of COVID-19 are being discovered.

The purpose of this editorial is to illustrate and summarise the current measures taken to respond to the emerging need for technology-enhanced learning and simulation during the COVID-19 outbreak

in China and the potential challenges (table 1).

ONLINE LEARNING: FROM CHOICE TO REQUIREMENT AND MORE CHOICES EMERGING

Several online learning platforms with professional medical information, such as iCOURSE, People's Medical Publishing House Open University, are already established, the majority of which are presented in the format of Massive Open Online Courses (MOOCs) and are enlisted in 'National Selected Online Open Courses'. Regardless of platform, these government-supported courses are received as supplements to current medical and healthcare curriculum, and for some, there may also be some restrictions (eg, individual pay-per-view or institutional subscription) prior to accessing certain courses. As these courses are often not mandated, learners were not driven to take them unless incentives, such as CME credits, were available after course completion. Nevertheless, these previously available resources became useful after the announcement from the MOE to deploy online learning for the higher education institutions during the COVID-2019 outbreak and the postponement of the new semester.⁵ These online learning resources are now beginning to be taken more seriously and are even becoming compulsory in certain institutions.

Alternatively, online live sessions were also previously presented via existing platforms. Mobile phone applications such as Tencent Conference, DingTalk and even TikTok are among the popular ones that provide teleconference functions that are transferable for medical teachers to offer quality live streaming of real-time instruction and at no direct cost. Certain health-themed websites also use these platforms to inform and educate health professionals on the research progress of the diagnosis and treatment of coronavirus diseases. These live and replay-able approaches create more individualised, interactive, learning-on-demand choices with their up-to-date information and fast-iterations dealing with the rapid growing knowledge regarding the COVID-19. These live sessions are important add-ons to the current medical curricula.

SIMULATION: BACKBURNER BECOMING THE FIRST CHOICE

Simulation training has grown exponentially in China over the past 5 years. This is in large part associated with the mandated residency training policy for physicians initiated in 2015. However,

¹Department of General Practice, Guangzhou First People's Hospital, South China University of Technology, Guangzhou, Guangdong, China

²Department of Healthcare Simulation, Wu Jieping Medical Foundation, Beijing, Beijing, China

³The Clinical Skills Training Center, Second Xiangya Hospital, Changsha, Hunan, China

⁴Department of Emergency Medicine, Guangzhou First People's Hospital, Guangzhou, Guangdong, China

⁵Department of Outpatient, Guangzhou First People's Hospital, Guangzhou, Guangdong, China

⁶Department of Nephrology, The Second Xiangya Hospital of Central South University, Changsha, Hunan, China

Correspondence to Dr Li Li, General Practice, Guangzhou First People's Hospital, Guangzhou, Guangdong, China; mrcatking@gmail.com and Professor Ying Li, Department of Nephrology, The Second Xiangya Hospital of Central South University, Changsha, Hunan, China; liyingdoctor@163.com

Table 1 Challenges and possible solutions for simulation and technology-enhanced learning during COVID-19 outbreak in China

Approaches	Challenges	Possible solutions	
Online learning	<ol style="list-style-type: none"> MOOCs and other prerecorded online platforms; Teleconference software and mobile applications 	<p>Lack of learner engagement, interaction and real-time feedback</p> <p>Course-delivery quality, technical failure</p> <p>Learner progress monitoring</p> <p>Mostly knowledge-based learning, not enough on clinical skills</p>	<p>Online group discussion via social network services (phone applications and so on)</p> <p>Delivery platform how-to-use manual, testing before course presentation, improve recording environment</p> <p>Precourse and postcourse assignments</p> <p>Add sessions on virtual lab/practical learning platform (eg, http://www.ilab-x.com/)</p>
Simulation	<ol style="list-style-type: none"> Training and maintaining procedural Skills (eg, hand hygiene, PPE) Specific patient management skills (eg, airway management, CRRT and ECMO) Training to adapting unfamiliar working environment 	<p>Limited training resources; large number of HCWs that require training</p> <p>Limited qualified instructors</p> <p>Limited time for course delivery</p> <p>Increased chance of infection</p> <p>Skill degradation over time</p>	<p>Reuse of equipment and materials; strive for support from the leadership</p> <p>Design, develop of course materials and fast iterations; training and maintain homogeneous, qualified faculty team</p> <p>Devising a reasonable training scheme: reduce total training-time, allow self-paced learning, adequate grouping and scheduling</p> <p>Self-protection, health check (body temperature and so on) before attending training, avoid a large group of learners attending</p> <p>Allow for repeated training routines, deploy just-in-time training mechanism</p>
Systems probing	<ol style="list-style-type: none"> Access to a certain area Time allocation Staff support and attending 	<p>Seek support from hospital leadership and relevant departments (outpatient, fever clinic, department of infectious diseases, office of infectious control and so on)</p>	

CRRT, continuous renal replacement therapy; ECMO, extracorporeal membrane oxygenation; HCW, healthcare worker; MOOCs, Massive Open Online Courses; PPE, personal protective equipment.

the major focus of those simulations was to meet the educational needs of different training programmes or to supplement certain curricula. After identifying the need for training, simulation has become a powerful weapon fighting against the virus, as it can not only ensure patient safety but also provide a safe learning and training environment for HCWs to develop practical skills to deal with the COVID-19.

Different simulation programmes have worked together and with other departments in their institutions to develop simulation curricula. A relatively comprehensive list for simulation-based training activities include:

- Hand hygiene.
- Wearing and removing protective masks/respirators.
- Wearing and removing sterile gloves.
- Wearing and removing disposable goggles/face shields.
- Donning and doffing of isolation gown and protective coveralls.
- Protection classification based on guidelines and so on.

