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REVIEW | REVISÃO

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Conceptual analysis and applicability of telesimulation in health education: A scoping review

Análise conceitual e aplicabilidade de telessimulação no ensino em saúde: Revisão de escopo

Análisis conceptual y aplicabilidad de la telesimulación en educación en salud: Revisión del alcance

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ABSTRACT

Objective: to analyze the "telesimulation" concept and its applicability in the context of health education. **Method:** this is a conceptual analysis performed through a scoping review carried out in May 2021 in the following databases: PubMed, PMC, Educational Resources Information Center, Web of Science, Science Direct, Scopus, LILACS, Scientific Electronic Library Online and Google Scholar, through the use of the descriptor "*telesimulação*" and its respective translations into English and Spanish. To analyze the studies, the concept's attributes, antecedents, and consequences were assessed. **Results:** telesimulation is defined as a branch of clinical simulation that is characterized by the promotion/enabling of educational practices in health education, performed remotely, synchronously, through video call. It aims to facilitate contact between instructors and participants in situations of need for social distance, access made difficult for economic reasons, such as the scarcity of human and material resources, and/or geographically distant, aiming at developing and improving relevant skills and abilities for health professions. **Conclusion and implications for practice:** telesimulation represents a new opportunity in health education as it expands teaching possibilities and breaks down barriers ranging from geographic to economic.

Keywords: COVID-19; Education, Distance; Teaching; Concept Formation; Simulation.

RESUMO

Objetivo: analisar o conceito de telessimulação e sua aplicabilidade no contexto do ensino em saúde. **Método:** trata-se de uma análise conceitual, realizada através de uma *scoping review* realizada em maio de 2021, nas seguintes bases de dados: PubMed, PMC, *Educational Resources Information Center*, *Web of Science*, *Science Direct*, Scopus, LILACS, *Scientific Electronic Library Online* e *Google Scholar*, mediante o uso do descritor "telessimulação" e suas respectivas traduções para inglês e espanhol. Para análise dos estudos, avaliaram-se os atributos, antecedentes e consequentes do conceito. **Resultados:** a telessimulação é definida como uma ramificação da simulação clínica que se caracteriza pela promoção/viabilização de práticas educativas no ensino em saúde, realizadas remotamente, síncrona, através de videochamada. Tem como objetivo facilitar o contato entre instrutores e participantes em situações de necessidade de distanciamento social, acesso dificultado por razões econômicas, como a escassez de recursos humanos e materiais, e/ou geograficamente distantes, com a intenção de desenvolver e aperfeiçoar competências e habilidades pertinentes as profissões da saúde. **Conclusão e implicações para a prática:** a telessimulação representa uma nova oportunidade na formação em saúde, ao ampliar as possibilidades de ensino e romper barreiras que vão desde as geográficas até as econômicas.

Palavras-chave: COVID-19; Educação à Distância; Ensino; Formação de Conceito; Simulação.

RESUMEN

Objetivo: analizar el concepto de "telesimulación" y su aplicabilidad en el contexto de la educación para la salud. **Método:** se trata de un análisis conceptual realizado a través de una revisión de alcance realizada en mayo de 2021 en las siguientes bases de datos: PubMed, PMC, *Educational Resources Information Center*, *Web of Science*, *Science Direct*, Scopus, LILACS, *Scientific Electronic Library Online* y *Google Scholar*, mediante el uso del descriptor "telesimulación" y sus respectivas traducciones al inglés y al español. Para analizar los estudios, se evaluaron los atributos, antecedentes y consecuencias del concepto. **Resultados:** la telesimulación se define como una rama de la simulación clínica que se caracteriza por la promoción/habilitación de prácticas educativas en educación para la salud, realizadas de forma remota, sincrónica, mediante videollamada. Tiene como objetivo facilitar el contacto entre instructores y participantes en situaciones de necesidad de distancia social, acceso dificultado por razones económicas, como la escasez de recursos humanos y materiales, y/o geográficamente distantes, con la intención de desarrollar y mejorar las habilidades y competencias relevantes. habilidades las profesiones de la salud. **Conclusión e implicaciones para la práctica:** la telesimulación representa una nueva oportunidad en la educación para la salud, ya que amplía las posibilidades de enseñanza y rompe barreras que van desde las geográficas hasta las económicas.

Palabras clave: COVID-19; Educación a Distancia; Enseñanza; Formación de Concepto; Simulación.

