Role of health simulation centres in the COVID-19 pandemic response in Italy: a national study

Pier Luigi Ingrassia ,[1,2] Mattia Ferrari,[1] Matteo Paganini ,[3] Giulia Mormando[3]

[1]Centro Interdipartimentale di Didattica Innovativa e di Simulazione in Medicina e Professioni Sanitarie (SIMNOVA), Università degli Studi del Piemonte Orientale Amedeo Avogadro, Novara, Italy
[2]Centro di Simulazione (CeSi), Centro Professionale Sociosanitario, Lugano, Switzerland
[3]DIMED, Università degli Studi di Padova, Padova, Veneto, Italy

Correspondence to
Professor Pier Luigi Ingrassia, Centro Interdipartimentale di Didattica Innovativa e di Simulazione in Medicina e Professioni Sanitarie (SIMNOVA), Università degli Studi del Piemonte Orientale Amedeo Avogadro, Novara 28100, Italy; Pierluigi.ingrassia@gmail.com

Accepted 6 January 2021
Published Online First 10 February 2021

To cite: Ingrassia PL, Ferrari M, Paganini M, *et al*. *BMJ Simul Technol Enhanc Learn* 2021;**7**:379–384.

ABSTRACT

Introduction The COVID-19 pandemic has dramatically affected the Italian health systems and drastically impacted healthcare workers' daily routine and training. Simulation is an efficient tool to provide medical education, especially in the case of incoming public health emergencies. This study investigated the role and activities of Italian simulation centres (SCs) during the acute phase of the COVID-19 pandemic.

Methods The population was identified through a web search. The directors of Italian SCs were contacted via email and then enrolled. A structured interview was created, internally validated and administrated by phone to participants.

Results Following the government's ordinance, 37 (88.37%) SCs had to be closed to the public. Twenty (46.51%) SCs organised in situ simulation while 7 (16.28%) of them organised simulation inside the centre. Twenty-three (53.49%) SCs resorted to telematic modalities to provide training about COVID-19 and 21 (48.84%) of them for other training. Up to date, 13 SCs are still closed to the public.

Conclusions Italy has been severely hit by COVID-19, with differences between the regions. Almost all the SCs were closed, with only a few delivering training. The SCs took advantage of emergent technologies to create new ways to train people safely. Unfortunately, nearly one-fourth of Italian SCs have not reopened yet. The evolution of the COVID-19 epidemic calls for reconsideration about training activities including adequate safety measures implemented for all individuals involved.

INTRODUCTION

The COVID-19 pandemic has put a difficult burden on the entire world. With an increasing number of infected patients needing assistance, most healthcare systems had to face high pressure and some of them were brought on the brink of collapse. Italy was the first European country to be severely hit by SARS-CoV-2.[1] The ease of virus diffusion and the need for infection control required changes in almost every aspect of life, especially for healthcare workers' (HCWs) daily routine and training.

Simulation is a well-known tool to train and prepare HCWs for difficult and hazardous scenarios. In particular, simulation improves HCWs' skills and can be used to validate protocols, identifying threats and issues, and test solutions.

Simulation centres (SCs) represent safe places for learning a variety of skills with the help of qualified training staff before getting in touch with patients or coordinated with direct patient contact.[2]

Despite the demonstrated potential of simulation in contributing to the management of previous pandemics[3–5] and the current global COVID-19 crisis,[6–9] to our knowledge, there is no study which addresses how simulation facilities coped with this pandemic, and how they contributed to the health response to the outbreak. The evolution of this worldwide crisis necessitates a review of all activities performed in SCs and we believe that sharing challenges and policy experiences will ultimately foster the dissemination of good practices. For these reasons, we investigated the role and activities of Italian SCs during the acute phase of the COVID-19 pandemic.

METHODS

Study design and population

An observational transversal study was designed. A list of all the Italian SCs was created on 1–7 September through a web search conducted on the websites of the Italian Society of Health Simulation (Società Italiana di Simulazione in Medicina, www.simmed.it) and the Society in Europe for Simulation (www.sesam-web.org).[9] The list was enhanced by consulting SC registry of the Italian Society of Anaesthesia and Intensive Care (Società Italiana Anestesia, Analgesia, Rianimazione e Terapia Intensiva, http://www.siaarti.it) and through free internet searches. Contact details of SC directors or representatives were then collected in a spreadsheet.

