A simulation training course for family medicine residents in China managing COVID-19

Dandan Shi, Hong Lu, Haiyuan Wang, Shisan Bao, Lingmei Qian, Xiaoyan Dong, Kun Tao, Zhongqing Xu

Background and objective

As a result of the pandemic, family physicians face the additional challenge of navigating COVID-19. The aim of this study was to provide simulated training for best-practice management of COVID-19 presentations for residency program trainees in Shanghai, China.

Methods

A simulated suspected COVID-19 case was designed on the basis of a real patient. The simulation included: pre- and post-simulation surveys, a PowerPoint presentation, simulation practice, debriefing and reflection. Improvement in survey outcomes was assessed using a paired t-test.

Results

A total of 25 trainees participated in the simulation, consisting of first-, second- and third-year family medicine residents. Significant improvement was observed in their knowledge of COVID-19, and sub-analysis showed that all three grades of residents improved their knowledge significantly. Ninety-six per cent of participants believed the simulation was very helpful.

Discussion

The simulation scenario improves crisis management skills for family physicians managing the high risk of transmission of respiratory infectious diseases. Higher-order learning outcomes will be explored in future training programs.

COVID-19, which was first detected in December 2019,[1] was declared a pandemic on 30 January 2020.[2] The seriousness of COVID-19 is evident in the fact that there are 3,517,345 confirmed cases globally at the time of writing (5 May 2020).[3]

The symptoms of COVID-19 typically include fever, fatigue, dry cough, anorexia and diarrhoea.[4] However, a number of patients with COVID-19 exhibit atypical manifestations; thus, a range of different specialists may be initially consulted, including general practitioners (GP).[5] Family doctors/GPs are the 'front door' of the health system, involved in planning for and carrying out emergency health risk management.[6] There are >1000 medical staff in China who have contracted a confirmed COVID-19 infection.[7] Although it has been shown that SARS-CoV-2 is transmitted between humans,[8] many GPs have not had significant experience managing COVID-19. Thus, the situation has put these medical staff, as well as the community, at substantially increased risk for COVID-19 infection.

Simulation is a technique that involves simulating the behaviour of a situation or process through appropriate scenarios or devices, mainly for the purpose of study or personnel training.[9] Simulation is widely used in medical education to ensure the safety of patients. A module relating to COVID-19 was designed to provide a safe training environment for medical staff to comprehensively practise their skills for managing COVID-19.[10]

The education objectives of this training module were for trainees to be able to:
- introduce concepts relating to the epidemiological history in detail
- understand when to seek appropriate guidance from a superior doctor
- communicate effectively between doctors as well as with a patient with suspected COVID-19
- become proficient at correctly performing hand hygiene
- mitigate personal risk by using appropriate personal protective equipment
- understand the reporting process of the infectious disease
- understand the proper referral and patient transportation processes of a patient with suspected COVID-19.

Methods

This research was approved by the Human Ethics Committee, Shanghai Tongren Hospital (2019-096-01). Funding was sourced from the teaching budget.

The simulation model was designed on the basis of a case that raised suspicion of COVID-19, and was ultimately the first confirmed patient with COVID-19 in Shanghai. It took approximately one month to create the simulation model. The authors' intention was to use this model to allow family medicine residents to experience a scenario of COVID-19, thereby allowing them to learn and/or practise their knowledge and maximise their capacities to respond to the

COVID-19 challenge, facilitating their ability to eventually make appropriate decisions. In this scenario, a man (aged 42 years) urgently arrives at a community health centre with a fever (38.5℃) and cough of three days' duration, but without difficulty breathing. He has just returned to Shanghai from a business trip to Wuhan.

The group that completed the simulation included 25 residents of family medicine in Shanghai Tongren Hospital. There was no selection criteria for the trainees, because all family medicine residents were required to have such training following specific instruction from the medical school. The residents were divided into five groups of five trainees. Consequently, the simulation was performed five times, but each group of trainees only participated once.