INTRODUCTION

Health education has undergone several changes in recent decades. Among these changes, education mediated by clinical simulation is mentioned. The literature points to several benefits of the strategy, ranging from interpersonal development to communication, problem-solving, satisfaction, self-confidence, improvement in cognitive performance and development of clinical skills.[1-3]

However, it should be noted that the lack of dedicated experts and educators is the main barrier to clinical simulation advancement, in addition to the lack of structure and investment of institutions.[1,4]

It is known that clinical simulation, as an educational intervention strategy, can improve health care provision. However, researchers warn that, in a system of limited financial resources, this reality can interfere with the strategy accessibility, since it is not all institutions, especially in rural and remote areas, that have simulation centers and technologies focused on this strategy.[4,5]

In order to connect, via the internet, instructors and learners from different locations, telesimulation has emerged, in the last decade, with the potential to overcome these challenges through audiovisual technology and as a cost-effective means of simulation training for participants in remote, less accessible and travel-limited locations. From this perspective, it is believed that, by eliminating these geographical barriers, it provides a quality education and institutional collaboration.[4]

Telesimulation collaborates in the development of students' crucial cognitive, kinesthetic, and psychomotor skills by providing real-time hands-on training that is facilitated by the task instructor.[6] Unfortunately, however, there is a shortage of research that uses telesimulation in team-based performance and in the acquisition of psychomotor skills.[1]

Still, the literature points to telesimulation validity and its educational benefits for students in external locations.[7] Moreover, it has shown an exponential growth in areas such as pediatric and neonatal resuscitation, surgery, anesthesia, nursing and emergency medicine. Studies in these areas, especially in medical specialties, have shown that this is a potentially effective strategy.[6] Its benefits are promising,[8] and extend beyond the walls of a simulation center, proving particularly useful where there are distance limitations that prevent effective/efficient instruction, time constraints that make travel to students or instructor's location impractical, or a lack of available educators with specific content knowledge.[6]

It is also important to consider that, in the current context, the pandemic caused by the new coronavirus (COVID-19) has had a significant impact on student education, limiting and changing face-to-face learning.[9] In addition to practices in health services, it has also affected simulated clinical experiences in laboratories, which may have long-term consequences on health outcomes.

Therefore, there is an urgent need to think about alternative strategies for sessions of simulated clinical experiences in the context of health education, considering the particularities of the remote method and the diversity and characteristics of health courses. In this perspective, telesimulation is presented as a complete solution for the simulated clinical experiences in the situations presented.[10]

Considering the recent expansion of its use in the scientific literature, it is valid to understand the telesimulation concept in health education. Therefore, it is important to analyze the formation of a concept to enable the construction of properly grounded hypotheses. Also, the results of this analysis can be useful in the construction of research instruments, standardization of a language in health education and in the provision of subsidies to build new simulators or validate pre-existing equipment.[11]

In this context, the following research question emerged: according to the literature, how is the conceptual definition of telesimulation and its applicability in the context of health education given? Thus, the objective was to analyze the "telesimulation" concept and its applicability in the context of health education.

METHOD

This is a study of conceptual analysis based on the methodology suggested by Walker and Avant, considering its applicability and dissemination in nursing field concepts.[11] Eight steps are pointed out by the authors, in which the first seven were followed in the present article, taking into account that the description of the empirical references is unnecessary to contemplate the objective proposed in the study.

The first step deals with concept selection,[11] where, in the present study, the concept defined for analysis was "telesimulation in health education". The second step deals with the definition of the objective of conceptual analysis. The analysis aimed to elucidate the "telesimulation" concept in the context of health education.

In the third step, the possible uses of the concept were identified, through the analysis of studies and experiences of telesimulation in health. Subsequently, the attributes were determined (fourth step). It is noteworthy that attributes are defined from the analysis of words or expressions that appear repeatedly in the literature and that show the concept essence.[11]

In the fifth step, a model case was identified as a way to illustrate the concept use. Subsequently, an additional case was elaborated, which does not apply to the concept.[11] Finally, in the seventh step, antecedents and consequences were identified. It should be noted that antecedents are events that must occur before the concept occurs. As for the consequences, they are a result of the concept appearance. Therefore, none of these elements fit the attributes.[11]

The definition of the empirical references is the eighth methodological step.[11] However, due to its observation of reality and the need to develop field research, it was not possible to include it in this article. In the authors' reality, the concrete experiences with telesimulation were punctual and concued before the conclusion of this study.

The study was conducted through a scoping review, according to the Joanna Briggs Institute (JBI) proposal.[12] To construct the research question, the PCC strategy was applied, which represents

a mnemonic for Population, Concept and Context (P – concept definition, attributes and consequences; C – telesimulation; C – health education). For study search and selection, the following guiding question was established: according to the literature, how is the conceptual definition of telesimulation in the context of health education? What are the attributes, antecedents and consequences of the "telesimulation" concept?