An email containing the study purpose and protocol was sent to each SC contact person on 9–10 September 2020. The interviews were conducted on 11–15 September. A second email was sent to non-respondents and they were recontacted by phone in the following 2 weeks (16–28 September). The telephone interview method was preferred to assist the respondents in understanding the questions and to reduce interviewees' tendency to satisfice and give top-of-the-head answers.[10]

Study instrument

A 10 min standardised interview instrument was developed and hosted on SurveyMonkey (SurveyMonkey, Palo Alto, California, USA). It consisted of four sections: (1) general and demographic characteristics of the centres; (2) SC activities before the COVID-19 pandemic and (3) during the COVID-19 pandemic; and (4) reopening of the SC.

The interview content was reviewed for accuracy by experts with specialised knowledge on simulation and previous experience in survey design, who provided appropriate modifications to ensure the

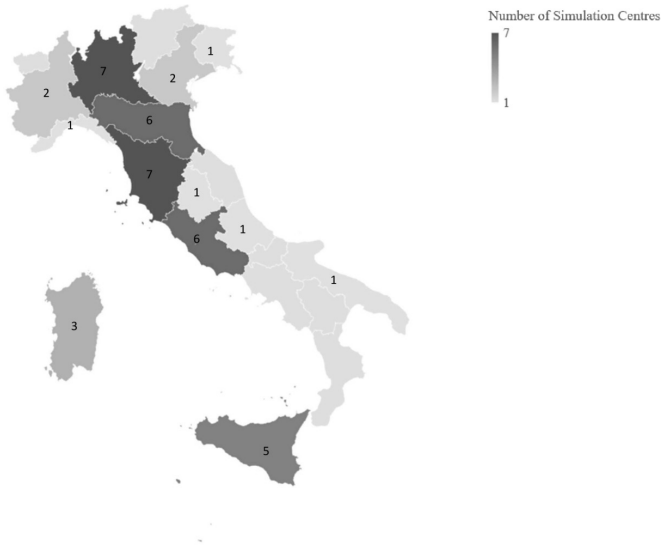

Figure 1 Geographical distribution of simulation centres in Italy.

validity of the study. The interview included multiple-choice and open-ended questions and is available in online supplemental files 1-2.

Statistical analysis

Qualitative data were analysed descriptively through their distribution frequency (n, %) using SurveyMonkey software (SurveyMonkey).

RESULTS

A total of 53 SCs were identified across Italy. Forty (75.5%) were interviewed by phone while

3 (5.7%) were asked to answer via email. Of the remaining, 8 (15.1%) did not answer and 2 (3.8%) lacked essential contact information, thus were excluded from the study.

Demographics and general characteristics of Italian SCs

The identified centres were mostly located in northern regions (19, 44.2%) (figure 1) and affiliated to a university (16, 37.2%). Most SCs were located inside hospital facilities (25, 58.1%) and covered a surface of less than 250 m^2 (20, 46.5%). Funding was similarly provided by hospitals (18, 41.9%) and universities (18, 41.9%) (table 1).

Most SCs rely on a *part-time workforce* to lead (35, 81.4%), administer (15, 34.9%), deal with information technology and simulators (34, 79.0%) and deliver the training initiatives (43, 100%). The staff comprehends physicians (41, 95.4%), nurses (30, 73.2%), psychologists (16, 39.0%) and others (20, 48.9%) such as midwives, psychotherapist and social workers. Most SCs (33, 76.7%) are accredited to at least one simulation society. Details are available in table 1.

Before the COVID-19 pandemic

Before the outbreak of COVID-19, 38 (88.4%) SCs reported to organise in situ simulations (ISS)—either for clinical training or diagnostic and/or therapeutic pathway test—and 40 (93.0%) in-centre simulation—either for technical and non-technical skills or high-fidelity simulation. Only a few (14, 26.4%) offered some form of telematic simulation.

In most cases (38, 88.4%), the spaces of the SCs were reserved for simulation and training while 5 (11.6%) SCs were available as a potential treatment area. Equipment (ie, ventilators, ultrasound scanners) were devoted to simulation in 30 (71.4%) SCs but were shared with clinical activities in 12 (28.6%) centres. The health furniture was also regularly employed for simulation only in 39 (90.7%) SCs.

