

## Remote nursing training model combined with proceduralization in the intensive care unit dealing with patients with COVID-19

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### Abstract

The shortage of personal protective equipment and lack of proper nursing training have been endangering health care workers dealing with coronavirus disease 2019 (COVID-19). In our treatment center, the implementation of a holistic care model of time-sharing management for severe and critical COVID-19 patients has further aggravated the shortage of intensive care unit (ICU) professional nurses. Therefore, we developed a short-term specialized and targeted nursing training program to help ICU nurses to cope with stress and become more efficient, thus reducing the number of nurses required in the ICU. In order to avoid possible human-to-human spread, small teaching classes and remote training were applied. The procedural training mode included four steps: preparation, plan, implementation, and evaluation. An evaluation was conducted throughout the process of nursing training. In this study, we documented and shared experiences in transitioning from traditional face-to-face programs to remote combined with proceduralization nursing training mode from our daily work experiences during the COVID-19 pandemic, which has shown to be helpful for nurses working in the ICU.

**Key Words:** Nursing training model; Remote; Proceduralization; COVID-19; Heilongjiang province; Intensive care unit

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**Core Tip:** The rapid spread of the epidemic and surge of coronavirus disease 2019 (COVID-19) patients have put the health care system under tremendous pressure, and even on the verge of collapse. The implementation of a holistic care model of time-sharing management for severe and critical COVID-19 patients has further aggravated the shortage of intensive care unit (ICU) professional nurses. We tried to document the shared experiences in transitioning traditional face-to-face programs to remote combined with proceduralization nursing training mode during the COVID-19 pandemic, which was shown to be helpful for nurses to adapt to ICU work quickly and make up for the shortage of ICU professional nurses.

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## INTRODUCTION

In China, coronavirus disease 2019 (COVID-19) has been officially classified as Class B infectious disease, yet its prevention and control measures were following the Class A infectious disease guidelines<sup>[1]</sup>. COVID-19 is considered to be one of the worst outbreaks of the 21<sup>st</sup> century. Currently, there is still no effective treatment for severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) infection<sup>[2,3]</sup>, to which everyone is susceptible and thus the entire world has been affected by this infection. To date, there is no effective vaccine and exact intervention for SARS-CoV-2 infection, but only supporting treatment<sup>[4-6]</sup>. As a result, cutting off the route of transmission is the most important principle in the prevention and control of COVID-19<sup>[7,8]</sup>. Most countries have adopted lockdown measures, such as banning social interaction, closing public places and taking isolation measures<sup>[9]</sup>, which has been proved to be effective in controlling the spread of the virus. However, health care workers at the forefront are at high risk of occupational exposure due to inevitable close contact<sup>[10,11]</sup>. Therefore, three-grade prevention measures and personal protective equipment are essential for intensivists to avoid further infection in clinical practice. In addition, new training methods, which may improve workers skills, reduce stress and improve efficiency should be applied.

Efficient human-to-human spread during close contact resulting from oral secretions, aerosols, and direct contact is the primary means of SARS-CoV-2 transmission<sup>[12-16]</sup>; thus, the risk of viral transmission caused by a large number of nurses gathering in classrooms for training should be avoided. New training methods should be applied. New pedagogy has been developed during the transition from the traditional face-to-face method to a remote training mode in practice. Certainly, both opportunities and challenges existed with rapid transformation in nursing training mode. During remote training, the lack of active interaction with instructors and classmates, also known as teaching presence can lead to negative learning experiences for some trainees<sup>[17]</sup>. Moreover, the remote training mode may pose a challenge for trainees in developing "hands-on" practical abilities. Nonetheless, adequate and targeted training and learning are crucial for health care workers dealing with COVID-19.

Currently, there are few studies on the training of intensive care unit nurses during the COVID-19 epidemic worldwide. In this study, we propose a remote nursing training mode combined with proceduralization from our daily work experiences, which may be helpful for nurses to quickly adapt to intensive care unit (ICU) work and may compensate for the shortage of ICU professional nurses.

### Training population

A total of 225 nurses, including 137 ICU professional nurses and 88 other specialties nurses working in the COVID-19 treatment centers of Heilongjiang province, were involved in the study. Ten different hospitals in Heilongjiang province were included, namely the First Affiliated Hospital, the Second Affiliated Hospital, the Cancer Hospital and the Fourth Affiliated Hospital of Harbin Medical University, the Second

Affiliated Hospital of Mudanjiang Medical College, Mudanjiang Hongqi Hospital, the First Affiliated Hospital, the Second Affiliated Hospital and the Third Affiliated Hospital of Qiqihar Medical College, the First Affiliated Hospital of Jiamusi University, Daqing Oilfield General Hospital and Daqing Traditional Chinese Medicine Hospital.

