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SYNCHRONOUS AND OBSERVATIONAL TELESIMULATION IN HEALTH: A SCOPING REVIEW

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ABSTRACT

Objective: to map the necessary steps and components for operationalizing a synchronous and observational telesimulation design in the context of developing clinical competencies aimed at students and health professionals.
Method: a scoping review supported by the recommendations of the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews: Checklist and Explanation, and by the assumptions of the Joanna Briggs Institute Reviews' manual method. The search was carried out in November 2021 in 13 databases, totaling nine studies in the final sample, which were then analyzed using Thematic Analysis.
Results: two categories were developed: steps and components for operationalizing a synchronous and observational telesimulation design; and challenges to implement synchronous and observational telesimulation.
Conclusion: operationalizing a synchronous and observational telesimulation has been supported by a six-step instructional design, characterized by planning, preparation, participation, teledebriefing, learner assessment/ feedback collection and additional learning, capable of developing the students' cognitive and affective skills. The relevant challenges to this context were also highlighted, configured by the need to obtain a sufficient technological structure for remotely transmitting the telesimulated scenario and an adequately trained faculty.

DESCRIPTORS: Distance Education. Learning. Simulation training. Health Sciences students. Healthcare personnel. Clinical competence.

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TELESSIMULAÇÃO SÍNCRONA E OBSERVACIONAL EM SAÚDE: *SCOPING REVIEW*

RESUMO

Objetivo: mapear as etapas e componentes necessários para a operacionalização de um *design* de telessimulação síncrona e observacional no contexto do desenvolvimento de competências clínicas voltadas a estudantes e profissionais de saúde.
Método: *scoping review* sustentada pelas recomendações do *Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews: Checklist and Explanation* e pelos pressupostos do método *Joanna Briggs Institute Reviews' manual.* Realizou-se a busca em novembro de 2021 em 13 bases de dados, totalizando nove estudos na amostra final, analisados por meio de Análise Temática.
Resultados: desenvolveram-se duas categorias: etapas e componentes para a operacionalização de um *design* de telessimulação síncrona e observacional; e desafios para implementar a telessimulação síncrona e observacional.
Conclusão: a operacionalização da telessimulação síncrona e observacional vem sendo sustentada por um *design* instrucional de seis etapas, caracterizadas pelo planejamento, preparação, participação, *teledebriefing*, avaliação do aprendiz/coleta de *feedback* e aprendizagem adicional, capazes de desenvolver as habilidades cognitivas e afetivas do aprendiz. Destacaram-se, ainda, os desafios pertinentes a este contexto, configurados pela necessidade de se obter uma estrutura tecnológica suficiente para transmissão remota do cenário telessimulado e um corpo docente adequadamente treinado.

DESCRITORES: Educação à distância. Aprendizagem. Treinamento por simulação. Estudantes de Ciências da Saúde. Pessoal de saúde. Competência clínica.

TELESIMULACIÓN SÍNCRONA Y OBSERVACIONAL EN SALUD: SCOPING REVIEW

RESUMEN

Objetivo: mapear los pasos y componentes necesarios para la operacionalización de un diseño de telesimulación síncrona y observacional en el contexto del desarrollo de competencias clínicas dirigidas a estudiantes y profesionales de la salud.
Método: *scoping review* respaldada por las recomendaciones de *Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews: Checklist and Explanation* y por los supuestos del método manual de Joanna Briggs Institute Reviews. La búsqueda se realizó en noviembre de 2021 en 13 bases de datos, totalizando nueve estudios en la muestra final, analizados mediante Análisis Temático.
Resultados: se desarrollaron dos categorías: etapas y componentes para la operacionalización de un diseño de telesimulación síncrona y observacional; y desafíos para implementar la telesimulación síncrona y observacional.
Conclusión: la puesta en funcionamiento de la telesimulación observacional y sincrónica ha sido respaldada por un diseño instruccional de seis pasos, caracterizado por planificación, preparación, participación, *teledebriefing*, evaluación del alumno/ recopilación de comentarios y aprendizaje adicional, capaz de desarrollar las habilidades cognitivas y afectivas del aprendiz. También se destacaron los desafíos relevantes a este contexto, configurados por la necesidad de obtener una estructura tecnológica suficiente para la transmisión remota del escenario telesimulado y un cuerpo docente adecuadamente capacitado.

DESCRIPTORES: Educación a distancia. Aprendizaje. Entrenamiento de simulación. Estudiantes de Ciencias de la Salud. Personal de salud. Competencia clínica.

INTRODUCTION

The long pandemic period caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) virus hampered the pedagogical processes supported by face-to-face clinical practice and made implementing simulation-based education challenging[1].

In addition to demanding a quick adaptation to the teaching approaches adopted in health around the world, this condition has also encouraged the use of new educational technologies based on high-level simulated experiences which are capable of reaching remote environments of difficult access and establishing online learning methods such as telesimulation[1–2].

During the International Conference of the Society for Simulation in Health held in 2016 in the United States, it was proposed to expand the definition of telesimulation, characterizing it as a process by which telecommunication and simulation resources are adopted to provide education, training and/or assessment for students at an offsite location[2–3].