Table 1 Demographic and general characteristics of the simulation centres

	All respondents, n (%)
Geographical distribution	
Northern	19 (44.2)
Central	14 (32.7)
Southern	10 (23.3)
Affiliation	
Hospital	13 (30.2)
University	16 (37.2)
Private society	7 (16.3)
Other	7 (16.3)
Mixed	5 (11.6)
Regional authority	2 (4.7)
Localisation	
In hospital	25 (58.1)
Out of hospital	18 (41.9)
Surface area (m^2)	
<250	20 (46.5)
250–500	11 (25.6)
>500	12 (27.9)
Funded by (one or more answers)	
Hospital	18 (41.9)
University	18 (41.9)
Private foundation	10 (23.3)
Government	0 (0)
Other (ie, courses fee, self-funding)	21 (48.8)
Staff members	
Director(s)	
Full time	7 (16.3)
Part time	35 (81.4)
Administrative	
Full time	22 (51.2)
Part time	15 (34.9)
IT	
Full time	15 (34.9)
Part time	9 (20.9)
Instructors/facilitators	
Full time	0 (0)
Part time	43 (100)
Accreditation (one or more answers)	
Società Italiana di Simulazione in Medicina (SIMMED)	16 (48.5)
Society in Europe for Simulation (SESAM)	6 (18.2)*
Society for Simulation in Healthcare (SSH)	2 (6.1)
Società Italiana Anestesia, Analgesia, Rianimazione e Terapia Intensiva (SIAARTI)	16 (48.5)
Società Italiana di Medicina d'Emergenza-Urgenza (SIMEU)	4 (12.1)
Other (ie, IRC, AHA, ACS)	11 (33.3)

*Five in progress or members of Simulation Centre Networking Project.
ACS, American College of Surgeons; AHA, American Heart Association; IRC, Italian Resuscitation Council; IT, information technology.

Table 2 Types of simulation during the COVID-19 pandemic

Type	All respondents, n (%)
In situ simulation	20 (46.5)
Training of COVID-19 patient care	14 (70.0)
Technical skills for COVID-19 patient care (ie, donning and doffing, endotracheal intubation)	17 (85.0)
Creation and testing of COVID-19 patient path (ie, triage, screening)	10 (50.0)
Non-technical skills for COVID-19 patient care (ie, communication with patient and relatives, decisions on life ending)	3 (15.0)
Other training (ie, trauma, non-COVID-19 patient airway management, cardiac arrest)	8 (40.0)
Creation and testing of diagnostic and/or therapeutic path for other patients	2 (10.0)
In-centre simulation	7 (16.3)
Training of COVID-19 patient care	5 (71.4)
Technical skills for COVID-19 patient care (ie, donning and doffing, endotracheal intubation)	5 (71.4)
Creation and testing of COVID-19 patient path (ie, triage, screening)	3 (42.9)
Non-technical skills for COVID-19 patient care (ie, communication with patient and relatives, decisions on life ending)	2 (28.6)
Other training (ie, trauma, non-COVID-19 patient airway management, cardiac arrest)	4 (57.1)
Creation and testing of diagnostic and/or therapeutic path for other patients	0 (0.0)
Telematic modality for COVID-19	23 (53.5)
Webinar	20 (87.0)
Video recorded	12 (52.2)
Virtual reality	3 (13.0)
Augmented reality	1 (4.4)
Telematic modality for other training	21 (48.9)
Webinar	20 (95.2)
Video recorded	10 (47.6)
Virtual reality	3 (14.3)
Augmented reality	2 (9.5)
None	8 (18.6)

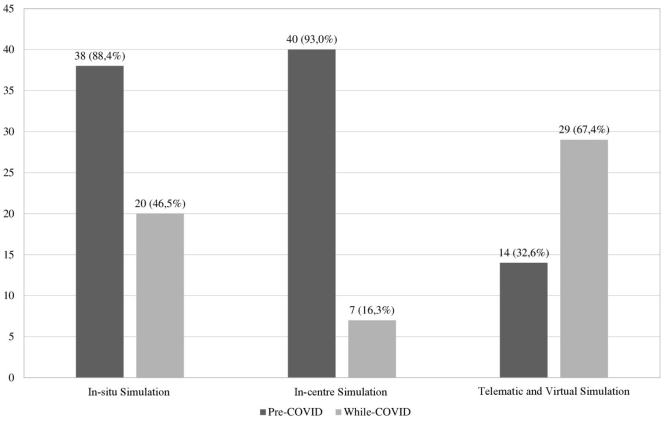

Figure 2 Simulation modalities organised before and during the COVID-19 pandemic acute phase.

