Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Clinical Simulation in Nursing (2022) 62, 52-56

Clinical Simulation in Nursing

www.elsevier.com/locate/ecsn

Short communication

In-Situ Simulation for Intensive Care Nurses During the COVID-19 Pandemic in Italy: Advantages and Challenges

Alessandro Monesi, RN, CCRN[a,b], Guglielmo Imbriaco, MSN, RN, CEN[b,c,*], Carlo Alberto Mazzoli, MD[d], Aimone Giugni, MD[d], Patrizia Ferrari, HN, RN, CCRN[a]

[a] *Intensive Care Unit, Maggiore Hospital, Bologna, 40133, Italy*
[c] *Helicopter Emergency Medical Service, Maggiore Hospital Carlo Alberto Pizzardi, Bologna, Italy*
[d] *Division of Anesthesia, Intensive Care, and Prehospital Emergency, Maggiore Hospital, Bologna, 40133, Italy*
[b] *Critical Care Nursing Master course, University of Bologna, Bologna, Italy*

KEYWORDS
intensive care unit;
in-situ simulation;
simulation-based training;
critical care nursing;
COVID-19;
staffing

AbstractThe COVID-19 pandemic required a global increase in intensive care unit (ICU) resources and the recruitment of a great number of nurses without any tprior critical care experience. The opportunities for traditional education and supervised clinical training were limited to prevent infections. The massive increase of nursing staff resources required a rethinking of the usual educational strategies for newly acquired nurses. This short communication describes our experience of an "in-situ" simulation training course in an Italian tertiary level hospital. A series of two-part classes were structured with short lectures on fundamental principles of intensive care nursing and brief hands-on sessions, and a set of simulated scenarios, based upon the most common situations to be faced in the ICU. In-situ simulation offers greater realism and transferability and represents a cost-effective strategy, avoiding the costs and the maintenance of a dedicated simulation center. The simulated multidisciplinary teamwork in the real ICU setting contributes to an effective experiential learning, improving staff familiarity with devices, equipment, and environment, and allows trainees to improve both technical and nontechnical skills.

Cite this article:
Monesi, A., Imbriaco, G., Mazzoli, C.A., Giugni, A., & Ferrari, P. (2022, Month). In-Situ Simulation for Intensive Care Nurses During the COVID-19 Pandemic in Italy: Advantages and Challenges. *Clinical Simulation in Nursing*, 62, 52-56. https://doi.org/10.1016/j.ecns.2021.10.005.

Introduction

Italy was one of the most affected Western European countries during the first outbreak of the COVID-19

ICU, intensive care unit; CCN, critical care nurses; PPE, personal protective equipment; NTS, non-technical skills.

* Corresponding author: guglielmo.imbriaco.work@gmail.com (G. Imbriaco).

1876-1399/
https://doi.org/10.1016/j.ecns.2021.10.005

pandemic. The great number of critically ill patients required a nationwide increase in intensive care beds (Grasselli, Pesenti, & Cecconi, 2020). Consequently, a massive nursing workforce without any precedentprior critical care training or experience was deployed to the intensive care units (ICU), trying to guarantee a nurse-to-patient ratio of 1:2, as a defined standard for Italian ICUs. Despite those recruitments, the number of experienced critical care nurses (CCN) remains too often disproportionate in relation to the patients' clinical complexity. The resulting dilution of the nursing staff skill-mix associated with a critical workload may represent a serious threat to patients' and health care workers' safety (Bambi, Iozzo, & Lucchini, 2020).

Key Points

- The current pandemic and the need to increase nursing staff in a short period of time altered the traditional educational paths, requiring shortened but effective training courses.
- Simulation in the real working setting offers greater realism, represents a cost-effective strategy, and improves staff familiarity with devices, equipment, and environment.
- In-situ training with multidisciplinary teams represents an added value to enhance the global performance, improving both technical and non-technical skills.

