Medical Students' Perception of Telesimulation Training: A Qualitative Analysis

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ABSTRACT

OBJECTIVES: Over the past 2 decades, simulation-based learning has become an essential part of medical training. Simulated clinics have proven to be effective for training medical students. Even so, this learning method presents organizational and financial challenges that limit its dissemination to all medical students, especially since the COVID-19 pandemic. Simulated teleconsultation retains the advantages of interactive simulated clinics while offering concrete solutions to the challenges faced. The project aims to explore students' perspectives on simulated teleconsultation training compared to simulated clinics in person.

METHODS: Ten pre-clerkship students in the Faculty of Medicine at the University of Ottawa participated in interviews following in-person and teleconsultation simulated clinic sessions. The interview guide was developed based on previous work. The questions asked concerned experience with teleconsultation, interaction with the tutor and patient, practical or logistical obstacles, educational value and feasibility. The authors evaluated the results using a thematic analysis.

RESULTS: The interview analysis showed that the tutor feedback received during the simulated teleconsultation was comparable to that received after the in-person simulated clinic. Although most of the students enjoy teleconsultation, they raised the challenge of carrying out physical examinations and creating a personal connection with the tutor/patient.

CONCLUSION: Given the circumstances of the pandemic and students' comfort with technology, the new generation of medical students seems prepared to embrace teleconsultation. The themes identified in the analysis will enable the necessary adjustments to be made in order to optimize their teleconsultation training, an inextricable step in promoting the active offer of healthcare services.

KEYWORDS: telesimulation, curriculum development, virtual, simulation, medical education

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Introduction

Currently in medical schools, numerous learning methods are used to enable students to develop their skills. According to a descriptive literature review carried out in 2020, active strategies such as case-based, simulation-based, online, peer-assisted, observation-based, and flipped classroom learning are just some of the so-called modern learning methods.[1]

Among these methods, simulation-based learning has proven to be indispensable in medicine over the past 2 decades. Simulation can be done using simulated patients[2] or state-of-the-art mannequins.[3] This clinical training is based on the experiential learning approach first described by Kolb.[4] The simulated clinic enables students to carry out concrete experiments, make thoughtful observations, conceptualize, and formulate diagnostic hypotheses.[4]

However, this learning method presents organizational and financial challenges that limit its dissemination to all medical students, especially since the COVID-19 pandemic. In addition, the training of simulated patients[5] and physician tutors is often done in person, which requires local recruitment, further hindering the implementation of these simulated clinics.

Telesimulation is defined as simulation-based teaching through the use of telecommunication resources, whereas teleconsultation represents telemedicine in practice. Telesimulation seems to offer some of the advantages of in-person simulated clinics, while providing concrete solutions to the challenges encountered in these clinics.[6] In medicine, it has been proven effective in helping students and residents to develop their communication skills,[7,8] especially when learning how to conduct the medical interview,[9] and in providing educational content for these learners, as well as for administrative staff, particularly those working in rural communities.[10]

Telesimulation thus enables medical students to develop certain skills remotely, while preserving the advantages of in-person training by helping them to develop their clinical reasoning.[11]

The purpose of this study was to explore the perception of students in the Francophone stream of the Faculty of Medicine at the University of Ottawa regarding telesimulation training compared to simulated clinics in person. More specifically, we aimed to explore their perceptions of interaction with the tutor and the simulated patient, practical or logistical obstacles, educational value, and the feasibility of telesimulation training.

Methods

Qualitative approach and research paradigm

We used a latent thematic analysis approach following the interpretive research paradigm to describe participants' perception on telesimulation training compared to simulated clinics in person. We conducted this study in accordance with the University of Ottawa's institutional ethical standards (#H-02-22-7783). All participants in this research project signed a consent form prior to data collection. We used the *Standards for Reporting Qualitative Research (SRQR)*[12] in the writing of this article (Appendix 6).