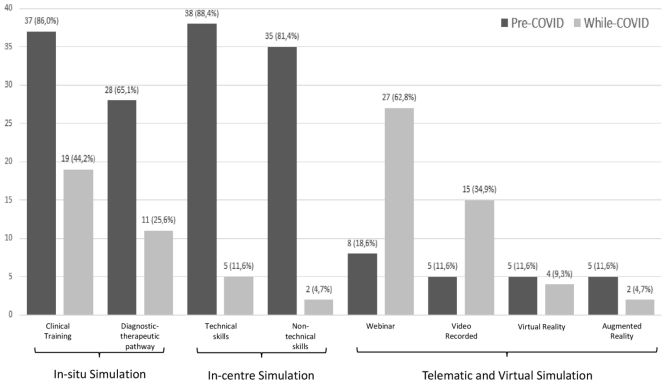

Figure 3 Simulation modalities before and during the COVID-19 pandemic acute phase, in-depth.

In 31 cases (72.1%), no formal agreements were established with healthcare facilities to use SC space and stuff in case of patient surge.

During the COVID-19 pandemic

Thirty-eight (88.4%) SCs were closed to the public: 23 (60.5%) following the lockdown decree of the Italian government issued on 9 March[11] and 15 (39.5%) even before as a precautionary measure. Specifically, 1 SC reopened after 2 weeks and 2 remained open in Northern Italy (2/19, 10.5%), 3 in Central Italy (3/14, 21.4%) and 0 in Southern Italy (0/10, 0.0%).

Twenty SCs (46.5%) organised ISS training and 7 (16.3%) in-centre simulation. Of the 25 SCs located inside a hospital, only 12 (48.0%) organised some sort of ISS while 12 of the 18 (66.7%) centres outside a hospital organised ISS initiatives. Twenty-three SCs (53.5%) resorted to telematic modalities to provide education about COVID-19 and 21 (48.8%) for other training. The details of simulation modalities delivered during the emergency are available in table 2. Figures 2 and 3 report the differences in training modalities delivered before and during COVID-19 emergency and figure 4 reports their distribution in the various regions. Most centres (26, 61.9%) adopted the European Resuscitation Council guidelines to deliver life support and organise the training during the pandemic.

Only 6 (14.0%) SCs used their space to deliver COVID-19 training, 1 (2.3%) other training and 4 (9.3%) set up mixed sessions. Three (7.0%) SCs were repurposed to patient care areas.

Either the medical devices (33, 76.7%) or health furniture (37, 86.1%) available in SCs were not used in hospitals to increase surge capacity.

Figure 4 Types of simulation delivered during the COVID-19 pandemic, by region. Percentage of simulation centres (SCs) delivering simulation modality as follows: (A) in situ, (B) in centre, (C) telematic and virtual.

Seven SCs hired additional staff to design and deliver training about the clinical management of patients with COVID-19 (4, 9.3%), psychological management of COVID-19 emergency (1, 2.3%) or others. Only 1 (2.3%) SC reported a temporary increase of staff to urgently train and credential hospital personnel reallocated to emergency departments and intensive care units to face the pandemic.

After the COVID-19 pandemic

Thirty SCs (69.8%) reopened after the acute phase of the outbreak but the return to activity occurred in the summer (mean months of no activity: 5). Only one centre reopened in the middle of March with an immediate restart of operation during the acute phase. Up to 30 September, 13 SCs were still closed to the public and interviewees reported the planned reopening date between October and January 2021.

At the time of reopening, all centres have taken measures to prevent and control the diffusion of SARS-CoV-2 such as social distancing, face masks and remodelling of the room layout.