### **Training content**

The training content mainly included theoretical knowledge of preventing and controlling COVID-19, work standards, contents and procedures in the ICU of COVID-19 treatment centers, expert consensus on diagnosis and treatment of new coronavirus pneumonia, routine technical operations and communication skills between nurses and patients. Theoretical knowledge of preventing and controlling COVID-19 included disinfection and isolation systems, infection control and management systems, standards for wearing and removing protective equipment, procedures for entering and leaving the isolation ward, and disposing of medical waste and corpses of SARS-CoV-2 infected patients. Routine technical operations included closed sputum aspiration, arterial blood gas analysis, and nucleic acid sample collection.

Dealing with SARS-CoV-2 infection may cause significant psychological stress<sup>[18]</sup>. Fear of illness and death inevitably leads to anxiety- and stress-related disorders, which require further intensive humanistic care training for nurses to implement effective psychological interventions. In fact, like most SARS-CoV-2 infected patients, most nurses experience fear, which may manifest as poor self-efficacy and sleep quality, and different levels of anxiety, depression, and stress<sup>[19-21]</sup>. Therefore, it is crucial to support health care workers with useful skills and assistance (consulting) to adapt to these challenging circumstances and respond effectively<sup>[22,23]</sup>. In our COVID-19 treatment center, a full-time psychiatrist has been chosen to provide online one-on-one psychological counseling to nurses at the front line.

### **Training methods**

To avoid possible human-to-human transmission, small teaching classes and remote training have been applied. Procedural training mode included preparation, planning, implementation, and evaluation. The required relevant knowledge, standards, consensus and standard operation were obtained through social media for interactive synchronous learning and further online instructions. Every topic was packaged into short videos to reduce the cognitive load of each learning session and was timely updated. This method also facilitated the long-term preservation of data for later viewing. "Hands-on" practical abilities were cultivated by experienced senior ICU professional nurses in a small class, usually in a nursing group unit. Among them, the targeted training on standards for wearing and removing protective equipment was conducted by professionals in the Infection Control Department, and the qualified results were the prerequisite for working at the front line. During this unprecedented epidemic, flexibility and adaptability enable the continuity of nursing training and troubleshoot unavoidable practical matters.

### **Assessment methods**

Most of the learning feedback was provided through online quizzes. After each small class training, the assessment of "hands-on" practical abilities without material objects and patients was carried out and asked to be uploaded to social media for comment. The personal protective equipment training was required to conduct a one-on-one assessment based on standards for wearing and removing protective equipment. Answers were then uploaded at the end of each training session. Trainees were asked to evaluate the content uploaded by other trainees through the internet. The more they were involved, the better the nursing training effect was. Each group of nurses had a senior ICU professional care team leader, who was responsible for clinical supervision and guidance of all training contents and feedback to the trainers so that the trainers could summarize the common clinical weak links and conduct intensive training again.

### **Nursing training effect**

Continuous feedback on the nursing training effect was conducive to modification and improvement of the nursing training plan. All trainees successfully completed the assessment related to properly wearing and removing protective equipment, and, so far, no health care worker has been infected. The common clinical weak links in our practice included failure to complete the nursing shift handover according to the standard procedures, incorrect specimen collection container, inaccurate writing of

nursing records, and occupational exposure. Necessary adjustments were made accordingly: A holistic care model of time-sharing management and detailed checklist in each shift was proposed (Tables 1 and 2), the corresponding table of the specimen collection container in the work area was set, intensive online training on occupational exposure was conducted and the flow chart of occupational exposure treatment was posted in the work area.

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## CONCLUSION

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Specialized and targeted nursing training is essential and an indispensable means to avoid occupational exposure and compensate for the shortage of professional intensive care unit nurses. In this study, we documented and shared experiences in transitioning from traditional face-to-face programs to remote combined with proceduralization nursing training mode from our daily work experiences during the coronavirus disease 2019 pandemic, which has shown to be helpful for nurses working in the intensive care unit. These findings provide a valid reference for nursing training in other regions and countries.

**Table 1 A detailed checklist during each shift for patients with severe coronavirus disease 2019**

	08:00-12:00	12:00-16:00	16:00-20:00	20:00-00:00	00:00-04:00	04:00-08:00
Temperature	10:00	14:00	18:00	22:00	2:00	6:00
Atomization inhalation	8:30		16:30			
Chest physiotherapy	9:00		17:00			
Prevention of deep vein thrombosis		13:30		22:00		
Arterial blood gas analysis		14:30		22:30		6:30
Calculating liquid equilibrium			20:00			8:00

**Table 2 A detailed checklist during each shift for patients with critical coronavirus disease 2019**

	08:00-12:00	12:00-16:00	16:00-20:00	20:00-00:00	00:00-04:00	04:00-08:00
Temperature	Real-time monitoring					
Atomization inhalation	8:30	12:30	16:30			
Chest physiotherapy	9:00	13:00	17:00			
Prevention of deep vein thrombosis		13:30		22:00		7:30
Arterial blood gas analysis	11:00	15:00	19:00	23:00	3:00	7:00
Calculating liquid equilibrium	12:00	16:00	20:00	0:00	4:00	8:00