The restrictions related to the COVID-19 pandemic had altered the traditional training experience and severely limited the opportunities for supervised clinical training (Adamson & Prion, 2020; Ingrassia, Ferrari, Paganini, & Mormando, 2021). The massive increase of nursing staff required a rethinking of the usual educational strategies for newly acquired nurses. Training programs were shortened and focused on fundamental aspects of ICU nursing, such as infection control, pressure injury prevention, and safe drug management; training in complex activities was mainly undertaken in practice, even considering the limits of impaired communication caused by personal protective equipment (PPE) (Imbriaco & Scelsi, 2020).

The main objective of this short communication is to describe our experience of a shortened training program for newly acquired ICU nurses at Maggiore Hospital Carlo Alberto Pizzardi, a tertiary level hospital in Bologna, Italy, focusing on the advantages of simulation in a dedicated in-situ setting.

ICU Remodeling During the Pandemic

At the end of the first wave of COVID-19 (March-May 2020), the number of ICU beds in our hospital was increased from the initial 20 (10 ICU beds dedicated to medical/surgical patients and 10 to trauma/emergency patients) to 54, due to the construction of a new critical care area dedicated exclusively to COVID-19 patients.

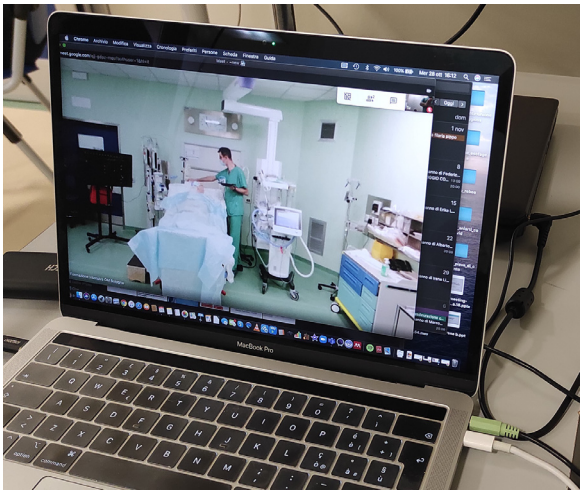

Figure 1 audio-video recording system set up for debriefing in the in-situ simulation area.

At the beginning of the second wave, in October 2020, the surging demand for intensive care resources required the medical/surgical ICU to be reallocated for critical patients with COVID-19. The current increase in the demand for intensive care admissions has required the reallocation of two operating blocks, with a capacity of 18 ICU beds each. Compared to a year ago, the total capacity of intensive beds in our hospital increased by more than 300% and required a consequent increase in nursing staff through new hires and reallocating staff from other hospital areas (Gamberini et al., 2021).

Training Course for Non-ICU Nurses

A three-day, 30 hours, training course was organized with the main objective to train as many new nurses as possible at the beginning of the second wave of COVID-19, when the pressure on our hospital was still relatively low. One of the areas converted to ICU during the first surge (a temporarily unused operating block) was identified as a training area for newly recruited personnel. The main advantage was that the equipment was already in place, as well as the ICU configuration set up in the previous months. The audio and video recording systems required for debriefing were set up by connecting laptops and video cameras through the hospital's Wi-Fi network (Figure 1). The planning had to take into account the need to maintain an adequate distancing between the trainees concerning the size of the training area and the number of participants was limited to 12 per class. A total of 85 nurses attended seven training classes between October 2020 and February 2021.

The course has been structured in two distinct parts. The first part consisted of short lectures on basic princi-

Table 1 Lectures and Hands-On Training Topics

Theoretical lectures	Hands-on training sessions
- Description on the ICU environment - Infection control strategies - Fundamentals of nursing care in the ICU (oral and eye care, skin care and pressure injury prevention, enteral feeding and gastric residual volume management) - Arterial/venous blood gas sampling and rapid interpretation scheme - Basic knowledge of ventilation (invasive vs non-invasive, controlled vs assisted)	- Tracheal intubation, including Rapid Sequence Intubation, intubation of COVID-19 patient, and difficult airways - Central venous catheters: management, dressing, and drug infusions - Infusion pumps management - Invasive pressure monitoring: Arterial line and transducer setting - Ventilator setting: circuit management, humidifiers, and closed tracheal suction systems - NIV with different interfaces (full-face masks, helmets) - HFNC

Note. HFNC = high-flow nasal cannula; ICU = intensive care unit; NIV = noninvasive ventilation.