Based on this concept, researchers believe that telesimulation enables reaching learners where there are distance limitations which prevent efficient instruction, minimizing time constraints or the lack of available educators with experience in a specific content, taking advantage of interactive audiovisual resources to implement models capable of providing a student-centered simulation and learning objectives[2,4].

Although a common taxonomy for telesimulation has not yet been established, it is already possible to identify its classifications named according to the synchronicity between the instructor and the learner, defined as synchronous (both experience and/or observe the activity in real time) and asynchronous (the learner experiences part of the activity offline through pre-recorded videos and part online with the help of an instructor, or even when all the proposed activity takes place offline and without the presence of the instructor)[1,5.] Also, according to the nature of student participation characterized by mobile telesimulation (when the learner receives materials for their practical training remotely), by observational telesimulation (the learner only observes the scenario execution and participates in the teledebriefing from a distance), and also according to the number of strategies used during the telesimulation, called hybrid[1,5].

Regarding the synchronicity classification of telesimulation between instructors and apprentices, it is worth mentioning that scientific evidence points to a greater development of clinical competencies such as knowledge and psychomotor skills focused on surgical techniques (for example) when applied to synchronous telesimulation, meaning that students and teachers live the experience in real time and online, than when using asynchronous telesimulation based on self-practice offline[6]. However, even with the potential of synchronous telesimulation, this is an issue which also instigates the need for further deepening and scientific exploration given the scarcity of literature capable of clarifying this context and the intention to successfully optimize its adoption in view of the variability of implementations[4].

The classifications of telesimulation are also noteworthy, and in order to overcome the barriers imposed by the lack of financial resources which make the mobile type possible by sending simulators and anatomical parts for the student's training, observational telesimulation, in which the student only contemplates the simulated experience at a distance, has been gaining considerable pedagogical space in developing countries[1,4], but which requires planning and implementing a validated design/protocol that contains the steps and components of telesimulation[4].

Furthermore, there is still no evidence in the literature of a guideline capable of standardizing a common language and defining the ideal operationalization of telesimulation, making it difficult to systematize this pedagogical strategy[5]. In this context, it is necessary to recognize the challenges for adopting telesimulation in teaching and learning in health, such as the incipience of research which addresses the most effective methodological path to carry it out[7], and above all, considering that the best way to optimize synchronous and observational telesimulation nature is still not clear, especially at the national level[8].

The present study aims to map the steps and components necessary for operationalizing a synchronous and observational telesimulation design in the context of developing clinical skills aimed at students and health professionals.

METHOD

This is a scoping review on synchronous and observational telesimulation made possible by the real-time online participation of instructors and students with the observation of the clinical scenario by the students[5]. This type of review was chosen when considering the demand for information and the scarcity of manuscripts which clarify the operationalization of this simulation modality, and constitutes a condition capable of justifying the inclusion of conventional and non-conventional documents to identify gaps on the subject and provide significant bases for future research[9].

The research protocol was registered on the Open Science Framework platform (https://osf.io/6amvb) supporting its methodological path in the recommendations of the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation[9] and method assumptions from the Joanna Briggs Institute Reviews' manual[10]. Five steps were performed: (1) identification of the research question; (2) identification of relevant studies; (3) selection of studies for review; (4) data mapping; and (5) collection, summary and reporting of results[11], as detailed below.

The research question was elaborated through the fundamental elements of the mnemonic Population - Concept - Context (PCC)[10,12], defined as: "P" (population): undergraduate and graduate students and professionals in the health field; "C" (concept): the operationalization of synchronous and observational telesimulation as a teaching and learning modality; and "C" (context): the development of clinical and cognitive skills, psychomotor and affective skills in the health field. Thus, the following question was obtained: what steps and components are necessary to operationalize a synchronous and observational telesimulation design applied to the context of the development of clinical skills aimed at students and health professionals?

The search for evidence took place in November 2021 in the following databases: US National Library of Medicine National Institutes Database Search of Health (Medline/PubMed®), Scopus, Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science, Education Resources Information Center (ERIC), Latin American and Caribbe an Literature in Health Sciences (LILACS). In addition, non-conventional databases in review studies were searched to cover the gray literature, characterized by: Catalog of Theses and Dissertations of the Journal Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES), Europe E-Theses Portal (DART), Electronic Theses Online Service (EThOS), Repositorio Científico de Access Aberto de Portugal (RCAAP), National ETD Portal and Theses Canada.

The health descriptors available on the Health Sciences Descriptors Portal (DeCS) in the Virtual Health Library (VHL) in Portuguese, English and Spanish were used, in addition to the descriptors from Embase Subject Headings (Emtree) and Medical Subject Headings (MESH) in English, including: "Health Sciences Students", "Health Personnel", "Training by Simulation"; "Clinical Competence", and the keywords: "Telesimulation" and "Virtual Simulation".

The studies were identified by combining the elements of the PCC strategy, Boolean operators and search codes, specific for each database, since each one works in a unique way and responds to different commands, which implies adapting the strategy. Furthermore, it should be noted that the keywords "Virtual Simulation" and "Telesimulation" were adopted with the intention of directing the search to the intended study object, and that the keyword Telesimulation was adopted in its English, Spanish and Portuguese versions in non-conventional databases for the selection of gray literature, given that such repositories do not allow the use of advanced search strategies. The adopted databases, descriptors, keywords and respective search strategies are presented in Chart 1, below.