The simulation (Appendix 1, available online only) took place over a 60-minute period and comprised:
1. a pre-simulation survey
2. a 10-minute presentation to introduce the process of simulation by explaining how to perform the task to the group of five trainees, what role each participant must assume, and for what purposes and how the activity was going to proceed
3. the simulation itself
4. a debriefing or reflection conducted by the group members and the instructor at the end of the activity
5. a post-simulation survey.

The use of the simulator followed The Guideline of Chinese Clinical Practice (Version 6 Trial) in February 2020.[11]

Equipment/environment

The training was conducted within a standard clinic room in the simulation centre of Shanghai Tongren Hospital.

A checklist was completed to ensure the scenario was consistent for all the trainees and proper functioning of the recording system, as well as to ensure access to all the consumables required for the scenario (gowns and masks).

One week prior to the simulation, trainees received instructions via email with an attached PowerPoint presentation of COVID-19 instruments (Appendix 2, available online only). Pre-reading was advised prior to attending the simulation. Other basic equipment was relatively simple, including stethoscopes and surgical masks.

Personnel

Two chief preceptors, the Chief of The Department of General Practice and the Vice-Director of The Medical Teaching Centre, facilitated the simulation. All other preceptors were required to have at least three years of teaching experience, in addition to their clinical duties. These trainers were educated strictly according to The Guideline of Chinese Clinical Practice (Version 6 Trial)[11] in February 2020. Thus, the evaluation is in line with this guideline. However, the ratio of preceptors to the team of trainees in the simulation should be 1:2 or 1:3. The roles of the participants were defined prior to starting the simulation: one first-year resident assumed the role of the first GP to see the patient, while one second-year resident acted as the attending doctor within the hospital, one third-year resident acted as the chief doctor and one third-year resident acted as the staff specialist in the Department of Medical Administration.

Implementation

Prior to entering the simulation room, trainees were required to complete the pre-simulation survey. The first step of the simulation was the presentation of the clinical vignette. The members of the team performed their roles on the basis of their experiences. At this point, trainees were making several decisions: should this patient be transferred to another hospital with a quarantine facility that is specific for COVID-19? If the decision was made to transfer the patient, then to where and how should this transfer occur? What precautions should be taken in terms of infection prevention and control measures? Another important issue was which authority should be informed, when and how? The critical actions checklist showed clearly the essential steps to be performed during the simulation. The simulation itself took 20 minutes, but the length of time was dependent on the competence of the trainee. Any team members not directly involved in the simulation were watching the simulation via live video from the multimedia setup in the observation room.

Assessment of the COVID-19 risk

Pre- and post-simulation surveys were developed (Appendices 3 and 4, available online only), consisting of 20 multiple choice questions. There were five questions addressing identification/ diagnosis, 12 questions testing infection prevention/ treatment and three questions designed to assess the referral/patient transportation. Furthermore, anonymous feedback about the scenario was provided from each of the participants (Appendix 5, available online only), offering objective measurement for assessing the trainees' achievements.

The evaluation was performed by the experienced educators, as stated above, to reduce confounding biases.

A paired t-test was used for statistical analysis, and $P <0.05$ was considered to be significant.

Debriefing trainees once the simulation ended

The trainees had a chance to debrief among the team. The chief doctor who was leading the simulation facilitated the discussion, including questions such as: How do you feel about your performance? Do you feel the procedures are challenging? If so, which ones? Do you find anything from this simulation particularly helpful? Do you have any comments about possible improvement? Additional questions addressing key concepts of COVID-19 were also discussed. The instructor then reviewed the critical actions with each learner against the checklist and pointed out the strengths of the trainee, as well as the weaknesses that required improvement. The trainees were encouraged to review their own performance by themselves, as a self-reflection exercise.

Results

There were 25 trainees (10 first-year residents, seven second-year residents and eight third-year residents) who participated in the simulation.