Table 2 Scenarios for "In-Situ" Intensive Care Simulation-Training

Brief scenario description	Learning objectives *Technical skills*	*Non-technical skills (NTS)*
1 – ICU Admission of a patient with respiratory failure	- Anticipation - Set up of patient unit and ventilator - Patient evaluation and monitoring - NIV management	- Anticipate and plan - Mobilize resources - Establish role clarity - Distribute the workload
2 – Deteriorating patient with non-invasive ventilatory support (helmet or full-face mask) requiring tracheal intubation	- Monitoring vital signs - Recognition of ineffective NIV - Airway management - Knowledge of intubation devices and techniques	- Use all available information - Allocate attention wisely
3 – Difficult airway management	- Knowledge of intubation devices and techniques - Advanced airway management	- Communicate effectively - Designate leadership
4 - Unplanned extubation	- Maintain oxygenation with bag valve mask - Support for reintubation	- Awareness - Use cognitive aids - Mobilize resources - Communicate effectively
5 - Tracheal intubation with subsequent hypotension and cardiac arrest	- Recognize the rhythms of cardiac arrest - Advanced cardiac life support manoeuvres and drugs - Quality CPR	- Know the environment - Distribute the workload - Communicate effectively - Mobilize resources

Note. CPR = cardiopulmonary resuscitation; ICU = intensive care unit; NTS = nontechnical skills; NIV = noninvasive ventilation.

ples of intensive care nursing, such as ICU organization, infection control, monitoring, and alarm management, and brief hands-on training sessions on specific techniques, as listed in Table1. The second part of the course consisted of a series of simulated scenarios in which the trainees actively participated, practicing the notions acquired in the theoretical part. Simulated scenarios (Table 2), based upon common ICU situations where nurses are initially alone while waiting for the arrival of the supporting physician, were conducted by expert CCN and intensivists. During our classes, participants donned full PPE only in a couple of final scenarios, with the aim of not wasting gowns and coveralls and not limiting the communication aspects during these first experiences of simulation training.

The training program emphasized active learning and post-simulation debriefing represented a key element; scenarios were video recorded, analyzed, and discussed with the trainees, to stimulate reflection and develop their ability of critical thinking like a CCN (Bradley, Johnson, & Dreifuerst, 2020).

Newly hired nurses' performance improvement in both technical and non-technical skills was evaluated through a checklist, scoring 0 to 2 for each item. An overall performance greater than 70% was achieved by 67.6% (n. 46) of trainees. A performance between 60% and 70% was considered acceptable and was achieved by 22% (n. 15). Trainees that underperformed continued supervised clinical training and were assigned to less critical patients. Seven-

teen nurses reallocated from other services, with previous ICU experience of at least six months, have not been assessed.

Advantages and Pitfalls of Simulation Training in the COVID-19 Era

The COVID-19 pandemic has been characterized by an urgent need to increase intensive care staffing while traditional training and education opportunities are reduced in an unprecedented and sudden manner (Ingrassia et al., 2021). In this emergency, simulation represented an essential strategy to rapidly acquire new skills and optimize checklists and invasive procedures in the ICU (Armenia et al., 2018; Fregene, Nadarajah, Buckley, Bigham, & Nangalia, 2020; Li, Lin, Wang, Bao, & Li, 2020). The role of simulationists in this altered setting is to guarantee adequate preparation for front-line providers, adapting themselves to different environments and opportunities to continue to provide a practical education (Harder, 2020).