Chart 1 - Presentation of databases, descriptors, keywords and search strategies. Uberaba, MG, Brazil, 2021.

Databases, descriptors and keywords	**Search strategy**
Medline/PubMed® **MeSH: *Students, Health Occupations*"; "*Health Personnel*"; "*Simulation Training*"; "*Clinical Competence"* and the keywords: *Telesimulation*; "*Virtual Simulation"*.	("*Students, Health Occupations*"[*All Fields*] OR "*Health Occupations Students*"[*All Fields*] OR "*Health Occupations Student*"[*All Fields*] AND "*Health Personnel*"[*All Fields*] OR "*Personnel, Health*"[*All Fields*] OR "*Health Care Professionals*"[*All Fields*] OR "*Health Care Professional*"[*All Fields*] AND "*Simulation Training*"[*All Fields*] OR "*Training, Simulation*"[*All Fields*] OR *Telesimulation*[*All Fields*] OR "*Virtual simulation*"[*All Fields*] AND "*Clinical Competence*"[*All Fields*] OR "*Competency, Clinical*"[*All Fields*])
Scopus **MeSH: "*Students, Health Occupations*"; "*Health Personnel*"; "*Simulation Training*"; "*Clinical Competence*" and the keywords: *Telesimulation*; "*Virtual Simulation*".	*TITLE-ABS-KEY*((*{Students, Health Occupations} OR* {*Health Occupations Students*} OR {*Health Occupations Student*} OR {*Occupations Student, Health*} OR {*Occupations Students, Health*} OR {*Student, Health Occupations*}) AND ({*Health Personnel} OR {Personnel, Health} OR {Health Care Professionals} OR {Health Care Professional})* AND ({*Simulation Training*} OR {*Training, Simulation*} OR *Telesimulation OR {Virtual simulation*}) AND (*{Clinical Competence} OR {Competency, Clinical*}))
Embase ‡‡Emtree: "*Health Student*"; "*Health Care Personnel*"; "*Simulation Training*"; *Clinical Competence*" and the keywords: "*Telesimulation*" and "*Virtual Simulation*".	("*Health Student" AND "Health Care Personnel" AND "Simulation Training"* OR *Telesimulation OR "Virtual Simulation"* AND "*Clinical Competence"*)
*CINAHL Títulos/Assuntos: *"Students, Health Occupations*"; "*Health Personnel*"; "*Simulation Training*"; "*Clinical Competence*" and the keywords: *Telesimulation*; "*Virtual Simulation*".	SU(("*Students, Health Occupations*") AND (*"Health Personnel"*) AND (*Telesimulation OR "Virtual simulation*") AND (*"Clinical Competence"*))
ERIC Thesaurus: "*Graduate Study*"; "*Health Personnel*"; "*Simulation*"; "*Competence*" and the keywords: *Telesimulation*; "*Virtual Simulation*".	(*"Graduate Study*" AND *"Health Personnel" AND Simulation* OR *Telesimulation OR "Virtual simulation*" AND *Competence)*
Web of Science **MeSH: "*Students, Health Occupations*"; "*Health Personnel*"; "*Simulation Training*"; "*Clinical Competence*" and the keywords: *Telesimulation*; "*Virtual Simulation*".	AK=((*"Students, Health Occupations" OR* "*Health Occupations Students*" OR "*Health Occupations Student*" OR "Occupations Student, Health" OR "*Occupations Students, Health*" OR "*Student, Health Occupations*" AND "*Health Personnel" OR "Personnel, Health" OR "Health Care Professionals" OR "Health Care Professional"* AND "*Simulation Training"* OR "*Training, Simulation*" OR *Telesimulation OR "Virtual simulation*" AND *"Clinical Competence" OR "Competency, Clinical"*))

Chart 1 - Cont.

Databases, descriptors and keywords	**Search strategy**
†LILACS ††DeCS: Descriptors in Portuguese, English and Spanish. The Portuguese version was: "*Estudantes de Ciências da Saúde*", "*Pessoal de Saúde*", "*Treinamento por Simulação*", "*Competência Clínica*" and the keyword: *Telessimulação*.	Portuguese: (("*Estudantes de Ciências da Saúde*") AND ("*Pessoal de Saúde*") AND ("*Treinamento por Simulação*" OR *Telessimulação*) AND ("*Competência Clínica*")) English: (("Students, Health Occupations") AND ("Health Personnel") AND ("Simulation Training OR Telesimulation) AND ("Clinical Competence")) Spanish: ("*Estudiantes del Área de la Salud*" AND "*Personal de Salud*" AND "*Entrenamiento Simulado*" OR *Telesimulación* AND "*Competência Clínica*")
‡CAPES	Use of the keyword: *Telessimulação* (https://catalogodeteses.capes.gov.br/catalogo-teses/)
§DART	Use of the keyword: Telesimulation *(*https://www.dart-europe.org/basic-search.php.)
‖EThOS	Use of the keyword: Telesimulation (https://ethos.bl.uk/SearchResults.do)
¶RCAAP	Use of the keyword: *Telessimulação* (https://www.rcaap.pt/)
National ETD Portal	Use of the keyword: Telesimulation (http://www.netd.ac.za/?query=telesimulation&action=search)
Theses Canada	Use of the keyword: Telesimulation (https://www.bac-lac.gc.ca/eng/services/theses/Pages/list.aspx?AW_S=telesimulation)