Researcher characteristics and reflexivity

All the researchers demonstrated reflexivity at every stage of this research project. Following a collaborative research approach, the research team was multidisciplinary and included a physician/research manager/clinician researcher with expertise is methodological specifications and data analysis (S.F.), a physician/academic/clinician researcher/content expert with experience in validating research data (M.D.L.), a physician/academic/clinician researcher and director of clinical skills development in the Faculty of Medicine with expertise in research data validation and the training of simulated patients and tutors involved in simulated clinics within the Faculty of Medicine (I.B.), 2 undergraduate medical students with experience of simulated clinics and a perspective of contributing to the implementation of telesimulation (J.A.K. and D.A.), and a psychologist/clinician with expertise in qualitative analysis (M.P.V.). All co-authors were free to express their opinions during project-related meetings and communications.

Context

We conducted the research at the Faculty of Medicine of the University of Ottawa. We performed all data collection outside of regular course hours in classrooms commonly used for in-person simulated clinics.

Sampling strategy

We chose the non-probabilistic sampling method recommended in the writings of Murphy et al[13] and Higginbottom.[14] During their first 2 years of medical school at the University of Ottawa, students take part in in-person simulated clinic sessions. Considering their exposure to these sessions, 1st and 2nd year students were the target population to meet the research objective. Our sample size is based on the writings of Guest, Bunce, & Johnson[15] who state that in a qualitative study where the aim is to understand common perceptions and experiences among a relatively homogeneous group of individuals, the basic elements of the themes studied are present in participants' discourse as early as 6 interviews, and theoretical saturation of information is present after the first 12 interviews. We therefore opted for a sample of 10 participants.

Data collection

We carried out data collection between October 2022 and February 2023. E-mail invitations to participate in the research project were sent to all 2nd year students, as well as to 1st year students who had participated in at least 10 in-person simulated clinic sessions in the Francophone stream of the Faculty of Medicine. First, students were invited to take part in a simulated clinic session in person followed by a telesimulation session. Then, the week following these simulation activities, participants were invited to semi-structured interviews.

The in-person simulated clinic session and the telesimulation session were each 10 min long. They used the same types of data collection tools: a scenario for the simulated patient explaining the biopsychosocial conditions to be memorized (Appendix 1), a scenario for the tutor indicating the student learning objectives (Appendix 2), and a scenario for the student with their instructions (Appendix 3). We also provided the tutor and simulated patient with a feedback guide (Appendix 4). The in-person and telesimulation sessions used different scenarios with the same level of difficulty. The simulated patients and tutors received the scenarios 48 h prior to the sessions, whereas the student did not have access to their scenario until the start of each session. The student had to perform a case history before receiving feedback from the simulated patient and then the tutor. For the in-person session, the simulated patient, tutor, and student were all present in the classroom in the Faculty of Medicine, whereas during the telesimulation, all 3 were connected by videoconference using different classrooms having a computer equipped with a camera and microphone. To simulate a realistic teleconsultation setting, each member was seated facing the computer webcam, about 1-2 feet away. This allowed a full view of the head and shoulders. Other than the standard overhead lighting of the room, there was no additional lighting equipment used to enhance the setting. The sound input and output originated from the computer itself, with no headphones used. No specific instructions were given for verbal tone and rhythm, however participants were encouraged to speak as though they were having a regular face-to-face conversation. Although the camera and sound settings were verified before starting the

experiment, participants were encouraged to address any difficulties during the experiment and to ask for camera or sound adjustments if needed. We also asked about technical difficulties in our interview sessions in order to document any technical shortcomings that could have impacted students' perceptions.

The semi-structured interviews lasted approximately 30 min each and were conducted using a guide developed by the research team based on the work of Darnton et al.[16] This guide consisted of questions aimed at gathering students' experience of remote supervision by a tutor based at another site, interaction with the simulated patient during the telesimulation, as well as the feasibility of telesimulation in a context of clinical skills training (Appendix 5).