An individual search strategy was applied to the following databases: PubMed, PMC,Educational Resources Information Center (ERIC), Web of Science, Science Direct, Scopus, LILACS, Scientific Electronic Library Online (SciELO) and Google Scholar. The databases were accessed through the Journal Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES - *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*), from the Federated Academic Community (CAFe - *Comunidade Acadêmica Federada*), through access from a federal public university. The study was carried out in May 2021, through the following search strategy: "telesimulation" OR "*telessimulação*" OR "*telesimulación*". The selection of studies was performed by two reviewers, independently. Therefore, the Rayyan platform – Intelligent Systematic Review was used. The reviewers were a physician and a PhD student in nursing. There was no disagreement in the sample selection.

To select the articles, a careful reading of titles and abstracts was performed, and when these were not sufficient, the entire article was read. For selection, inclusion and exclusion criteria guided by the guiding question were considered.

Primary research studies, systematic reviews, meta-analyses, letters, guidelines, websites, blogs, official communications from governmental institutions and studies that have telesimulation as a theme were included. There was no language restriction or time frame.

Studies that did not answer the research question and that did not have telesimulation as a research object in the context of health education were excluded. In more detail, in Google Scholar, 540 were found and 31 were excluded; in PMC, 61 were found and 11 were excluded; in PubMed, 51 articles were found and 12 were excluded; in Scopus, 43 were found and 16 were excluded; in Science Direct, 39 were found and 9 were excluded; in Web of Science, 34 were found and 8 were excluded; in SciELO, 2 articles were found and selected; in LILACS, one article was found and excluded; and in ERIC, none was found. Figure 1 presents a synthesis of the search process according to the PRISMA model.

After searching for articles, the data were organized in Excel spreadsheets. The following information was extracted

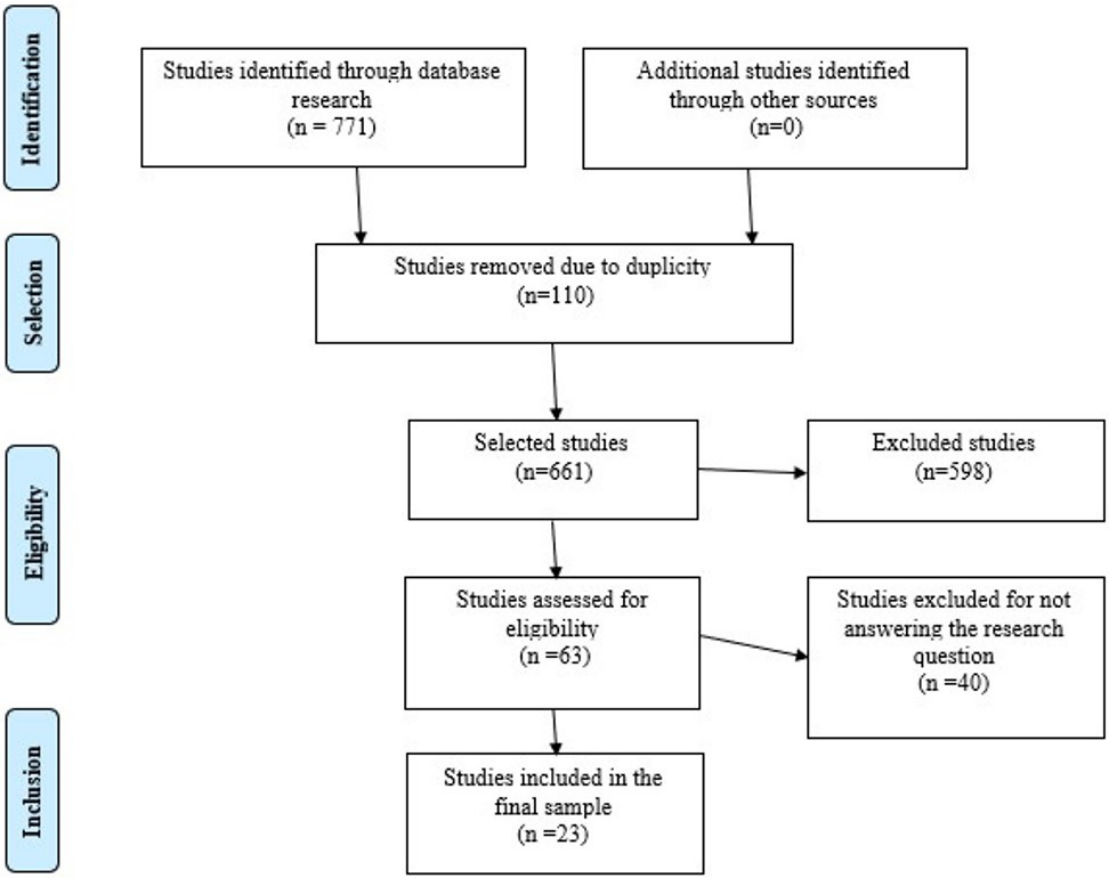

Figure 1. Scoping review search flowchart.
Source: developed by the authors.

from the studies: title, author(s), year of publication, database/library/database, type of study, country of origin, objectives, methodological design, main findings. The spreadsheets were organized from the coding of included articles, attributes, antecedents and consequences, and contents were analyzed.