Note: *CINAHL: Cumulative Index to Nursing and Allied Health Literature; †LILACS: *Literatura Latino-Americana e do Caribe em Ciências da Saúde*; ‡*CAPES*: *Catálogo de Teses e Dissertações do Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*; §DART: Europe E-Theses Portal; ‖EThOS: Electronic Theses Online Service; ¶*RCAAP*: *Repositório Científico de Cited Aberto de Portugal*; **MESH: Medical Subject Headings; ††*DeCS*: *Descritores em Ciências da Saúde*; ‡‡Emtree: Embase Subject Headings

Studies were selected considering the following inclusion criteria: primary research, literature reviews, editorials, dissertations and theses, which addressed the steps and/or components necessary to establish a telesimulation design/protocol aimed at teaching and learning for students and professionals in the health field without delimiting time frame and language, published electronically. Records which addressed simulation types other than synchronous and observational were excluded.

Literature identified in conventional sources (primary and secondary manuscripts) was first considered, and then the source information was exported to a free single-version web review program called Rayyan Qatar Computing Research Institute (Rayyan QCRI), capable of excluding duplicate articles and facilitating the initial screening, blinding the assistant researcher and incorporating a high level of usability, effectiveness and reliability in the selection process[13].

After this step, the studies exported to Rayyan were selected by reading titles and abstracts by two independent researchers, experts in the theme of simulation. A total of 37 articles were selected by the researchers, which were then sent to a third researcher who was responsible for deciding whether or not to include them in the sample.

The identified gray literature (theses and dissertations) was then manually selected by reading the titles and abstracts by two researchers specializing in the proposed theme, and then the entire selected literary collection was read (articles, dissertations and theses) for defining the final sample.

It should also be noted that a search was carried out in the reference list of the studies that made up the sample in order to verify the possibility of new inclusions; however, no new articles or gray literature were inserted.

The information from the manuscripts relevant to the research question was extracted using an instrument[14] constructed and validated by Brazilian researchers with the intention of facilitating the extraction of findings and scientific evidence in review studies, composed by the domains: (1) identification of the original article; (2) methodological characteristics of the study; and (3) assessment of methodological rigor, measured interventions and results found. This instrument was adapted for the present study contemplating the information of interest: authors of the manuscript; year of publication; country of origin of the study; purpose and clinical scenario addressed; kind of study; target audience; assessed skills; procedure to carry out the telesimulation; main outcomes; and level of evidence[15].

The analyzed studies were mapped according to previously defined criteria and deepened in light of the principles of Minayo's Thematic Analysis[16]. Next, three stages were conducted in order to obtain the axes and their categories: (1) pre-analysis stage, in which the manuscripts of the final sample were read, and the evidence or information which was similar in each article was noted. The information that was repeated about the elements which support a telesimulation design or protocol responding to the intended objective were grouped and called recording units. Thus, the challenges to operationalize this tele-simulation modality were highlighted by grouping the findings regarding its components and stages, which led to the second category of results; (2) material exploration: with the registration units identified, the information that characterized the same subjects was grouped, generating both categories; (3) finally, data treatment: after structuring, the categories were analyzed, interpreted and described to clarify all steps and components of synchronous and observational telesimulation, as well as all the challenges inherent to this context.

RESULTS

A total of 1,901 studies were identified, and nine composed the final sample of this study. The selection process is demonstrated in Figure 1 below.

Among the nine studies included in the present sample, there was a predominance of North American studies[1,3–4,7–8,17], from the year 2021[4,8,17–20], being descriptive with an evidence level of [6,4,8,17–20] aimed at the telesimulated teaching and learning process of medical students and professionals[1,3–4,7–8,17,20], mainly in the context of urgency and emergency[1,3,7,17].

The skills considered for assessing learners regarding telesimulated experiences covered cognitive aspects (knowledge)[3,8,18–19] and mainly affective aspects (behavior/feelings/attitudes/perceptions)[1,3,7–8,17,19–20]. Chart 2 below presents the characterization of the studies included in the sample.

The findings mapped through this scoping review enabled structuring two categories: (1) Steps and components for operationalizing a synchronous and observational telesimulation design; and (2) Challenges to implement synchronous and observational telesimulation.

The first category considered the identification, synthesis and description of the steps and respective components capable of characterizing how synchronous and observational telesimulation has been operationalized in contemporary times, with the intention of supporting the planning and execution of an instructional design in this type of telesimulation. Chart 3 below presents the first category of results.