Data processing and analysis

Two of the co-authors conducted the semi-structured interviews via Zoom. No questions were asked that could identify participants. An external firm with no connection to the participants recorded and transcribed the interviews verbatim. To protect anonymity, they saved transcriptions in the order in which the interviews took place and numbered them from Student 1 to Student 10.

During the analysis, the primary coder examined in detail the individual interviews of each of the participants in order to identify statements relating to their experience of telesimulation, as suggested in the guidelines of Braun and Clarke[17] for inductive thematic analysis. To start, we generated preliminary codes to produce a coding manual. We developed these considering the explicit meaning of each data extract in the data set and they were applied to each of the transcribed documents. In assessing thematic saturation within the context of qualitative data collected on telesimulation, it is evident that theoretical saturation was reached across the 10 interviews completed. Throughout the data analysis, the state of theoretical saturation was made evident by the absence of new emerging themes and the recurrence of ideas expressed by participants in the latter interviews before reaching the 10th one. With this, we believe that the data collection process successfully captured the comprehensive range of perceptions and experiences related to telesimulation within the targeted student cohort.

Techniques to enhance trustworthiness

To ensure the trustworthiness of the analysis, we analyzed the documents systematically. The primary coder manually coded 100% of the data. The second coder then coded 25% of the data independently. The second coder received training from the primary coder to explain the principles of qualitative analysis and the steps involved in analyzing the interview excerpts so that they could code them properly. The second coder coded 2 documents in their entirety and half of a third, selected randomly. The coders met to review their coding. Lastly, we created a tree diagram in order to segment the coded excerpts into themes. To do this, we sorted the coded excerpts into potential themes, identified by the presence of similar codes in the data set. We then used a latent thematic analysis with an interpretive approach to determine the sub-themes. The 2 coders discussed the themes and sub-themes related to the chosen quotes. At certain points, clarifications were made in order to better represent participants' experience, until a consensus was reached.

Results

Units of study

Ten students took part in the in-person simulated clinics and the telesimulation clinics. All these students then agreed to participate in a one-on-one interview to explore their telesimulation experience as part of their medical training at the University of Ottawa. Five participants were 1st year medical students and the other 5 were in their 2nd year, which represents roughly 10% of the total population of first and second year francophone cohorts. Among the group, 3 participants identified as men and 7 as women, which is representative of the student population enrolled in the 1st and 2nd years of medical school within the faculty. Regarding their experience in clinical settings, 8 participants reported having experience in electives, preceptorship or outside their medical training, for example, as a nurse, pharmacy assistant, health care aide or hospital volunteer. Half indicated they had previous experience or exposure to telesimulation.

Synthesis, interpretation, and links to empirical data

We listed and developed the themes according to the individual interview questions asked and categorized them according to the 4 areas explored.

1. Experience of remote supervision by a tutor based at another site.
   1.1. Student and tutor environment during the telesimulation clinic session.

The majority of students described having been alone in a room. The tutor and the patient were in separate rooms.

1.2. Virtual assessment by the tutor.

Most did not notice any difference during the tutor's virtual assessment compared to in person. One student stated:

> Student 8: I think for me at least, the experience was similar to the one in person. So, I got my comments at the end and from feedback and I don't think there was much difference.

Some students added positive and negative comments about their experience. Regarding positive comments, a few students said they appreciated that the tutor's camera was turned off

during the interview and that this reduced their stress level. As for negative comments, a few students stated that the experience felt impersonal. One student, for example, reported:

> Student 10: of course there's a lack of *emotional connection* when you're doing online. So, I think maybe I was less drawn to putting all my attention towards the tutor who is online.

1.3. Practical or logistical obstacles that had an impact on interaction with the tutor.

The majority of students said they did not encounter any obstacles. However, some students reported technology-related obstacles: (1) non-ideal camera positioning and (2) internet and audio connection difficulties.