DISCUSSION

The study investigated the role and the activities put in place by Italian SCs during the acute phase of the COVID-19 pandemic. In particular, the manuscript analysed what types of simulation were conducted and how SCs managed personnel, spaces and equipment during the emergency. To our knowledge, this is the first study conducted with the aim to capture a snapshot of the national situation on the subject. There is still great uncertainty about how COVID-19 will impact the future of healthcare, including the modalities of training. The evolution of the crisis necessitates a review of all activities performed in SCs to redesign the new normal. Providing an intuitive overview of what have been done in the acute phase could help policymakers. Almost all centres were closed to the public during the acute phase of the pandemic, either as a precautionary choice of SC executives or in accordance with the government regulations. Unfortunately, this deprived the healthcare system of a useful resource. Only a few SCs conducted ISS, and about half of the SCs that were normally delivering ISS training before the emergency suspended it. Conducting a simulation session in the actual patient care setting/environment provides a unique opportunity to identify system errors and latent hazards and improve the interdisciplinary performance of the care teams much more effectively compared with similar training carried out in SCs separate from the clinical context.[12] There is already evidence that ISS improved protocol compliance, knowledge and procedural skills of HCWs during the early phase of the COVID-19 response.[8 13 14] However, amid the COVID-19 pandemic, ISS training requires the adoption of specific strategies aimed to prevent the spread of SARS-CoV-2 among HCWs, patients and ISS participants. In particular, educators, facilitators and on-duty staff must be effectively trained in implementing the prescribed safety procedures within the facility.[15] It is noteworthy that SCs located outside the hospital delivered more ISS activities compared with those SCs located inside the hospital. We would have expected the opposite, thinking that SCs integrated within the hospitals would have been facilitated in the organisation of such sessions. A possible interpretation could be that contagion risk was perceived by SC staff as higher within the hospital premises, where most patients with COVID-19 were pooled and treated. This is a gap in our study and we hope it will be investigated in the future.

Italy has been severely hit by the COVID-19 pandemic, although with deep differences between the Italian regions. The highest number of cases was registered in the north, mostly in Lombardia, Piemonte, Veneto and Emilia Romagna.[16–18] Our study did not show any difference in the organisation of simulation training for healthcare providers throughout the country. Only half of the SCs organised some form of ISS or in-centre simulation, either COVID-related or not.

The role of telematics and virtual simulations have been already demonstrated throughout the years as effective educational methods for both technical and non-technical skills in various educational settings.[19–21] The present study shows that during the pandemic SCs took advantage of these technologies to create new ways to deliver health education while promoting safety. This is consistent with other studies that reported how these educational methods were efficient and effective during the early phases of the COVID-19 emergency.[7 22 23] The increased use of alternative simulation modalities than traditional simulation reflected also the invitation of international simulation societies to act and resort to these methods to 'continue education efforts seamlessly'.[24–26]

The COVID-19 pandemic brought a unique challenge to the Italian healthcare system.[1] In a few weeks, even congress venues or public assembly spaces were converted into temporary patient care facilities that eased the pressure on mainline hospitals by providing more space for patient beds. SCs normally integrate educational environments, such as classrooms and debriefing rooms, and simulation environments which replicate sufficiently the clinical environments, sometimes equipped with real ventilation and medical gas supply system.[27] Our report showed that only a few SCs were repurposed to treatment areas. Whether this can be more difficult for those SCs out of the health infrastructures, the simulation environments in the hospital premises might be identified among those spaces that are regularly used for non-clinical purposes and they may support patient care during a surge response. In fact, as a measure of the COVID-19 surge capacity management, healthcare authorities in several countries recommend identifying suitable space within existing hospitals that may retain the power, data and medical gases needed to provide care to patients.[28–30] Nonetheless, it is noteworthy that simulation facilities are generally designed and built to be learning contexts and accommodate the needs of its programmes and learners, and not with the primary purpose of serving the patients.[27] The very close resemblance of educational environments to real clinical spaces might be taken in consideration by healthcare providers if they repurpose them to clinical areas.

Over recent months, the world witnessed a severe shortage of high-quality medical devices, such as ventilators, to respond effectively to the COVID-19 public health emergency.[31] Ventilation-related products are still considered among those devices potentially in shortage.[32] The study shows that SC medical devices and equipment were not used for real patient care purposes in the majority of cases. When asked for the reason, most interviewees responded that either (A) SCs had outdated materials devoted to education activities or (B) did not receive a specific request from the affiliated hospitals. Similar findings were reported in the USA where most SC directors were either conflicted or 'against' the provision of their devices, mostly because of their obsolescence.[33]

The COVID-19 pandemic inevitably impacted HCWs due to an increased influx.[34] To shift towards contingency and crisis levels of activation,[35] hospitals recruited retired personnel, mobilised staff to specialised areas and credentialed junior doctors. SCs are fundamental in delivering primers and condensed courses

to rapidly meet the sudden need for trained staff in such emergency situations.[36 37] Our findings showed that Italian SCs were underused to help healthcare facilities organise and implement these crucial programmes.[13] This is probably due to a massive call to action of facilitators and educators, already working part-time in SCs, that shifted to full-time practice and did not have time to organise such training.