Pre- and post-simulation surveys were developed to assess improvement in knowledge of the management of COVID-19. A total of 50 surveys were collected, consisting of 25 before and 25 after simulation. In the pre-simulation survey, the mean baseline score of the participants in terms of identification and diagnosis, infection prevention, referral and patient transportation were 19.0 ± 4.78, 55.2 ± 3.05, 12.0 ± 3.81, respectively. In the post-simulation survey, their mean scores were 24.2 ± 1.87, 58.0 ± 2.5, 14.4 ± 1.66, respectively. For the total score, the mean scores before and after training were 86.2 ± 5.82 and 96.6 ± 3.14. The P values for the difference between the pre- and post-simulation training for all the groups were <0.05, consistent with the knowledge of the participants being significantly improved after simulation (Table 1).

Sub-analysis of the three different grades of trainee surveys also showed significant improvement of their knowledge of COVID-19 (P <0.05; Table 2).

Table 3 summarises the feedback by theme. Most participants felt this training was excellent, almost 96% thought it was

very helpful, and none felt it was so-so (mediocre) or poor.

Discussion

COVID-19 is a novel disease to all health practitioners, although the possible mechanisms of pathogenesis, infectivity, clinical features, disease course and approach to management are being slowly elucidated.[12] Therefore, given this novelty and the significant risk to the community posed by the associated morbidity and mortality, the teaching of robust and clear practical procedures is ideal to familiarise healthcare professionals with COVID-19, especially with hands-on practice. Simulation is indeed able to offer healthcare professionals the effective opportunity to practise in a safe environment to help build confidence without risk of infection.[10]

The resident doctors in family medicine are expected to be trained as competent specialists with as much updated knowledge as possible, which will enable them to effectively manage real clinical challenges when dealing with highly infectious diseases. The well-designed scenarios used in the present study are

accessible and safe, but simultaneously are also as similar as possible to the real-life situations they represent. Simulation enables the instructor to modulate or control the degree of difficulty and danger, assessing individual and team participation. The trainees are instructed clearly that both the safety of the patients and self-protection for doctors are fundamentally important. To achieve this goal, the instructor must train residents to restrict their decisions to adhere to the protocol rules precisely. The simulation scenario allows trainees to interact in lifelike situations; such training is also highly complementary to traditional didactic teaching. The present simulation is supported by other simulation-based training for physician performance in clinical areas such as critical intraoperative events,[13,14] airway management,[15] non-cardiac critical care ultrasonography[16,17] and obstetric emergencies.[18]

Obviously, there are different emphasis points for specialists in family medicine, intensive care or infectious disease. GPs are gatekeepers for empowering the community to build a firewall against COVID-19.[19] This simulation approach

Table 1. Mean difference in scores among all participants (n = 25)

Topic	Mean baseline score	Mean post-simulation score	t score	P value
Identification and the diagnosis*	19.0 ± 4.78	24.2 ± 1.87	5.21	0.0006
Infection prevention of COVID-19†	55.2 ± 3.05	58.0 ± 2.5	3.15	0.02
Referral and patient transportation‡	12.0 ± 3.81	14.4 ± 1.66	2.86	0.02
Total§	**86.2 ± 5.82**	**96.6 ± 3.14**	**8.34**	**<0.001**

*The total score of this part is 25.
†The total score of this part is 60.
‡The total score of this part is 15.
§The total score is 100.

Table 2. Mean difference in scores among residents of different grades

Grade	Mean baseline score	Mean post-simulation score	t score	P value
First-year resident (n = 10)	84.0 ± 6.50	96.0 ± 2.00	5.51	0.004
Second-year resident (n = 7)	90.7 ± 4.50	97.1 ± 3.93	3.62	0.006
Third-year resident (n = 8)	84.4 ± 3.20	96.9 ± 3.72	6.19	<0.001
Average	**86.2 ± 5.82**	**96.6 ± 3.14**	**8.34**	**<0.001**

represents a custom-designed training module specific for this purpose.