2.1. Perceived educational value of telesimulation in terms of feedback by the tutor.

Most of the students reported that the educational value of telesimulation is similar to in person sessions.

> Student 4: for me, I think anyway, in my opinion, I find that it compares to the feedback received when the tutor is in person.

The advantages raised were that the experience (1) introduced best practices to ensure confidentiality, (2) increased accessibility by freeing up travel time, and (3) was useful for preparing for future virtual consultations. Some students also mentioned disadvantages. Most of them reported that telesimulation does not take into consideration the physical examination of the patient. One student explained:

> Student 4: […] And I think that in terms of the physical examination, it could be a problem in the sense that the tutor won't be able to perform certain movements, manipulations and tests directly in front of the student to demonstrate how it needs to be done the right way.

Some students added that teleconsultation does not allow access to non-verbal language:

> Student 5 explained that […] through a screen, you're kind of, there are some limits on the interaction you can have with the tutor or with, I don't know, the patient. So it's not very practical, in my opinion.

2. Experience of interaction with the patient during telesimulation.

2.1. Experience of interaction with the patient during telesimulation.
Participants described their interactive experience both positively and negatively. On one hand, the majority described having good interaction with the patient, indicating that they obtained as much information as they did during the in-person session. On the other hand, a few students said that the experience was more impersonal and that it was difficult to communicate using non-verbal language. Some reiterated the complexity of carrying out the physical examination and the inadequate camera positioning.Student 3: […] we're not with our patient since we're limited to observing what we see through the camera and especially in relation to certain observational data that we do more innately during a consultation with a patient (3).

2.2. Practical or logistical obstacles related to the effect of patient interaction.
Most confirmed that they had not experienced any obstacles. However, some students again raised the challenges of adequately understanding non-verbal language and the complexity of carrying out a practical examination.
2.3. Advantages and risks of teleconsultation for the physician–patient relationship.Most of the students reported that the main advantage is the increased accessibility of services.Student 6: […] much more accessible for some people who are too busy, so they can't get there in person.Student 2: […] especially for those who live in places that are kind of isolated, rural areas, let's say, they say to themselves I don't feel like travelling, say, miles and miles to see a doctor.Similarly, some students added that teleconsultation will give them greater flexibility in their future schedules and those of their patients.Student 5: […] I'd say it's much more flexible because the patient can stay home, in the comfort of their own home.Concerning the risks, several students reported that the most important thing is to ensure confidentiality.Student 2: for sure, I think really ensuring confidentiality and making sure the patient is really in a space where he can have the consultation in a way that is confidential to protect privacy because not everyone has the luxury, let's say, of being in a space that's private.Another risk mentioned by a few students is the negative effect of limited access to technology. One student specified that this issue would be seen more in a geriatric population.Student 8: there can be problems with technology, especially, say, with people who are a bit older, who aren't necessarily as *technologically savvy*, let's say. […].Some students also reported that teleconsultation makes interaction more impersonal.Student 8: And it can also make for a slightly more distant interaction, I think.

2.4. Perceived educational value of simulated teleconsultation in terms of the physician–patient relationship.Most reported that their simulated teleconsultation experience enables them to develop new skills while preparing them for a new reality in service delivery.Student 7: I think it's something that's good that we're learning to do because it's going to become more and more prevalent in the future.Some students added that their experience had shown them that meeting in person is not essential to

maintaining a good physician–patient relationship, but that it's easier to conduct the consultation in person.

2.5. Patient's experience.
Most perceived the patient's experience as positive. They generally felt that the patient enjoyed the interaction.Student 8: […] the feedback my patient gave me was really positive. So I think she had a good experience.Some students raised a few negative aspects perceived as having an effect on the patient's experience, that is, internet connection and audio challenges.Student 10: I think at the beginning, she was a little frustrated because I didn't clearly hear two rather vital pieces of information.One student added that they sensed the patient's wish to be in person.