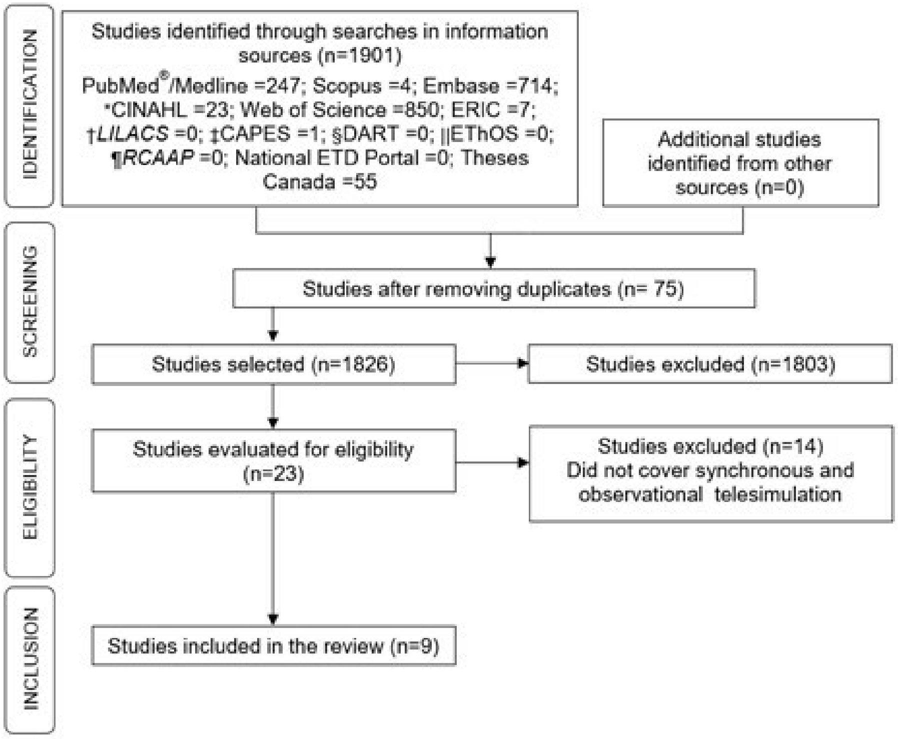

Figure 1 - Study identification, selection and inclusion flowchart, prepared based on the recommendations of the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Uberaba, MG, Brazil, 2021.

Note: *CINAHL: Cumulative Index to Nursing and Allied Health Literature; †LILACS: *Literatura Latino-Americana e do Caribe em Ciências da Saúde*; ‡*CAPES*: *Catálogo de Teses e Dissertações do Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*; §DART: Europe E-Theses Portal; ||EThOS: Electronic Theses Online Service; ¶*RCAAP*: *Repositório Científico de Cited Aberto de Portugal*.

Chart 2 - Characterization of the studies which composed the Scoping Review sample. Uberaba, MG, Brazil, 2021.

Authors/ Year of publication/ Country of origin	Objective and clinical scenario	Type of study, target audience and assessed skills	Telesimulation procedure, outcomes and evidence level
McCoy et al., 2017[3] United States.	Compare the effectiveness of telesimulation with face-to-face simulation. Cardiac arrest scenarios.	Clinical, randomized study. Medical students. Assessment of cognitive and affective skills.	Randomization of 32 students divided into a control group (traditional simulation) and an intervention group (telesimulation). The intervention group observed the scenario through a live television connection to the internet. There was no significant difference regarding knowledge of groups and preference for modalities. Although both modalities have positive effects for learning, telesimulation provides benefits in the absence of face-to-face resources. Level of evidence: 2

Chart 2 - Cont.

Authors/ Year of publication/ Country of origin	**Objective and clinical scenario**	**Type of study, target audience and assessed skills**	**Telesimulation procedure, outcomes and evidence level**
McCoy et al., 2019[7] United States	Evaluate the feasibility of telesimulation. Pre-hospital emergency scenarios.	Intervention study. Doctors; nurses; paramedics; pharmacists; educators and administrators. Assessment of affective skills.	The telesimulation was based on a mass accident scenario in the pre-hospital environment. Content and study materials were delivered using telecommunication resources. Standardized patients and high-fidelity mannequin simulation were combined. The teledebriefing was carried out. All 32 participants provided a favorable response to telesimulation and reported that this experience added educational value. This study demonstrated the success of a medical emergency triage course using telesimulation. Level of evidence: 3
Naik et al., 2020[1] United States.	Evaluate the effectiveness of a telesimulation. Mechanical ventilator management scenario in patients with COVID-19.	Intervention study. Doctors; nurses and nursing faculty. Assessment of affective skills.	A telesimulation was developed using a high fidelity simulator, locally operated by a tablet. Vital signs were displayed on a monitor, and a test lung was positioned over the dummy's chest, connected to a mechanical ventilator to mimic lung compliance. A portable camera system was used to provide real-time images of the ventilator and monitor, and each group of students formed a virtual care team. A 20-minute teledebriefing was held. Students found telesimulation useful and similar to traditional simulation. Level of Evidence: 3
Yang et al., 2021[17] United States.	Describe the implementation of a telesimulation. Pediatric emergency scenario.	Descriptive study with a qualitative approach. Medical students. Assessment of affective skills.	Telesimulation sessions brought together participants from different locations via personal computer, phone or tablet. A professional actor played the role of the father, using a virtual background to display images of a pediatric patient. An actress played the role of a nurse and conveyed the patient's clinical status. A facilitator led the pre-briefing. The students were divided into two teams. While one team actively cared for the patient, the other team observed and participated in the teledebriefing. Ninety percent of the students were comfortable and confident with the subject after the tele-simulation, in addition to demonstrating satisfaction with this teaching modality. Level of evidence: 6

Chart 2 - Cont.