After organizing the data, the authors, the same ones from the sample selection step, in a joint reading of included manuscripts, extracted the attributes, antecedents and consequences. Therefore, the definition of these three concepts was taken into account in the light of Walter and Avant's methodological framework.[11]

A descriptive data analysis was performed using relative and absolute frequencies, as well as data characterization and reproduction charts and tables.

As this study did not involve human beings, it was not submitted to the Research Ethics Committee for approval. However, it is emphasized that the precepts of Law 9.610/98 were followed, in order to preserve and respect the ideas, concepts and definitions of the authors of selected primary studies.

RESULTS

Of the 771 documents assessed, 23 met the criteria for eligibility in the study. The sample is characterized by articles in medicine (91.3%), predominantly carried out in the United States (56.5%) and published in 2021 (26%) and 2020 (26%). Regarding the method adopted, descriptive studies (78.2%) are the most evident.

Chart 1 presents the characterization of studies belonging to the final sample, considering the author, the year, the method and the main conclusions. All studies had positive experiences with the use of telesimulation in the context of health education.

Chart 1. Characterization of studies that composed the sample (n=23).

ID*	Author/year	Objective	Method	Main conclusions
1	Patel et al. 2020[8]	Assess the reproducibility of a complex case using telesimulation.	Descriptive study	The feasibility of adapting a complex case to telesimulation and effective knowledge gain has been demonstrated. Participants were satisfied with the learning experience, suggesting that this format can be used in other distance learning situations.
2	Mileder et al. 2021[13]	Assess the feasibility of telesimulation for neonatal resuscitation training.	Descriptive study	Telesimulation is feasible for neonatal resuscitation training, and associated with significant improvements in knowledge of current care guidelines, with no differences between medical students and neonatal nurses.
3	Diaz and Walsh 2020[9]	Analyze the authors' recommendations for the development and delivery of successful telesimulations.	Expert consensus	Telesimulation as an educational platform is evolving. Feedback from our own telesimulations was extremely positive with participants, indicating that this is an interactive and thought-provoking way to learn in the context of the pandemic.
4	McCoy et al. 2017[6]	Provide a comprehensive and unifying definition of telesimulation.	Concept analysis	Early studies demonstrated the concept of bringing low-cost simulation training to students in outdoor locations, including remote and resource-restricted areas who would not be able to benefit from this innovative educational modality.
5	McCoy et al. 2017[14]	Assess the comparative efficacy of telesimulation versus standard simulation.	Randomized clinical trial	This was a prospective crossover randomized study that assessed telesimulation versus standard simulation. No significant difference was found in the assessment scores between the two groups. There was also no significant difference found in the favorability of a teaching modality in post-educational session research.

* ID – identification.
Source: developed by the authors.

Chart 1. Continued...

ID*	Author/year	Objective	Method	Main conclusions
6	Yang et al. 2020[15]	Describe the creation and implementation of a fully online simulation-based pediatric emergency medicine training intervention for medical students.	Descriptive study	Telesimulation intervention involving all medical students, staff and facilitators, from remote interaction to pediatric emergency training during COVID-19. It was associated with high levels of satisfaction by most students and professors.
7	Garland et al. 2019[4]	Describe the application of low-cost telesimulation to facilitate the teaching of chest tube insertion.	Descriptive study	The availability of clinical skill instructors, skill practice expenses, and distance from simulation centers can be a barrier to teaching and maintaining skills, especially in rural settings. Telesimulation has the potential to overcome these challenges using audiovisual technology to connect rural students with instructors in simulation centers.
8	Kishimoto et al. 2021[16]	Describe a telesimulation training applying inverted classroom in the dental clinic for emergencies.	Descriptive study	It is possible to remotely learn the management of medical emergencies in dental clinics through Zoom. The positive feedback obtained through the questionnaire suggests that the use of telesimulation applied in an inverted classroom is useful for dentists.
9	Renouf et al. 2017[17]	Describe a telesimulation exercise to treat hypertensive pneumothorax.	Descriptive study	Telesimulation can be a useful way to teach remote physicians emergency procedures and communication skills.
10	Bond et al. 2019[18]	Describe the method of interprofessional integration during in situ simulation.	Descriptive study	It was possible to carry out a simulated practice in situ with the support of teleconference software effectively.
11	Hayden et al. 2018[5]	Describe an approach to telesimulation.	Descriptive study	Telesimulation can provide simulation education and instructor training with less time and resources than face-to-face simulation and thus increase access to simulation education throughout the system.
12	Brei et al. 2020[19]	Investigate the feasibility of a large group of telehealth software telesimulation provider training for remote team leadership skills with neonatal cases and procedures.	Descriptive study	Multi-platform telesimulation training for large groups is feasible and can increase the comfort of participants with the use of specialized telehealth software, expanding the telemedicine capacity of healthcare organizations in the care of patients during the COVID-19 pandemic.
13	Mikrogianakis et al. 2011[20]	Determine whether telesimulation could be used to teach an intraosseous insertion technique.	Descriptive study	The session improved physicians' knowledge, confidence and comfort level by inserting the intraosseous needle. This modality offers potential for teaching other procedural skills at a distance.