3. Feasibility.
3.1. Opinion on the implementation of telesimulation. Most students stated that the implementation of telesimulation training is useful for their future practice.Student 7: it's something that's going to become a big part of our practice in the future. So knowing how to bridge the skills we develop in person and physically with the patient and being able to do those things and still build good physician-patient relationships remotely, it's really important.However, some pointed out that this would require more practice.Student 1: it would take a bit more practice I think for it to flow as smoothly as an in-person simulated clinic.Some said that telesimulation is more useful for training students to provide teleconsultations in certain circumstances where in-person consultations are rather difficult, such as the pandemic.

3.2. Opinion on the usefulness of training medical students using telesimulation.
Most reiterated that telesimulation training was beneficial, as it increases accessibility to services and prepares them for future medical practice.
3.3. Recommendations for improving the experience for the tutor, patient, and student.

The students generally reported that telesimulation could be improved for all by optimizing the technological equipment. More specifically, some indicated that offering variety in the scenarios (eg, physical examination) and having the interview timed would be useful. Some mentioned the importance of having training on confidentiality and modified consent for telesimulation.

Discussion

The interviews with the 10 participants highlighted several themes relating to the quality of interaction with the tutor and patient, such as logistical obstacles, educational value, advantages and disadvantages of telesimulation for the physician–patient relationship, and feasibility.

Several themes emerged in support of the positive educational value felt by participants. The analysis showed that participants generally enjoyed their experience of telesimulation, which is in line with several previous studies highlighting participants' positive impression of telesimulation.[18,19] Most found the feedback provided by telesimulation to be comparable to that offered in person. Indeed, previous studies have discussed the benefits of telesimulation in providing students with the opportunity to receive quality feedback from remote educators.[20,21] In addition, several participants perceive that telesimulation training will allow for developing skills that will be useful in the new reality of healthcare delivery.[20,21] Participants appreciate that technology is an essential part of their future practice to allow for better accessibility, especially in rural areas where there is a lack of healthcare services.[22]

The recurring themes relating to the negative aspects of telesimulation were uncertainty regarding confidentiality and inadequate non-verbal communication. A previous study reported that simulated patients considered non-verbal communication challenges to be a weakness of telesimulation.[23] According to the participants, the challenge of non-verbal communication seems to hinder the development of the therapeutic relationship with the patient, affect the accuracy of the tutor's assessment and make the physical examination component difficult. These results are consistent with those of a study using telesimulation as a tool for training medical students in case management involving physical examinations. In this study, 50% of students found that telesimulation did not meet their expectations.[24]

Although telesimulation presents certain challenges, our study suggests that these can be overcome. The suggested solutions include preventing technological problems, optimizing the tutor assessment process, practicing non-verbal communication, practicing physical examinations, and obtaining proper consent.

In terms of technological issues, participants raised the importance of ensuring a stable internet connection and having clear camera and microphone quality, stating that this was their greatest concern. Previous studies also report that technological challenges are the main problems associated with telesimulation.[8,25] In addition, participants offered suggestions on camera logistics for tutor observation. More specifically, a camera showing a more distant image of the participant and the simulated patient would enable the tutor to better observe the participant's interaction skills during telesimulation. The tutor should take time at the start to confirm that they have a good view of both parties, in order to properly assess the interaction. Furthermore, participants suggest that tutors turn off their camera until feedback is given. This seems to have reduced the stress associated with the evaluation aspect, improving their perception of the educational value of the experience. As for non-verbal communication, students would benefit from case integration with physical examinations, a highly anticipated limitation

of telesimulation.[26,27] Participants would also welcome a presentation on tips for ensuring confidentiality and how to maintain non-verbal engagement virtually. A study has shown that preparing students and sharing additional resources are key steps in implementing telesimulation in medical education.[9]

Limitations and strengths

One of the strengths of the study is the fact that the interviews of medical student participants were conducted by interviewers who were also medical students. These peer-to-peer relationships created a certain ease, encouraging comfort and authenticity in the participants' responses. However, since the interviews were conducted by 2 separate interviewers, there may have been differences in interviewing styles. Although both interviewers had implemented the interview guide, they had not undergone any formal training.