Simulation-based training in the real working setting (defined as "in-situ simulation") offers greater realism and transferability of skills (Ballangrud, Hall-Lord, Persenius, & Hedelin, 2014). In-situ simulation represents a cost-effective strategy, avoiding the costs and the maintenance of a dedicated simulation center; training in the real working unit improves staff familiarity with devices, equipment, and environment (Low, Horrigan, & Brewster, 2018). In-situ training with multidisciplinary teams, composed of intensivists and nurses, represents an added value to enhance the global performance: the simulated teamwork in the real ICU setting contribute to an effective experiential learning and allow trainees to improve both technical and nontechnical skills, such as communication issues and situational awareness (Armenia et al., 2018; Ballangrud et al., 2014; Xie, Xiao, Zhou, & Li, 2020). Moreover, teamwork, communication issues, and personal knowledge were improved by training with the same CCN and intensivists the trainees would have worked with. We must consider a series of challenges related to simulation-based training during the COVID-19 outbreak. The use of PPE represents an increased level of difficulty and stress even in a simulated setting; it restricts people's movements, vision, and ability to hear alarms and voices, complicating verbal and nonverbal communication (Fregene et al., 2020; Imbriaco, Monesi, & Ferrari, 2021). While this problem may have partially affected the effectiveness of the simulation, it also prepared the trainees for the real difficulties they will encounter in a COVID-19 ICU. Considering the working setting of a COVID-19 ICU, the simulation training sessions would have been more realistic and effective if the trainees had always worn full PPE but at the same time make it more difficult to improve certain soft skills such as non-verbal communication, which are necessary during an emergency. The need to safeguard the stocks of PPE, in view of the limited availability, did not allow them to be used consistently during all the simulations. In addition, the use of PPE can be an element of stress and physical fatigue for participants and can be a barrier to an effective learning process.

Simulation may represent a resource-consuming activity, in time, human resources, and medical supplies (Li et al., 2020). The availability of free spaces dedicated to "in-situ" simulation is not always guaranteed due to the growing need to set up intensive care areas for critically ill patients. Training activities for health care workers, who have been working overtime for weeks, should be carefully planned to optimize the time available and to guarantee adequate rest time between shifts and training. It is also mandatory to pay attention to the infectious risk for trainers and participants, taking general precautions and maintaining a safe distancing during theoretical and hands-on sessions.

Conclusions

Critical care is a 'team sport' (Tume, Trapani, and Walker, 2020), where players must be trained and know their role and the strategy of the game; the different roles and multiple sets of skills, which often overlap, create a moderate redundancy of the system to maximize safety for the patient and health care providers. The biggest difficulty encountered was the need to train a team for a 'big match' in a very short time, with players with very little knowledge of the rules of the game and sometimes out of shape.

This training aimed to prepare future health care professionals for an unfamiliar field so that they could face their first shift without being harmful to the patient in the first place. Our organization tried, when possible, to maintain a mixed staff of experienced nurses and new nurses, to continue the mentoring process started during the training course, and to bring it into the everyday work environment.

The authors are well aware that such a 'fast-track' course does not reflect the normal standards required in the pre-COVID era but we believe that, with this type of training organization, we have achieved an appropriate balance between the pressing need to assimilate new workforce and the patient's right to be cared by a trained health care staff.

Funding or Grants

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Informed Consent Statement

Clear written consent to data collection and treatment was submitted and obtained by all participants

Conflict of Interests

All authors have no financial relationships with any organizations that might have an interest in the submitted work.

Acknowledgments

The authors would like to thank all the health care personnel who participated in this training project and who collaborated in the intensive care assistance at Maggiore Hospital Carlo Alberto Pizzardi, Bologna, Italy, during the covid-19 pandemic.

References

Adamson, K. H., & Prion, S. (2020). Questions regarding substitution of simulation for clinical. *Clinical Simulation in Nursing*, *50*, 79-80. https://doi.org/10.1016/j.ecns.2020.06.014.

Armenia, S., Thangamathesvaran, L., Caine, A., King, N., Kunac, A., & Merchant, A. (2018). The role of high-fidelity team-based simulation in acute care settings: A systematic review. *The Surgery Journal*, *04*(03), e136-e151. https://doi.org/10.1055/s-0038-1667315.