This study also found that, even at the end of the COVID-19 first wave, nearly one-fourth of Italian SCs were still closed. There is strong evidence that simulation in healthcare curricula and continuing education improves clinicians' learning outcomes and clinical practice and enables local transformation that improves access to care.[38] Therefore, today's clinicians and students have an expectation that simulation laboratories are part of lifelong healthcare education.[39]

The evolution of the COVID-19 epidemic calls for reconsideration about the delivery of training activities including adequate safety measures implemented for all individuals involved.[40] Our findings show that, at the time of reopening, all the centres have taken measures to prevent and control the diffusion of SARS-CoV-2 such as social distancing, face masks or remodelling of the room layout. In fact, the audience is mainly formed by healthcare professionals, who might face exposure to COVID-19 infection. Additionally, for many simulation-based activities, such as teamwork training, adequate physical distancing cannot be maintained.

While the uncertainty from COVID-19 persists throughout the globe, we hope that sharing policy experiences will ultimately foster dissemination of good practices. To achieve this result, it would be advisable to establish a sort of national or international community of practice which, as in reported in other fields of healthcare, breaks down geographical and organisational barriers and can help SC executives and educators to share information, reduce professional isolation and facilitate the implementation of new processes.[41]

CONCLUSIONS

The COVID-19 pandemic has altered the traditional training experience in an unprecedented and sudden manner. Data for the global picture show that the pandemic is far from over.

What is already known on this subject

- Simulation is an efficient tool to improve skills and knowledge, test new protocols and search for threats and their solutions.
- The potential of simulation in contributing to the management of previous pandemics and the current global COVID-19 crisis.

What this study adds

- How COVID-19 pandemic impacted simulation centres and how these coped with it in one of the most affected countries.
- The rising importance of new technologies in perpetuating education in emergency.
- Sharing common problems and policy experiences will help simulation centre executives and educators in maintaining high operational readiness at the beginning of the second wave of COVID-19.

We presented how SCs in one of the most affected countries in the world responded to the COVID-19 acute emergency phase. Simulation is a key training resource for quality care and improving healthcare provider and patient safety also during the COVID-19 pandemic response.

We remain optimistic in the future of healthcare, but challenging times require difficult decisions. We believe that sharing common problems and policy experiences will ultimately foster dissemination of good practices and will help SC managers and educators to better adapt the training activities to the new normal and continue to deliver high-quality simulation.

Limitations

Our study had several limitations. First, the structured interview was not validated but designed by a group of experts from our SC. However, it is the first study that shows a nationwide snapshot of SCs and their role in this recent pandemic.

Second, the interview was designed to investigate the most general aspects of the activities carried out by SCs without analysing what type of simulators was available and then used. The authors also decided to keep the structured interview as brief as possible (no longer than 10 min) in order to increase the study participation rate. The interview was conducted by phone to avoid misinterpretation of questions by respondents and reduce interviewees' tendency to satisfice and give top-of-the-head answers.

Twitter Pier Luigi Ingrassia @PLIngrassia and Giulia Mormando @GiuliaMormando

Acknowledgements We acknowledge the members of the simulation centres taking time to complete the survey.

Contributors PLI developed and refined the ideas in this paper. MF and PLI wrote the first draft, and all the authors discussed it actively and revised the draft until the final agreement on the submitted version. All the authors read and approved the final 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 PLI holds a professorship and leads the Centro Interdipartimentale di Didattica Innovativa e di Simulazione in Medicina e Professioni Sanitarie (SIMNOVA) at the Università del Piemonte Orientale in Novara, Italy. MF is a medical student in the Medical School at the Università del Piemonte Orientale. GM is a PhD candidate at the Università degli Studi di Padova. Paganini is MD at the Università degli Studi di Padova.

Ethics approval Participation in the study was voluntary, anonymous, and independent. Confidentiality of information was ensured and no financial incentive to participate in the study was offered. Verbal informed consent was obtained, and the participants could withdraw from the interview at any time. Since all data were collected such that individual subjects could not be identified or exposed to risks or liabilities, the study was deemed exempt from institutional review approval by the local ethics committee.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. The authors confirm that the data supporting the findings of this study are available within the article as its supplementary materials.