In addition, this study did not evaluate the aspect of physical examination within telesimulation training, despite its perceived difficulty made apparent by participants. To ensure an equal level of difficulty between both in person and telesimulation cases, both scenarios were constructed around history taking. Given the well-document difficulty of physical examination training with teleconsultation in the literature, we decided that a simple history taking station would avoid the involvement of physical examination as a confounding variable in the perception of medical students in regard to feasibility of telesimulation training.

Conclusion

Considering the circumstances of the pandemic and students' comfort with technology, the new generation of medical students seems prepared to embrace telesimulation. The themes identified in the analysis will enable the necessary adjustments to be made in order to optimize their telesimulation training. Future research should explore the perspective of tutors and simulated patients during telesimulation sessions. Tutors' clinical experience and the perspective of simulated patients could help to develop more tangible strategies for improving telesimulation training. Future studies should also evaluate the use of telesimulation as a teaching tool for other components of medical students' learning, such as clinical skills and collaboration in a multi-disciplinary team. Lastly, future studies should be repeated with a larger sample size and should compare scenarios for physical examination cases.

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Ethical consideration

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Supplemental material

Supplemental material for this article is available online.

REFERENCES

1. Challa KT, Sayed A, Acharya Y. Modern techniques of teaching and learning in medical education: a descriptive literature review. *MedEdPublish*. 2021;10(1):8–10. doi:10.15694/mep.2021.000018.1
2. Lane JL, Slavin S, Ziv A. Simulation in medical education: a review. *Simul Gaming*. 2001;32(3):297–314. doi:10.1177/104687810103200302
3. Maran NJ, Glavin RJ. Low- to high-fidelity simulation - a continuum of medical education? *Med Educ*. 2003;37(Suppl 1):22–28. doi:10.1046/j.1365-2923.37.s1.9.x
4. Schultz K, McEwen L, Griffiths J. Applying Kolb's learning cycle to competency-based residency education. *Acad Med*. 2016;91(2):284. doi:10.1097/ACM.0000000000000584
5. Pageau S, Burnier I, Fotsing S. Stratégies de recrutement et de formation des patients en éducation : une synthèse de la littérature. *Pédagogie Médicale*. 2021;22(2):91–100. doi:10.1051/pmed/2021008
6. Watanabe I, Ades AM, Nishisaki A. Tele-Simulation for healthcare team and system improvement. In: Deutsch ES, Perry SJ, Gurnaney HG, eds. *Comprehensive healthcare simulation: improving healthcare systems. Comprehensive healthcare simulation*. Springer International Publishing; 2021:91–96. doi:10.1007/978-3-030-72973-8_13
7. Carter K, Podczerwinski J, Love L, et al. Utilizing telesimulation for advanced skills training in consultation and handoff communication: a post-COVID-19 GME bootcamp experience. *J Hosp Med*. 2021;16(12):730–734. doi:10.12788/jhm.3733
8. Roach E, Okrainec A. Telesimulation for remote simulation and assessment. *J Surg Oncol*. 2021;124(2):193–199. doi:10.1002/jso.26505
9. Thomas A, Burns R, Sanseau E, Auerbach M. Tips for conducting telesimulation-based medical education. *Cureus*. 2021;13(1):e12479. doi:10.7759/cureus.12479
10. McCoy CE, Sayegh J, Alrabah R, Yarris LM. Telesimulation: an innovative tool for health professions education. *AEM Educ Train*. 2017;1(2):132–136. doi:10.1002/aet2.10015