Authors/ Year of publication/ Country of origin	Objective and clinical scenario	Type of study, target audience and assessed skills	Telesimulation procedure, outcomes and evidence level
O'Era et al., 2021[18] Canada	Describe the application of a telesimulation. Therapeutic care for a family scenario.	Descriptive study with a mixed approach. Nursing students.	A total of 101 nursing students provided care for a family through telesimulation. Each event lasted 10 minutes of pre-briefing/briefing, 20 minutes of scenario and 40 minutes of teledebriefing. A telecommunication tool was used to connect students, patients and facilitators. The simulated patients played the roles of family members. 56% of students completed the online assessment and appreciated this teaching strategy. Telesimulation supported students' ability to practice their decision making. Level of evidence: 6
Kurji et al., 2021[19] Pakistan	Describe the implementation of a telesimulation. Communicating bad news scenario.	Descriptive study with a qualitative approach. Nurses. Assessment of cognitive and affective skills.	A telesimulation module provided its theoretical component on communicating bad news via PowerPoint with an online communication challenge. Nursing students were invited to be simulated patients. The 141 interns were divided into seven discussion groups in which each one was accompanied by an instructor. Students were divided into pairs to interact with the simulated patient. Faculty and interns took notes of their observations for the teledebriefing. The interns rated the activity within the parameters of good to excellent and the learning experience as positive and engaging. Telesimulation is an innovative and useful tool for teaching communication skills. Level of evidence: 6
Gutierrez-Barreto et al., 2021[20] Mexico.	Identify the barriers to implementing telesimulation in medical graduation. Prenatal consultation scenario.	Descriptive study with a qualitative approach. Medicine students. Assessment of affective skills.	The study sample consisted of 18 professors, 26 standardized patients and 407 students. There was a pre-briefing (10 minutes), simulated scenario (20 minutes) and teledebriefing (30 minutes). The simulation addressed a standardized patient and a videoconferencing platform. The scenario consisted of a prenatal consultation. Teledebriefing was conducted. A taxonomy of five telesimulation barriers was structured: knowledge; installations; financing; attitude and participants. The description of the barriers can improve the quality of the telesimulation. Level of evidence: 6

Chart 2 - Cont.

Authors/ Year of publication/ Country of origin	Objective and clinical scenario	Type of study, target audience and assessed skills	Telesimulation procedure, outcomes and evidence level
Thomas et al., 2021[4] United States.	Describe 12 tips on how to implement telesimulation.	Descriptive study. Medicine Students.	Twelve recommendations were described: (1) selection of the telesimulation classification; (2) consideration of telesimulation limitations; (3) identification of learning objectives; (4) identification of audiovisual materials; (5) preparation of faculty, staff, and telesimulation testing; (6) student preparation, including pre-briefing; (7) allowing "timeouts" during the pre-briefing; (8) establishing team and communication roles; (9) debriefing preparation; (10) involvement of silent participants; (11) sharing additional learning resources; (12) feedback collection. Although telesimulation does not replace face-to-face simulation, it can be used to actively engage participants and serve as a pedagogical alternative. Level of evidence: 6
Diaz; Walsh, 2021[8] United States	Analyze the criteria for developing telesimulations.	Descriptive study. Students and health professionals.	This study presented criteria for the development of telesimulation: (1) needs assessment; (2) learning outcomes; (3) equipment; (4) practice; (5) pre-briefing; (6) facilitators; (7) teledebriefing; (8) feedback. Telesimulation as an educational platform is evolving and can be considered an interactive and exciting way to learn. Level of evidence: 6

Next, the second category called "Challenges to implement synchronous and observational telesimulation" addressed the difficulties mapped in the selected literature to plan to execute and obtain the effective participation of learners in a synchronous and observational telesimulated experience in the scope of the teaching and learning process in health, namely: (1) requirement of an institutional structure based on technological, human and funding resources capable of enabling the live transmission of telesimulation for learners[3,7,18–20]; (2) commitment, training and knowledge of a teaching staff capable of planning and executing a telesimulated activity[3,18–20]. The following are less prominently described in the literature: (3) poor access to the internet or technological resources of learners in certain remote areas[15,18]; (4) learner acceptance of a new pedagogical strategy[20]; (5) learner communication barrier in an online environment[20]; (6) incipience of and available and validated instruments for assessing learning outcomes[3]; (7) incipient insertion of the telesimulated strategy in the pedagogical plans of undergraduate courses in the health area[3].

Chart 3 - Steps and components to operationalize synchronous and observational telesimulation in health. Uberaba, MG, Brazil, 2021.