ORCID iDs
Pier Luigi Ingrassia http://orcid.org/0000-0002-3123-2862
Matteo Paganini http://orcid.org/0000-0002-7556-6928

REFERENCES

1 Armocida B, Formenti B, Ussai S, *et al*. The Italian health system and the COVID-19 challenge. *Lancet Public Heal* 2020;5:e253.
2 Rees LH. Medical education in the new millennium. *J Intern Med* 2001;249:33–40.
3 Adams JJ, Lisco SJ. Ebola: urgent need, rapid response. *Simul Healthc J Soc Simul Healthc* 2016;11:72–4.
4 Biddell EA, Vandersall BL, Bailes SA, *et al*. Use of Simulation to Gauge Preparedness for Ebola at a Free-Standing Children's Hospital. *Simul Healthc J Soc Simul Healthc* 2016;11:94–9.
5 Rojo E, Oruña C, Sierra D, *et al*. Simulation as a tool to facilitate practice changes in teams taking care of patients under investigation for Ebola virus disease in Spain. *Simul Healthc J Soc Simul Healthc* 2016;11:89–93.
6 Lockhart SL, Naidu JJ, Badh CS, *et al*. Simulation as a tool for assessing and evolving your current personal protective equipment: lessons learned during the coronavirus disease (COVID-19) pandemic. *Can J Anesth/J Can Anesth* 2020;67:895–6.
7 Li L, Lin M, Wang X, *et al*. Preparing and responding to 2019 novel coronavirus with simulation and technology-enhanced learning for healthcare professionals: challenges and opportunities in China. *Bmj Stel* 2020;6:196–8.
8 Wong J, Goh QY, Tan Z, *et al*. Preparing for a COVID-19 pandemic: a review of operating room outbreak response measures in a large tertiary hospital in Singapore. *Can J Anesth/J Can Anesth* 2020;67:732–45.
9 Fregene TE, Nadarajah P, Buckley JF, *et al*. Use of in situ simulation to evaluate the operational readiness of a high-consequence infectious disease intensive care unit. *Anaesthesia* 2020;75:733–8.
10 de Leeuw ED. *International Handbook of survey methodology*. Routledge, 2012.
11 Decreto del Presidente del Consiglio dei Ministri. Ulteriori disposizioni attuative del decreto-legge 23 febbraio 2020, n. 6, recante misure urgenti in materia di contenimento e gestione dell'emergenza epidemiologica da COVID-19, applicabili sull'intero t. Gazz. Uff. Ser. Gen. 09-03-2020, n.62. Available: https://www.gazzettaufficiale.it/eli/id/2020/03/09/20A01558/sg [Accessed 22 Oct 2020].
12 Sørensen JL, Østergaard D, LeBlanc V, *et al*. Design of simulation-based medical education and advantages and disadvantages of in situ simulation versus off-site simulation. *BMC Med Educ* 2017;17:20.
13 Carenzo L, Costantini E, Greco M, *et al*. Hospital surge capacity in a tertiary emergency referral centre during the COVID -19 outbreak in Italy. *Anaesthesia* 2020;75:928–34.
14 Sharara-Chami R, Sabouneh R, Zeineddine R. In situ simulation: an essential tool for safe preparedness for the COVID-19 pandemic. *Simul Healthc J Soc Simul Healthc* 2020.
15 Ingrassia PL, Tomola S. Guida pratica per la simulazione in situ. Consigli su come realizzare e condurre scenari di simulazione in ambiente clinico durante l'epidemia di COVID-19. *Univ del Piemonte Orient*.
16 Ortosecco G, Vaia O. First 70 days critical data trend for COVID-19 in four regions of northern Italy: a pilot study. *J Epidemiol Glob Health* 2020:v.
17 Italian National Health Institute (Istituto Superiore di Sanit). Dati aggregati quotidiani Regioni / PPAA - Ministero della Salute - Istituto Superiore di Sanit . 2020, 2020. Available: http://www.salute.gov.it/portale/nuovocoronavirus/dettaglioContenutiNuovoCoronavirus.jsp?area=nuovoCoronavirus&id=5351&lingua=italiano&menu=vuoto [Accessed 5 Oct 2020].
18 Gatto M, Bertuzzo E, Mari L, *et al*. Spread and dynamics of the COVID-19 epidemic in Italy: effects of emergency containment measures. *Proc Natl Acad Sci U S A* 2020;117:10484–91.
19 Kononowicz AA, Woodham LA, Edelbring S, *et al*. Virtual patient simulations in health professions education: systematic review and meta-analysis by the digital health education collaboration. *J Med Internet Res* 2019;21:e14676.
20 Foronda CL, Fernandez-Burgos M, Nadeau C. Virtual simulation in nursing education: a systematic review spanning 1996 to 2018. *Simul Healthc J Soc Simul Healthc* 2020;15:46–54.