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## REFERENCES

- 1 **China NHCotPsRo.** Novel coronavirus infection pneumonia is included in the management of notifiable infectious diseases. Available from: <http://news.kedo.gov.cn/c/2020-01-21/1014700.shtml>
- 2 **Ou X,** Liu Y, Lei X, Li P, Mi D, Ren L, Guo L, Guo R, Chen T, Hu J, Xiang Z, Mu Z, Chen X, Chen J, Hu K, Jin Q, Wang J, Qian Z. Characterization of spike glycoprotein of SARS-CoV-2 on virus entry and its immune cross-reactivity with SARS-CoV. *Nat Commun* 2020; **11**: 1620 [PMID: 32221306 DOI: 10.1038/s41467-020-15562-9]
- 3 **Liu J,** Zheng X, Tong Q, Li W, Wang B, Sutter K, Trilling M, Lu M, Dittmer U, Yang D. Overlapping and discrete aspects of the pathology and pathogenesis of the emerging human pathogenic coronaviruses SARS-CoV, MERS-CoV, and 2019-nCoV. *J Med Virol* 2020; **92**: 491-494 [PMID: 32056249 DOI: 10.1002/jmv.25709]
- 4 **Adhikari SP,** Meng S, Wu YJ, Mao YP, Ye RX, Wang QZ, Sun C, Sylvania S, Rozelle S, Raat H, Zhou H. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. *Infect Dis Poverty* 2020; **9**: 29 [PMID: 32183901 DOI: 10.1186/s40249-020-00646-x]
- 5 **Shanmugaraj B,** Siriwananon K, Wangkanont K, Phoolcharoen W. Perspectives on monoclonal antibody therapy as potential therapeutic intervention for Coronavirus disease-19 (COVID-19). *Asian Pac J Allergy Immunol* 2020; **38**: 10-18 [PMID: 32134278 DOI: 10.12932/AP-200220-0773]
- 6 **Li H,** Liu SM, Yu XH, Tang SL, Tang CK. Coronavirus disease 2019 (COVID-19): current status and future perspectives. *Int J Antimicrob Agents* 2020; **55**: 105951 [PMID: 32234466 DOI: 10.1016/j.ijantimicag.2020.105951]
- 7 **Kraemer MUG,** Yang CH, Gutierrez B, Wu CH, Klein B, Pigott DM; Open COVID-19 Data Working Group; du Plessis L; Faria NR; Li R; Hanage WP; Brownstein JS; Layan M; Vespignani A; Tian H; Dye C; Pybus OG; Scarpino SV. The effect of human mobility and control measures on the COVID-19 epidemic in China. *Science* 2020; **368**: 493-497 [PMID: 32213647 DOI: 10.1126/science.abb4218]
- 8 **Cai Q,** Mi Y, Chu Z, Zheng Y, Chen F, Liu Y. Demand Analysis and Management Suggestion: Sharing Epidemiological Data Among Medical Institutions in Megacities for Epidemic Prevention and Control. *J Shanghai Jiaotong Univ Sci* 2020; **25**: 137-139 [PMID: 32288414 DOI: 10.1126/science.abb4218]