* ID – identification.
Source: developed by the authors.

Chart 1. Continued...

ID*	Author/year	Objective	Method	Main conclusions
14	Jewer et al. 2019[21]	Assess the educational effectiveness of simulation-based training of a remotely administered acute care procedure.	Randomized clinical trial	Training delivered remotely is an effective way to conduct a skills session. Those who were remotely trained had comparable learning outcomes to students who received face-to-face instruction.
15	Okrainec et al. 2010[22]	Determine the effectiveness of telesimulation for teaching the fundamentals of laparoscopic surgery.	Descriptive study	Remote telesimulation is an effective method for teaching the fundamentals of laparoscopic surgery in Africa, achieving a 100% skill pass rate.
16	Montgomery et al. 2021[23]	Describe the implementation of a pediatric emergency training intervention.	Descriptive study	The performance of a multicenter pediatric telesimulation for the nursing team in the community emergency environment was feasible and well received by students.
17	Henao et al. 2013[24]	Assess the effectiveness of telesimulation to teach the practical component of the Fundamentals of Laparoscopic Surgery program.	Descriptive study	This study demonstrates the effectiveness of telesimulation to improve the laparoscopic skills of participants with no prior knowledge of the Fundamentals of Laparoscopic Surgery program, which ensured they obtained the necessary levels to pass the practical section of the program.
18	Reece et al. 2021[25]	Describe the use of virtually facilitated simulation to improve COVID-19 preparedness in rural and remote areas of Canada.	Descriptive study	Telesimulation offers a fast and cost-effective way to provide high-quality simulation for geographically isolated communities.
19	Naik et al. 2020[26]	Describe the use of telesimulation for COVID-19 ventilator management training.	Descriptive study	The combination of a video tutorial followed by an interactive telesimulation was successful in providing timely education during the COVID-19 pandemic. Moreover, it reinforced the value and flexibility in which simulation education could conveniently continue for students despite the significant restrictions in place during the coronavirus pandemic.
20	McCoy et al. 2019[27]	Assess the effectiveness of using telesimulation to provide a course of emergency medical services.	Descriptive study	Demonstrated successful implementation of an intercontinental mass casualty incident triage course using telesimulation and wearable/mobile technology.
21	Ray et al. 2021[28]	Describe the process of implementing virtual telesimulation in a medical curriculum.	Descriptive study	Experience that quickly adapted the traditional simulation, for virtual telesimulation, and presented itself as a successful teaching experience.

* ID – identification.
Source: developed by the authors.

Chart 1. Continued...

ID*	Author/year	Objective	Method	Main conclusions
22	Duff et al. 2021[29]	Reflect on the applicability of telesimulation.	Editorial	Remote simulation is a convenient option for the simulation toolbox, whether for education, assessment or research. It allows interaction when it is difficult or impossible to bring students, facilitators, operators and mannequins together in a single space.
23	Sa-Couto and Nicolau 2020[30]	Check students' feedback on educational gains from telesimulation.	Descriptive study	Telesimulation can be used to promote a meaningful interactive simulation environment, even with limited physical resources.

* ID – identification.
Source: developed by the authors.

When verifying the reason for using telesimulation, 52% of studies opted for the strategy as a result of the COVID-19 pandemic, which brought the need for social distance.

As shown in Chart 2, the purposes of using the simulation are diverse, and involve technical procedures, managerial and care competencies, obtaining as target audience both undergraduate students, residents and health professionals. It is also noteworthy that, among the various video conferencing platforms available and used in the studies, the Zoom platform was highlighted (39.1%), followed by Skype (13%).

Identification of possible uses of concept

The telesimulation concept is used in different areas of health education. Although there is a concept, very referenced in the analyzed articles, the analysis also pointed to a variety of understanding and definition. Chart 3 presents some definitions of the concept analyzed. Studies 10, 16 and 18 do not present any type of definition.

By identifying the uses of telesimulation concept in health education, the antecedents and consequences of the analyzed concept were extracted. Table 1 summarizes the findings from the literature review.

Identification of additional cases

In order to clarify the antecedents, attributes and consequences related to the concept analyzed, four cases were created, two model cases and two contrary cases. The examples explained try to reproduce all the highlights and features of telesimulation. Model case 1 presents the particularities - for the training of technical skills. Model case 2 resents the particularities - during a clinical simulation scenario in telesimulation format.