Steps	**Description of the steps and the respective components**
Step 1 - Planning	Initial step of the telesimulation in which the instructors/facilitators describe and validate their instructional design composed of the necessary steps and components. For this step, a period of 30 days is generally used for planning and 60 days to validate the content of the instructional design, carried out by professionals who are experts in the subject, and preferably adopting the Delphi technique until reaching a Total Content Validity Index equal to or greater than 0.80. The components considered for description in this planning are: (1) definition of theoretical references that will support the telesimulation; (2) learning theme; (3) target audience; (4) learning objectives; (5) skills you want to develop through telesimulation (learning outcomes); (6) description of the type of instructional material and learning environment/platform to perform the pre- and post-simulation; (7) description of the elements that will be presented in the pre-briefing/briefing and of the fictional contract established with the learners by the facilitators; (8) description of the telesimulated clinical scenario design elements; (9) definition of scenario fidelity; (10) definition of the type of instrument adopted (simulator or simulated/standardized patient); (11) characterization of the simulator's fidelity, if adopted; (12) organization of the necessary human resources (laboratory technicians, specific technicians for the online and live transmission of the telesimulation, professors/facilitators, students); (13) description of materials needed to establish the clinical scenario; (14) definition of the technological resources that will enable telesimulation (teleconferencing platform, such as: computers, internet, camcorders, online transmission mechanisms); (15) establishment of technological resources for remote observation of the learner (personal computer, telephone or tablet, internet); mechanisms/formats/instruments for assessing learners' skills; (16) modality and technique of debriefing adopted; (17) learner feedback mechanisms; (18) time available for each step of the telesimulation; (19) format and guidelines for training facilitators and staff/personnel involved in telesimulation; (20) validation of the telesimulation instructional design; (21) pilot test of the proposed telesimulation. It should be noted that most of these components are addressed in the simulated scenario design section.[1,3–4,7–8,17–20]
Step 2 - A) Preparation: pre-simulation	Step which provides the study and prior preparation of learners on the subject of learning and peculiarities for online and remote participation in the telesimulated activity, which can be made possible by instructional platforms of the educational institution or via electronic mail (email of learners), providing references and study materials about the activity. A period of 15 days is recommended to establish this step. The following components are considered: (1) Dialogued expository class with the aid of a powerpoint presentation; (2) tutorial videos; (3) video lessons; (4) video simulations, guidelines, among other formats.[1,3–4,7–8,17–20]
B) Preparation - pre-briefing/ Briefing	After the online reception of the students, the facilitators present themselves and pre-test instruments are applied, if necessary, for evaluation. Then, the pre-briefing/briefing phase will be established by the facilitators in a calculated time of 5 to 10 minutes, covering: (1) presentation of the simulation environment; (2) description of the clinical case proposed for learning; (3) activity time; (4) scenario start and end time; (5) definition of the instruments (explanation about the simulator or role played by the simulated patient (actor trained for the scene), or standardized patient (individual from the community trained for the scene), or roles of the learners, if students are adopted to participate in demonstrating the scenario in person, while the others observe remotely and live; (6) clarification of the learning objectives; (7) materials available; (8) clues/hints which will be offered by the facilitators to conduct the scene; (9) need for silence on the part of the remote learners and to remain with their cameras turned off (offline) during execution of the scenario; (10) need to turn on the cameras and participate in the teledebriefing after executing the scene; (11) explanation about the evaluation tool, if a spreadsheet of criteria and notes is made available to learners to contribute to the discussion.[1,3,7–8,17–18]

Chart 3 - Cont.

Steps	Description of the steps and the respective components
Step 3 -Participation: telesimulated clinical scenario design	The participation stage corresponds to executing the simulated clinical scenario transmitted live, generally in a period of 10 to 15 minutes. This design must be described by the researchers and validated by specialists in the proposed theme, selected through well-established criteria using the Delphi technique, which recommends several “rounds” of construct evaluation until there is agreement between the experts involved. The telesimulation planning stage covers four phases with the following components: Phase A: Simulated clinical scenario design planning – components: (1) responsible for preparing and facilitating (conducting) the scenario; (2) classification of the adopted telesimulation; (3) scenario theme; (4) theoretical-methodological framework to elaborate the scenario; (5) theoretical foundation of the learning theme; (6) scenario fidelity; (7) physical space in which the scenario will be broadcast; (8) target audience; (9) inclusion and exclusion criteria; (10) skills developed; (11) general and specific learning objectives; (12) duration of the scenario; (13) instruments – simulators or simulated/standardized patients; (14) clinical case; (15) description of the starting and ending point of the scenario; (16) actions and training script for actors, standardized patients or students who participated in the scene in person; (17) decision-making tree for guiding apprentices, if they are responsible for executing the scene; (18) material resources for the scene. Phase B: Description of the learner’s assessment (instruments); Phase C: Validation of the telesimulated scenario design; Phase D: Pilot test of the scenario carried out at a pre-scheduled time, and establishing a number of participants for the experience according to the guidance of a professional statistician, with the intention of testing the feasibility of telesimulation and aligning any type still existing bias.[1,3–4,7–8,17–20]
Step 4 -Teledebriefing	Step characterized by an analytical moment of reflection/discussion of the telesimulated scenario observed by the learners remotely online and live, and conducted by one or more facilitators. It is recommended to carry out the teledebriefing until all the learning objectives are discussed and contemplated. It usually lasts twice as long as it takes to perform the clinical scenario. It must be based on a debriefing method and technique.[1,3–4,7–8,17–20]
Step 5 -Learner assessment and feedback collection	Definition of tools or instruments for assessing cognitive abilities (instrument for assessing knowledge, generally of the pre- and post-test type on the theme addressed for teaching and learning through tele-simulation) and affective (such as: Scale of Student Satisfaction and Self-Confidence in Learning[21], in which it is intended to be developed through the proposed telesimulated educational strategy. Generally lasts from 30 to 40 minutes. Organization of the selected feedback format for feedback on the telesimulated activity from the perspective of the facilitators.[8,17]
Step 6 - Additional learning	Support instructional resources such as: podcast, national and international guidelines, texts, articles, video class, video simulation, power point class, available after the end of the telesimulation to enhance knowledge on the selected topic with a period of 10 days to the feedback.[4,17]

DISCUSSION

Mapping the steps and components inherent to operationalizing a synchronous and observational telesimulation design was the focus of this investigation. As this is a simulation modality of recent scientific exploration[1,4,8,17–20], no nationally authored manuscripts were identified whose outcomes portray the practice of telesimulation, signaling a research gap in this territory. Only two Brazilian studies[22–23] have encouraged its adoption, mainly in pandemic times, but do not delve into its management.