- 10.1007/s12204-020-2166-3]
- 9 **Banerjee D.** The COVID-19 outbreak: Crucial role the psychiatrists can play. *Asian J Psychiatr* 2020; **50**: 102014 [PMID: 32240958 DOI: 10.1016/j.ajp.2020.102014]
  - 10 **Gong H, Feng H, Yu L, Tu N, Wang T, Yao Y, Wei Y, Wang Y, Hu W, Li X, Fu Z, Song X, Song Q, Bu L.** Coronavirus Disease 2019 Infection Among Medical Staff in Wuhan: A Retrospective Study From a Single Center. *Chest* 2020; **158**: 1409-1412 [PMID: 32473172 DOI: 10.1016/j.chest.2020.05.529]
  - 11 **Wang Y, Wu W, Cheng Z, Tan X, Yang Z, Zeng X, Mei B, Ni Z, Wang X.** Super-factors associated with transmission of occupational COVID-19 infection among healthcare staff in Wuhan, China. *J Hosp Infect* 2020; **106**: 25-34 [PMID: 32574702 DOI: 10.1016/j.jhin.2020.06.023]
  - 12 **Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, Wang B, Xiang H, Cheng Z, Xiong Y, Zhao Y, Li Y, Wang X, Peng Z.** Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA* 2020; **323**: 1061-1069 [PMID: 32031570 DOI: 10.1001/jama.2020.1585]
  - 13 **Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, Ren R, Leung KSM, Lau EHY, Wong JY, Xing X, Xiang N, Wu Y, Li C, Chen Q, Li D, Liu T, Zhao J, Liu M, Tu W, Chen C, Jin L, Yang R, Wang Q, Zhou S, Wang R, Liu H, Luo Y, Liu Y, Shao G, Li H, Tao Z, Yang Y, Deng Z, Liu B, Ma Z, Zhang Y, Shi G, Lam TTY, Wu JT, Gao GF, Cowling BJ, Yang B, Leung GM, Feng Z.** Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. *N Engl J Med* 2020; **382**: 1199-1207 [PMID: 31995857 DOI: 10.1056/NEJMoa2001316]
  - 14 **Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR.** Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *Int J Antimicrob Agents* 2020; **55**: 105924 [PMID: 32081636 DOI: 10.1016/j.ijantimicag.2020.105924]
  - 15 **Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z, Yu T, Xia J, Wei Y, Wu W, Xie X, Yin W, Li H, Liu M, Xiao Y, Gao H, Guo L, Xie J, Wang G, Jiang R, Gao Z, Jin Q, Wang J, Cao B.** Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020; **395**: 497-506 [PMID: 31986264 DOI: 10.1016/S0140-6736(20)30183-5]
  - 16 **Zhai P, Ding Y, Wu X, Long J, Zhong Y, Li Y.** The epidemiology, diagnosis and treatment of COVID-19. *Int J Antimicrob Agents* 2020; **55**: 105955 [PMID: 32234468 DOI: 10.1016/j.ijantimicag.2020.105955]
  - 17 **Pather N, Blyth P, Chapman JA, Dayal MR, Flack NAMS, Fogg QA, Green RA, Hulme AK, Johnson IP, Meyer AJ, Morley JW, Shortland PJ, Štrkalj G, Štrkalj M, Valter K, Webb AL, Woodley SJ, Lazarus MD.** Forced Disruption of Anatomy Education in Australia and New Zealand: An Acute Response to the Covid-19 Pandemic. *Anat Sci Educ* 2020; **13**: 284-300 [PMID: 32306555 DOI: 10.1002/ase.1968]
  - 18 **Lima CKT, Carvalho PMM, Lima IAAS, Nunes JVAO, Saraiva JS, de Souza RI, da Silva CGL, Neto MLR.** The emotional impact of Coronavirus 2019-nCoV (new Coronavirus disease). *Psychiatry Res* 2020; **287**: 112915 [PMID: 32199182 DOI: 10.1016/j.psychres.2020.112915]
  - 19 **Jackson D, Bradbury-Jones C, Baptiste D, Gelling L, Morin K, Neville S, Smith GD.** Life in the pandemic: Some reflections on nursing in the context of COVID-19. *J Clin Nurs* 2020; **29**: 2041-2043 [PMID: 32281185 DOI: 10.1111/jocn.15257]
  - 20 **Xiao H, Zhang Y, Kong D, Li S, Yang N.** The Effects of Social Support on Sleep Quality of Medical Staff Treating Patients with Coronavirus Disease 2019 (COVID-19) in January and February 2020 in China. *Med Sci Monit* 2020; **26**: e923549 [PMID: 32132521 DOI: 10.12659/MSM.923549]
  - 21 **Shen Y, Cui Y, Li N, Tian C, Chen M, Zhang YW, Huang YZ, Chen H, Kong QF, Zhang Q, Teng GJ.** Emergency Responses to Covid-19 Outbreak: Experiences and Lessons from a General Hospital in Nanjing, China. *Cardiovasc Intervent Radiol* 2020; **43**: 810-819 [PMID: 32342164 DOI: 10.1007/s00270-020-02474-w]
  - 22 **Chew NWS, Lee GKH, Tan BYQ, Jing M, Goh Y, Ngiam NJH, Yeo LLL, Ahmad A, Ahmed Khan F, Napoleon Shanmugam G, Sharma AK, Komalkumar RN, Meenakshi PV, Shah K, Patel B, Chan BPL, Sunny S, Chandra B, Ong JJY, Paliwal PR, Wong LYH, Sagayanathan R, Chen JT, Ying Ng AY, Teoh HL, Tsivgoulis G, Ho CS, Ho RC, Sharma VK.** A multinational, multicentre study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak. *Brain Behav Immun* 2020; **88**: 559-565 [PMID: 32330593 DOI: 10.1016/j.bbi.2020.04.049]
  - 23 **Wu W, Zhang Y, Wang P, Zhang L, Wang G, Lei G, Xiao Q, Cao X, Bian Y, Xie S, Huang F, Luo N, Zhang J, Luo M.** Psychological stress of medical staffs during outbreak of COVID-19 and adjustment strategy. *J Med Virol* 2020 [PMID: 32314806 DOI: 10.1002/jmv.25914]



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