Ballangrud, R., Hall-Lord, M. L., Persenius, M., & Hedelin, B. (2014). Intensive care nurses' perceptions of simulation-based team training for building patient safety in intensive care: A descriptive qualitative study. *Intensive and Critical Care Nursing*, *30*(4), 179-187. https://doi.org/10.1016/j.iccn.2014.03.002.

Bambi, S., Iozzo, P., & Lucchini, A. (2020). New issues in nursing management during the COVID-19 pandemic in Italy. *American Journal of Critical Care*, *29*(4), e92-e93. https://doi.org/10.4037/ajcc2020937.

Bradley, C. S., Johnson, B. K., & Dreifuerst, K. T. (2020). Debriefing: A Place for Enthusiastic Teaching and Learning at a Distance. *Clinical Simulation in Nursing*, *49*, 16-18. https://doi.org/10.1016/j.ecns.2020.04.001.

Fregene, T. E., Nadarajah, P., Buckley, J. F., Bigham, S., & Nangalia, V. (2020). Use of in situ simulation to evaluate the operational readiness of a high-consequence infectious disease intensive care unit. *Anaesthesia*, *75*(6), 733-738. https://doi.org/10.1111/anae.15048.

Gamberini, L., Coniglio, C., Cilloni, N., Semeraro, F., Moro, F., Tartaglione, M., … Gordini, G. (2021). Remodelling of a regional emergency hub in response to the COVID-19 outbreak in Emilia-Romagna. *Emergency Medicine Journal*, *38*(4), 308-314. https://doi.org/10.1136/emermed-2020-209671.

Grasselli, G., Pesenti, A., & Cecconi, M. (2020). Critical care utilization for the COVID-19 outbreak in Lombardy, Italy. *JAMA*, *323*(16), 1545. https://doi.org/10.1001/jama.2020.4031.

Harder, N. (2020). Simulation Amid the COVID-19 Pandemic. *Clinical Simulation in Nursing*, *43*, 1-2. https://doi.org/10.1016/j.ecns.2020.03.010.

Imbriaco, G., Monesi, A., & Ferrari, P. (2021). Nursing perspectives from an Italian ICU. *Nursing*, *51*(1), 46-51. https://doi.org/10.1097/01.NURSE.0000724372.73357.bf.

Imbriaco, G., & Scelsi, S. (2020). It is not just about equipment and beds: Critical care nursing meeting the challenge of the second COVID-19 wave in Italy. Nursing in Critical Care*, (November)*, 1-3. https://doi.org/10.1111/nicc.12580.

Ingrassia, P. L., Ferrari, M., Paganini, M., & Mormando, G. (2021). Role of health simulation centres in the COVID-19 pandemic response in Italy: A national study. *BMJ Simulation and Technology Enhanced Learning*. https://doi.org/10.1136/bmjstel-2020-000813.

Li, L., Lin, M., Wang, X., Bao, P., & Li, Y. (2020). Preparing and responding to 2019 novel coronavirus with simulation and technology-enhanced learning for healthcare professionals: Challenges and opportunities in China. *BMJ Simulation and Technology Enhanced Learning*, *6*(4), 196-198. https://doi.org/10.1136/bmjstel-2020-000609.

Low, X. M., Horrigan, D., & Brewster, D. J. (2018). The effects of team-training in intensive care medicine: A narrative review. *Journal of Critical Care*, *48*, 283-289. https://doi.org/10.1016/j.jcrc.2018.09.015.

Tume, L. N., Trapani, J., & Walker, W. (2020). Has COVID-19 forced us to implement better practices? *Nursing in Critical Care*. Retrieved from https://onlinelibrary.wiley.com . /doi/toc/10.1111/(ISSN)1478-5153.year-of-nurse-and-midwife (Accessed 31 March 2021).

Xie, Y., Xiao, Y., Zhou, J., & Li, L. (2020). Demands of experiential training for ICU nurses in Hunan of China. *International Journal of Nursing Sciences*, *7*(4), 427-432. https://doi.org/10.1016/j.ijnss.2020.09.010.