21 Lee J, Kim H, Kim KH, *et al*. Effective virtual patient simulators for medical communication training: a systematic review. *Med Educ* 2020;54:786–95.
22 Palancia Esposito C, Sullivan K. Maintaining clinical continuity through virtual simulation during the COVID-19 pandemic. *J Nurs Educ* 2020;59:522–5.
23 Pierce LM, Weber MJ, Klein CJ, *et al*. Transitioning an advanced practice fellowship curriculum to eLearning during the COVID-19 pandemic. *J Nurs Educ* 2020;59:514–7.
24 SIMMED. Position statement Simulazione Virtuale, 2020. Available: http://www.simmed.it/new/index.php/2020/05/18/position-statement-simulazione-virtuale/
25 Foronda CL, Armstrong B. Position statement on use of virtual simulation during the pandemic. *Simul Healthc* 2020;15:46–54 https://www.ssih.org/COVID-19-Updates/ID/2237/COVID-19-SSHINACSL-Position-Statement-on-Use-of-Virtual-Simulation-during-the-Pandemic
26 Park CS, Clark L, Gephardt G. Manifesto for healthcare simulation practice. *BMJ Simul Technol Enhanc Learn* 2020:bmjstel-2020-000712.
27 Seropian M, Lavey R. Design considerations for healthcare simulation facilities. *Simul Healthc J Soc Simul Healthc* 2010;5:338–45.
28 NSW Government. COVID-19 surge capacity management: adapting and commissioning clinical spaces, 2020. Available: https://www.health.nsw.gov.au/Infectious/covid-19/communities-of-practice/Pages/surge-management.aspx [Accessed 6 Oct 2020].
29 Hillside. Infrastructure guidance for COVID-19/Alternate care sites. Available: https://thehillside.info/index.php/Infrastructure_Guidance_for_COVID-19/Alternate_Care_Sites [Accessed 6 Oct 2020].
30 Tony Blair Institute for Global Change. Surge capacity – preparing for and coping with peaks : practical guidance, 2020. Available: https://institute.global/sites/default/files/inline-files/Tony Blair Institute%2C Surge Capacity.pdf
31 Ranney ML, Griffeth V, Jha AK. Critical supply shortages — the need for ventilators and personal protective equipment during the Covid-19 pandemic. *N Engl J Med* 2020;382:e41.
32 FDA. Medical device shortages during the COVID-19 public health emergency. Available: https://www.fda.gov/medical-devices/coronavirus-covid-19-and-medical-devices/medical-device-shortages-during-covid-19-public-health-emergency [Accessed 6 Oct 2020].
33 Park C, Kiser B. Adaptive Policy Modifications for Simulation Centers - Navigating Uncharted Waters: Simulation in the Age of COVID 19. Available: https://www.youtube.com/watch?v=POifheDzxpA&feature=youtu.be
34 Felice C, Di Tanna GL, Zanus G, *et al*. Impact of COVID-19 outbreak on healthcare workers in Italy: results from a national E-Survey. *J Community Health* 2020;45:675–83.
35 Hick JL, Barbera JA, Kelen GD. Refining surge capacity: conventional, contingency, and crisis capacity. *Disaster Med Public Health Prep* 2009;3:S59–67.
36 Iqbal MR, Chaudhuri A. COVID-19: Results of a national survey of United Kingdom healthcare professionals' perceptions of current management strategy – A cross-sectional questionnaire study. *Int J Surg* 2020;79:156–61.
37 Cotrin P, Moura W, Gambardela-Tkacz CM. Healthcare workers in Brazil during the COVID-19 pandemic: a cross-sectional online survey. *Inq J Heal Care Organ Provision, Financ* 2020;57:0046958020963711.
38 McGaghie WC, Issenberg SB, Cohen ER, *et al*. Does simulation-based medical education with deliberate practice yield better results than traditional clinical education? A meta-analytic comparative review of the evidence. *Acad Med* 2011;86:706–11.
39 Bearman M, Greenhill J, Nestel D. The power of simulation: a large-scale narrative analysis of learners' experiences. *Med Educ* 2019;53:369–79.
40 Ingrassia PL, Capogna G, Diaz-Navarro C, *et al*. COVID-19 crisis, safe reopening of simulation centres and the new normal: food for thought. *Adv Simul* 2020;5:13.
41 Ranmuthugala G, Plumb JJ, Cunningham FC, *et al*. How and why are communities of practice established in the healthcare sector? A systematic review of the literature. *BMC Health Serv Res* 2011;11:273.