Model cases

The cases described below were created by two researchers in the area of clinical simulation, who participated in the data extraction step. However, the cases were reviewed by the other authors of the manuscript based on the conceptual definition of the study steps and attributes, consequents and antecedent, as shown in Table 1.

Model case 1

After a dialogic exposure session on neonatal resuscitation, a group of students is gathered in the skills laboratory. The space has all the material resources to perform the training of steps related to neonatal resuscitation. Students were allocated into small groups to train psychomotor ventilation and chest compression skills. The groups are distributed in practical stations containing simulators, instruments and inputs. While performing the ventilation and chest compression procedures, in a low-fidelity simulator, they are monitored remotely, synchronously, through a video call platform, by a specialist instructor, who, due to displacement difficulties, finds to another location. The instructor observes the step-by-step procedures and provides real-time feedback to each student.

Model case 2

Following neonatal resuscitation skills training, a group of students are assembled in a virtual video calling platform type environment. In the environment, there are ten students and a tutor specialized in pediatrics. All participants are located in different regions of the country, due to recommendations for social distancing guided by health agencies, due to the current pandemic situation. The virtual environment offers sharing of screens, audios and chat. Students already know all the steps and procedures related to neonatal resuscitation, and have already trained, at another time, techniques of ventilation, chest compression, medication administration, among others. Participants had access, weeks before, to a material containing videos, articles and manuals of pediatric procedures. After accessing the virtual platform, they are asked about any doubts and invited to solve a clinical case proposed by the tutor. The tutor controls a pediatric virtual reality simulator. In the situation, students solve the case based on decision-making in the face of program situations. After solving

Chart 2. Definition of the reason for choosing telesimulation, purpose of simulation, target audience and conference platform used.

ID*	Reason for choosing telesimulation	Purpose of simulation	Target audience	Platform
1	COVID-19 pandemic	Pediatric neurological surgery	Anesthesiology residents	Zoom
2	COVID-19 pandemic	Neonatal resuscitation	Neonatal physicians and nurses	Webex
3	COVID-19 pandemic	Health technique teaching	Health students	n/d †
4	Remote places	Emergency medicine	Medical students	n/d
5	Distance and time barriers	Emergency medicine	Medical students	Telesimulation center
6	COVID-19 pandemic	Pediatric emergency	Medical students	Zoom
7	Remote places	Insertion of chest tube	Physicians and medical students	n/d
8	COVID-19 pandemic	Dental emergencies	Dental students	Zoom
9	Remote places, rural area	Medical emergency	Medical students	Skype
10	Rural area	Sepsis	Professionals	n/d
11	Remote places	Health education	Medical students	TeamViewer
12	COVID-19 pandemic	Neonatal conditions	Neonatology	Zoom
13	Need for training with professionals from another region	Intraosseous procedure	Physicians	Skype
14	Rural areas, geographic and time restriction	Thoracic drainage	Medical students	n/d
15	Need for training with professionals from another region	Laparoscopic surgery	Surgeons	Skype
16	COVID-19 pandemic	Pediatric seizure	Nurses	Zoom
17	Accessibility	Laparoscopic surgery	General surgery resident physicians	n/d
18	COVID-19 pandemic	Airway management in COVID-19	Nurses, physicians, paramedics and health assistants	Zoom
19	COVID-19 pandemic	COVID-19 ventilator management	Physicians, pediatric residents and nurses	Zoom
20	Need for training with professionals from another region	Accident involving multiple victims	Paramedics, nurses and physicians	Join.me
21	COVID-19 pandemic	All areas of medicine	Medical students	Zoom
22	COVID-19 pandemic	Health technique teaching	Health students	n/d
23	COVID-19 pandemic	Gastrointestinal bleeding, anaphylactic shock and opioid overdose	Medical students	Zoom

* ID - identification; † - no description.
Source: developed by the authors.

Chart 3. Definitions of telesimulation concepts.

Definition	ID*
"Process by which telecommunication and simulation resources are utilized to provide education, training, and/or assessment to students in an external location."	(ID 2, ID 5, ID 7, ID8, ID 19, ID 20 and ID 23)
"It uses video technology to interactively connect remote participants with their instructors."	ID3
"An innovative approach that typically involves students and facilitators in separate locations with simulation equipment in the same location as students."	ID6
"It provides simulation education in situations where manikin and students are geographically distant from the instructors."	ID11
"It connects two simulators in different physical locations so that professors and students can see in real time what the other is doing."	ID15
"Simulation experiences where participants, operators, facilitators and/or the standardized manikin or patient are in different physical locations."	ID22

* ID – identification.
Source: developed by the authors.

Table 1. Attributes, antecedents and consequences of telesimulation in health education. Natal, Rio Grande do Norte, Brazil (n=23).