These activities should be delivered to HCWs in relevant departments if not all medical staff in the hospitals. Certain simulations in specific settings such as intensive care, emergency and operating rooms also address:

- Patient management at emergency triage.
- Airway management of patients infected with COVID-19.

- Extracorporeal membrane oxygenation.
- Patient transportation.
- Team dynamic (especially after donning of PPE).⁶

Preassessment and triage against infectious diseases, though documented as a national policy, have often been overlooked in clinical practice and training. For success, this training requires the collaboration of outpatient and infectious diseases in health organisations, which can be challenging. However, this is a front-line protection measure to prevent patients with a highly contagious disease and the HCWs dealing with them from succumbing to the disease; it could also bring relief to the intensive care services by reducing the unnecessary flow of patients to the already of overwhelming intensive care units.⁷⁻⁹ Scenarios of this field are based on national preassessment and triage guides, hospital triage algorithms, as well as experiences from real cases. These include:

- Taking a COVID-19-related history and physical examination.
- Decision making for triage.
- Proper escorting of suspected patients.
- Self-protection and avoiding contamination.

These kinds of training enhance the skills of the triage HCWs and help building confidence and reducing anxiety.

Simulation also provides opportunities for systems probing for potential hospital hazards, such as outdated hospital or

departmental algorithms that could not accommodate the COVID-19 outbreak, poor team dynamics, HCWs unfamiliar with critical procedures while wearing PPE; or helping organisational decision making (such as establishing separate routes for transporting infected patients) by using simulation as a testing approach.

Although there are advantages of simulation in the COVID-19 outbreak setting, there are also limitations. First, simulation can never reproduce nor replace clinical circumstances, facilitators must debrief after simulation to help learners make meaning of their simulation experience relative to real clinical environments. Second, simulation is resource consuming, in time, human resources and medical supplies, especially during the current acute phase of a disease outbreak. Third, the face-to-face manner of delivering simulation sessions brings potential infection risks for instructors and learners.

Simulation and online learning enhanced by technology have already played a role in dealing with the COVID-19 outbreak in China, and its importance is likely to be recognised by more individuals and organisations in the health system. Emphasis should be put on the desired outcome and the quality of such learning informed by learning theories/principles. Quality assurance approaches should be taken, continuous efforts should seek more organisational support collaboration, and experience should be shared across institutions to help more to understand and

make better preparation regarding the spread of the COVID-19 outbreak and other potential pandemics.

Twitter Li Li @mrcatking

Collaborators Weifeng Xiong, Yi Ying.

Contributors The manuscript has been read and approved by all named authors. All authors have contributed to the writing, revision and approval of the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Provenance and peer review Commissioned; internally peer reviewed.

This article is made freely available for use in accordance with BMJ's website terms and conditions for the duration of the covid-19 pandemic or until otherwise determined by BMJ. You may use, download and print the article for any lawful, non-commercial purpose (including text and data mining) provided that all copyright notices and trade marks are retained.

© Author(s) (or their employer(s)) 2020. No commercial re-use. See rights and permissions. Published by BMJ.

LL and ML contributed equally.



To cite Li L, Lin M, Wang X, *et al.* *BMJ Stel* 2020;**6**:196–198.

Received 24 February 2020
Accepted 26 February 2020
Published Online First 11 March 2020

BMJ Stel 2020;**6**:196–198.
doi:10.1136/bmjstel-2020-000609

ORCID iD
Li Li <http://orcid.org/0000-0003-4151-967X>

REFERENCES

- 1 Hui DS, I Azhar E, Madani TA, *et al.* The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health - The latest 2019 novel coronavirus outbreak in Wuhan, China. *Int J Infect Dis* 2020;**91**:264–6.
- 2 Lu H, Stratton CW, Tang Y-W. Outbreak of pneumonia of unknown etiology in Wuhan, China: the mystery and the miracle. *J Med Virol* 2020;**92**:401–2.
- 3 World Health Organization. Novel coronavirus (2019-nCoV): situation report—20. Available: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200209-sitrep-20-ncov.pdf?sfvrsn=6f80d1b9_4 [Accessed 9 Feb 2020].

- 4 Ministry of Education of the People's Republic of China. MOE postpones start of 2020 spring semester. Available: http://en.moe.gov.cn/news/press_releases/202001/t20200130_417069.html
- 5 Ministry of Education of the People's Republic of China. MOE issues instructions for deployment of HEI online teaching. Available: http://en.moe.gov.cn/news/press_releases/202002/t20200208_419136.html
- 6 Devereaux A, Christian MD, Dichter JR, *et al.* Summary of suggestions from the task force for mass critical care Summit, January 26-27, 2007. *Chest* 2008;**133**:15–7.
- 7 Rubinson L, Hick JL, Hanfling DG, *et al.* Definitive care for the critically ill during a disaster: a framework for optimizing critical care surge capacity: from a task force for mass critical care Summit meeting, January 26-27, 2007, Chicago, IL. *Chest* 2008;**133**:18S–31.
- 8 May L, Shigyo K, Stahmer A, *et al.* Pre-implementation assessment of an antimicrobial stewardship program for acute respiratory infections within emergency and urgent care settings. *Open Forum Infect Dis* 2017;**4**:S261.
- 9 Han C, Gao S, Liu H, *et al.* Infectious diseases with five pre-triage and correlational research of nosocomial infection. *Chinese Journal of Nosocomiology* 2010;**20**:3744–5.