11. Burnier I, Ratté J, De Roock S, Benoit S, Denis-LeBlanc M. Raisonnement clinique et simulation : faciliter la priorisation d'hypothèses grâce aux patients simulés. Données d'une recherche quantitative [Clinical reasoning and simulation: facilitating hypothesis prioritization using simulated patients. Data from quantitative research]. *Can Med Educ J*. 2022;13(5):6–13. doi:10.36834/cmej.73556
12. O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med J Assoc Am Med Coll*. 2014;89(9):1245–1251. doi:10.1097/ACM.0000000000000388
13. Murphy E, Dingwall R, Greatbatch D, Parker S, Watson P. Qualitative research methods in health technology assessment: a review of the literature. *Health Technol Assess Winch Engl*. 1998;2(16):iii–iix. 1-274.
14. Higginbottom GMA. Sampling issues in qualitative research. *Nurse Res*. 2004;12(1):7–19. doi:10.7748/nr2004.07.12.1.7.c5927
15. Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation and variability. *Field Methods*. 2006;18(1):59–82. doi:10.1177/1525822X05279903
16. Darnton R, Lopez T, Anil M, Ferdinand J, Jenkins M. Medical students consulting from home: a qualitative evaluation of a tool for maintaining student exposure to patients during lockdown. *Med Teach*. 2021;43(2):160–167. doi:10.1080/0142159X.2020.1829576
17. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3:77–101. doi:10.1191/1478088706qp063oa
18. Lin E, You AX, Wardi G. Comparison of in-person and telesimulation for critical care training during the COVID-19 pandemic. *Sch*. 2021;2(4):581–594. doi:10.34197/ats-scholar.2021-0053OC
19. Sanseau E, Lavoie M, Tay KY, et al. Telesimbox: a perceived effective alternative for experiential learning for medical student education with social distancing requirements. *AEM Educ Train*. 2021;5(2):e10590. doi:10.1002/aet2.10590
20. Nelsen BR, Chen YYK, Lasic M, Bader AM, Arriaga AF. Advances in anesthesia education: increasing access and collaboration in medical education, from E-learning to telesimulation. *Curr Opin Anaesthesiol*. 2020;33(6):800–807. doi:10.1097/ACO.0000000000000931
21. Barrientos ER, Turrubiates Corolla ML, Olivares Olivares SL. Faculty self-assessment on telesimulation for health sciences education. *IEEE Rev Iberoam Tecnol Aprendiz*. 2023;18(1):28–32. doi:10.1109/RITA.2023.3250425
22. Donohue LT, Hoffman KR, Marcin JP. Use of telemedicine to improve neonatal resuscitation. *Children*. 2019;6(4):50. doi:10.3390/children6040050
23. Freeman KJ, Xin WW, Canning CA. Simulated patients' experience of adopting telesimulation for history taking during a pandemic. *Asia Pac Sch*. 2021;6(3):124–127. doi:10.29060/TAPS.2021-6-3/CS2344
24. Brandão CFS, Vaccarezza GF, Albanese RP, Fernandes GCVR, Cecilio-Fernandes D. Application of telesimulation in a medical undergraduate

course during the SARS-CoV-2 pandemic: a quantitative and retrospective study. *Sao Paulo Med J*. 2022;140(3):509–513. doi:10.1590/1516-3180.2021.0108.r2.22112021

25. Kurji Z, Aijaz A, Aijaz A, Jetha Z, Cassum S. Telesimulation innovation on the teaching of SPIKES model on sharing bad news. *Asia-Pac J Oncol Nurs*. 2021;8(6):623–627. doi:10.4103/apjon.apjon-20108

26. Ray JM, Wong AH, Yang TJ, et al. Virtual telesimulation for medical students during the COVID-19 pandemic. *Acad Med*. 2021;96(10):1431–1435. doi:10.1097/ACM.0000000000004129

27. Koff A, Burns R, Auerbach M, et al. Pediatric emergency medicine didactics and simulation (PEMDAS) telesimulation series: hyperleukocytosis. *MedEdPORTAL*. 2021;17:11205. doi:10.15766/mep_2374-8265.11205