Elements	Article identification	n (%)
Attributes		
Simulation	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23	23 (100%)
Virtual environment	1, 2, 3, 4, 5, 6,7,8,9,10,11,12,14,15	14 (60.9%)
Distance education	1, 2, 3, 4, 5, 6, 7, 13	8 (34.7%)
Remote simulation	16,17	2 (8.7%)
Antecedents		
Cancellation of activities	1, 2,3,4,5,6,13,19,23	9 (39.1%)
Geographic limitations	2, 10, 16	3 (13%)
Limited physical resources	15, 23	2 (8.7%)
Limited access to laboratories	7, 21	2 (8.7%)
Social distancing	12, 21	2 (8.7%)
Consequents		
Accessibility	11, 12, 13, 15, 16, 17, 18, 20, 21, 22, 23	11(47.8%)
Economy	4, 15, 11, 13, 15	5 (21.7%)
Increased knowledge	1, 2, 3, 19	4 (17.3%)
Continuation of activities	2, 19, 22	3 (13%)
Satisfaction with learning	6, 8, 18	3 (13%)
Increased trust	6, 8, 21	3 (13%)
Use of simulation in remote places	14, 16, 21	3 (13%)
Skill enhancement	4, 15	2 (8.7%)
Comfort	12, 13	2 (8.7%)
Lower risk of contamination	12	1 (4.3%)
Improved interaction	16	1 (4.3%)
Interprofessional interaction	10	1 (4.3%)

Source: developed by the authors.

the problems, they reflect on performance in the scenario, assess the moment and resourcefulness in knowldge consolidation as well as the experience that will lead to real practice.

Contrary cases

Contrary case 1

After a dialogic exposure session on neonatal resuscitation, a group of students receives an e-mail asking them to produce videos explaining and performing procedures related to neonatal resuscitation. Students are instructed to seek alternative materials to simulate ventilation and chest compression techniques in the child and perform these procedures. After recording and editing, students are instructed to deposit in the university's virtual environment. Subsequently, the videos are distributed to professors in the health area, who must, when appropriate, issue an opinion on the performance of students in performing the skills developed.

Contrary case 2

Following neonatal resuscitation skills training, a group of students is assembled in a virtual video calling platform type environment. In the environment, there are ten students and a tutor specialized in pediatrics. The online meeting was scheduled due to the tutor's individual preference. The virtual environment offers sharing of screens, audios and chat. Students already know all the steps and procedures related to neonatal resuscitation, and have already trained, at another time, techniques of ventilation, chest compression, medication administration, among others. After accessing the virtual platform, they are informed that they should observe a real video of a child in emergency care after delivery. During the video, the tutor pauses some scenes and discusses the procedures performed by the health team. At the end of the session, students are instructed to solve a series of clinical cases, in small groups, and proceed with sending the answers on the university's virtual platform.

Definition

Based on the analysis performed, telesimulation is defined as a branch of clinical simulation that is characterized by the promotion/viability of educational practices in health education, performed remotely, synchronously, through video call. It aims to facilitate contact between instructors and participants in situations of need for social distancing, comfort, access difficult for economic reasons, such as the scarcity of human and material resources, and/or geographically distant, to improve knowledge, increase confidence and satisfaction with learning, interprofessional interaction and for the development and improvement of competencies and skills relevant to health professions.

DISCUSSION

In science, much is discussed about the need to define and clarify concepts objectively, avoiding confusion and contradictions in the definitions of objects of study. Thus, authors who defined methods of performing these analyzes were highlighted, making it possible to identify interrelated aspects and contextual application of the concepts.[11]

In the clinical simulation context, many different terms are used to describe similar processes, including distance simulation, virtual simulation, telesimulation and others.[6] This variation in terms, what they intend to describe and the lack of clarity about what they mean make it challenging to delve into the literature on the subject.

The choice of the term "telesimulation" was justified considering the amplification of the use of this teaching modality in the last year, due to the pandemic caused by the new coronavirus 2019 (COVID-19). Virtual teaching strategies have achieved an expansion never seen in previous years. Theoretical classes were quickly aligned with digital strategies, however associating teaching practices with technologies became a great challenge.[8] It is in this context that telesimulation is evidenced as a strategy to provide support to practices and development of skills and abilities in health education.[6,8,9,13,16,22,25,26]

The articles analyzed in this study present several possibilities for the use of telesimulation in health education; however, there is a lack of conceptualization of the term telesimulation in the articles.

Study ID 4 presents a definition that is used by most articles that made up the sample (ID 2, ID 3, ID 5, ID 7, ID 19, ID 20 and ID 23), in which telesimulation is a "process by which telecommunication and simulation resources are used to provide education, training and/or assessment to students at an offsite location".[6:2] The other studies conceptualize it as an approach that involves students and facilitators in separate locations with simulation equipment.