Simulated patients are frequently used for the teaching of clinical skills for different systems, such as respiratory[20] or cardiovascular[21] systems. The current training is an extension of the usage of a simulated module. Simulated patients are valuable tools for training communication skills and technical skills in GP training.[22]

The feedback from the participants showed that all participants were receptive to the learning and experience provided by participation in this simulation. The simulation scenario was shown to improve the crisis management of highly transmissible respiratory infectious disease, by comparing the baseline with the post-simulation scores. The participating residents also expressed satisfaction with the simulation training. These findings support the idea that the use of a well-designed simulation scenario provides the opportunity to practise in a safe environment and helps build confidence and reduce anxiety.[10]

The current study followed The Guideline of Chinese Clinical Practice.[11] As it was a newly designed program for the authors' hospital, there were many lessons learned from it. The authors acknowledge that this study was performed in a single hospital setting in Shanghai and warrants further exploration. Limitations of the study included the small sample size. The participants were not strangers, which might interfere with the outcomes. In addition, some of the clinical information could already be obsolete; it would need to be updated as frequently as possible. Whether the information was retained long term was also not clear.

The aim of the current study was to provide training for best-practice management of COVID-19 presentations for the residency program trainees in family medicine in Shanghai, China. Such training aims to equip these family medicine residents with critical core knowledge of COVID-19 to manage unexpected presentations when they occur in both the current and/or future coronavirus epidemics without panic. The authors acknowledge that patients with COVID-19 would be transferred to the specialised hospital once a sufficient index of suspicion was reached – either clinically or, if available, through diagnostic testing – and that the current study was not written in a manner that specifically identifies higher-order learning outcomes. Nevertheless, the present study offers an alternative training opportunity for junior doctors to manage potential COVID-19 risks. The authors intend future similar training programs to explore higher-order learning outcomes, particularly in relation to the integration of knowledge to allow critical time-dependent clinical decision making.

Authors

Dandan Shi MM, GP Trainer; Deputy Director, Department of Medical Education, Shanghai Tongren Hospital, Shanghai, China

Hong Lu MB, GP Trainer; General Practitioner, Department of General Practice, Shanghai Tongren Hospital, Shanghai, China

Haiyuan Wang MB, GP Trainer; General Practitioner, Xinjing Town Community Health Service Center, Shanghai, China

Shisan Bao MD, PhD, Professor, Discipline of Pathology, School of Medical Sciences, University of Sydney, NSW

Lingmei Qian MD, GP Trainer; Chief Physician, Department of General Practice, Shanghai Tongren Hospital, Shanghai, China; Executive Deputy Director, Community Health Care Institute, China Hospital Development Institute, Shanghai Jiao Tong University, Shanghai, China

Xiaoyan Dong MM, Director, Department of Medical Education, Shanghai Tongren Hospital, Shanghai, China

Kun Tao MD, Vice President, Shanghai Tongren Hospital, Shanghai, China

Zhongqing Xu MM, GP Trainer; Director, Department of General Practice, Shanghai Tongren Hospital, Shanghai, China; Deputy Director, Community Health Care Institute, China Hospital Development Institute, Shanghai Jiao Tong University, Shanghai, China; Deputy Director, Department of General Practice, Shanghai Jiao Tong University School of Medicine, Shanghai, China; Visiting Scholar, Department of Family Medicine, Faculty of Medicine, University of Ottawa, Canada. zhongqing_xu@126.com

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Table 3. Participant feedback (n = 25)

Theme	Excellent n (%)	Good n (%)	So-so n (%)	Poor n (%)
Introduces the purpose of this training before beginning	23 (92)	2 (8)	0 (0)	0 (0)
Teachers can provide constructive feedback	20 (80)	5 (20)	0 (0)	0 (0)
Teachers can master the corresponding medical technology	22 (88)	3 (12)	0 (0)	0 (0)
Teachers know how you are doing and can help you make progress	18 (72)	7 (28)	0 (0)	0 (0)
Appropriate resident–teacher ratio	20 (80)	5 (20)	0 (0)	0 (0)
This training is helpful	24 (96)	1 (4)	0 (0)	0 (0)

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correspondence **ajgp@racgp.org.au**