It is important to note that there is no consensus on its concept that encompasses all areas that make use of telesimulation, although its use is not recent. The concept radical comes from distance education, which is not a new theme,[6] and studies, since 2010, point to the use of the strategy in the training of laparoscopic surgery effectively in the teaching and learning process and student satisfaction.[22]

However, it can be seen that the rise of the technique took place in the last two years, as shown in Chart 2, as a result of the COVID-19 pandemic. In studies, telesimulation was associated with several general areas of health education, such as emergency, primary care, pediatrics, gynecology and obstetrics, neurology, neurosurgery, in addition to specific procedures such as intraosseous puncture and chest drainage.

For the use of telesimulation, it is necessary minimally the presence of a computer/cell phone/tablet with internet access and a web conferencing application. In some studies, the Zoom platform gained prominence in the use of distance education.[8,15,16,19,23,25,26,28,30] The free options of telecommunication support to be considered, such as Skype, FaceTime, Google Hangouts, VSee and Join.me, are highlighted, characterizing it as a more economical and low-cost strategy.[6]

In the meantime, telesimulation eliminates the need to have instructors, students and mannequins in the same place at the

same time, allowing simulation-based educational sessions to occur more frequently for institutions not located close to formal simulation centers.[5]

It is important to highlight that, when it is intended to work with technical skills, the presence in the laboratory becomes indispensable. However, as a strategy to solve this difficulty in accessing skills laboratories, especially in times of a pandemic, it is feasible to organize a material loan schedule so that students can practice less complex procedures at home, with tutors accompanying them, in synchronous sessions, for feedback.

When considering the antecedents to telesimulation, the cancellation and suspension of activities related to the COVID-19 pandemic was evidenced. But other factors were also considered, such as geographical limitations, limited physical resources, and limited access to laboratories. In this way, benefits of teaching practices can be conferred on telesimulation, extended beyond laboratories and simulation centers, with several advantages and consequences: accessibility, economy, increased knowledge, continuation of activities, satisfaction with learning, use of simulation in remote locations, improvement of skills, improved interaction, interdisciplinary interaction, increased confidence, comfort and lower risk of contamination.[5,6,9]

Regarding the strategy effectiveness, a randomized clinical trial, which compared telesimulation versus face-to-face clinical simulation, showed that there was no significant difference in assessment scores between the two groups.[14]

This result is corroborated by a study on transatlantic medical education for interns, using telesimulation, in which distance medical training proved to be a highly effective tool to improve emergency medical skills, gaining potential for large-scale training of health professionals for less developed countries and in rural regions.[31]

It is noteworthy, on the other hand, that telesimulation requires technologically capable professionals with robust planning capacity.[1] It is also noteworthy that aspects such as internet speed, institutional firewalls and audio and video resources can determine student engagement.[9,32,33]

Telesimulation can also challenge students in the higher steps of learning mastery, where they depend less on rules and guidelines, enabling the application of analytical approaches during new simulated situations.[1] There may be limitations to the strategy in training specific skills; however, students have the opportunity to repeatedly observe how the technique is performed.[9,32]

The model and contrary cases presented show the robustness of telesimulation and, in addition, demonstrate the diverse and wide possibilities of learning, such as the interaction of people from different locations, allowing the sharing of experiences and strategies, and also the ease of obtaining training with experts, considering the reduction of geographical limits.

In this context, faced with advances and challenges of strategies for teaching skills, telesimulation is understood as a new educational modality that is characterized by the promotion of simulated practices carried out, when participants and facilitators are geographically separated, through videoconferencing.

Thus, the contributions of the study are highlighted as there is a lack in the national and international literature of studies on the subject and a gap in the conceptual definition of telesimulation internationally. Conducting a conceptual analysis allows a contribution in order to homogenize the term and more robust scientific discussions.

Regarding the study limitations, the absence of the descriptor "*telessimulação*" and its respective translations into English and Spanish occurs both in the Health Sciences Descriptors (DeCS) and in the Medical Subject Headings (MeSH), limiting the searches and restricting the sample number of this article. Furtehrmore, it is noteworthy as a limitation the non-performance of the eighth step of Walker and Avant's method.[11]

CONCLUSION AND IMPLICATIONS FOR PRACTICE

The conceptual analysis identified the telesimulation concept in the context of health education. From a scoping review, the attributes, antecedents and consequences most pointed out in literature were identified. With this, it was possible to create a new concept.

However, the study provides subsidies for a better understanding, application and use of telesimulation as a branch of clinical simulation in health education. Thus, this expanded understanding may contribute to improving teaching and learning processes, reflecting in better professional qualification.

In addition to this, the clarification of this concept may facilitate the development of research instruments in the area of investigation of the phenomenon studied to organize knowledge in this area of investigation in the context of research in clinical simulation.

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