Adopting telesimulation in nursing is noted[1,7,18–19] even in view of the predominance of evidence aimed at teaching students and medical professionals. An essential nature of research expansion and investment in preparing teachers and facilitators for this teaching strategy is highlighted[8], as well as stimulating research in this professional context[18], advancing in the nature of studies produced in face of the preponderance of descriptive studies and low level of evidence[4,8,17–20], further justified by the need to explore the theme to understand it before proceeding to evaluate its effectiveness or other scientific questions[18–19].

It is important to clarify that one of the main differences between synchronous and observational telesimulation and face-to-face simulation is the potential of these strategies to develop clinical skills[24], since it is possible to manipulate the clinical scenario in a face-to-face experience and repeat the actions which will refine psychomotor, cognitive and affective skills, whereas knowledge is developed in observational telesimulation, and the behavior of learners is aligned with one of the limitations of this teaching modality to the detriment of practical skills[1,3,4,7–8,17–20].

A synchronous and observational telesimulation design must contain six steps[1,3,7,17–20]: The first is characterized by planning the operationalization, in which the aim is to obtain components capable of enabling online learning in real time, such as technological resources used by teachers and students and interactive evaluation formats performed remotely[1,3,4,7–8,17–20].

The recommendations highlighted by the International Nursing Association for Clinical Simulation and Learning (INACSL), published in 2021, encourage the purposeful, systematic, flexible and cyclical planning of a simulation design with an emphasis on the face-to-face aspect[25], but do not yet address the telesimulation modality or its peculiarities[26].

Regarding the step which refers to preparing the telesimulation in the pre-briefing/briefing phase, it is essential that the facilitators address specific criteria of online learning, such as turning off the cameras of remote learners during the scenario so the actors can better concentrate and then turning on the cameras at the time of the teledebriefing with explanations which require the attention and planning of the teacher, since there is no such need in simulation activities as in the face-to-face format[1,3,7–8,17–18].

A study was carried out in Singapore in the year 2021 in which the evaluation of a telesimulation aimed at teaching 42 medical students about communication skills was described. It emphasized that a sufficient didactic contract should be established during the pre-briefing/briefing to prepare the learner on the subject to be addressed, on how and when they should interact remotely and the impact of this practice on their learning[27].

On the other hand, the participation step in telesimulation may be exposed to the same pedagogical mistake that permeates this step in a face-to-face simulation, when only considering the description of a clinical case as being a simulation scenario[1,3,4,7–8,18–20]. This statement is corroborated by a study that evaluated the methodological quality of a study which developed and validated clinical scenarios in nursing and pointed out a common practice of adopting a clinical case, calling it a scenario, simulating and devaluing fundamental criteria of this step[28].

In addition to requiring the design of a complete simulated clinical scenario in which the clinical case is one of the existing criteria and not the only one responsible for the participation step, synchronous and observational telesimulation requires trained actors to experience the proposed scenario so that learners observe what you want to teach in real time and remotely[1,3–4,7–8,18–20].

Next, and considered the “cornerstone” for success in telesimulation, the teledebriefing step covers the virtual and online discussion/reflection, being conducted by the facilitators with the learners after observing the scenario execution regarding their feelings, perceptions and description of the experience, with the intention of developing knowledge and enhancing positive attitudes and feelings, such as satisfaction, self-confidence and self-efficiency[1,3–4,7–8,18–20].

In this context, and despite the fact that teledebriefing does not have a specific method indicated in the literature, a structured teledebriefing is performed online, live and orally by one or more facilitators for reflection and discussion by remote learners about the observed scene[2,29]. In addition, the use of Plus/Delta teledebriefing methods and Structured and Supported Debriefing (Gather Analyze Summarize - GAS) are more frequently mentioned[2,29].

In a study carried out by American researchers who described 12 recommendations for telesimulation practice, it was suggested that the learners turned on their video cameras after observing the experience and saw each other in a virtual space different from the scenario form, then were submitted to the reaction, description and analysis phases of teledebriefing which characterize a structured model of teledebriefing, carried out in a period capable of covering the review of all learning objectives[4].

Visualizing the participants faces during the teledebriefing can indicate to the facilitator their understanding or lack of clarity, helping them to adequately guide the discussion process, as well as relay their questions in search of a more organized, interactive, and inclusive online conversation[1,3–4,7–8,17–20] finalized with the learners’ assessment through feedback collection and providing additional study materials[3,17].

This scoping review was also able to map the challenges to implement synchronous and observational telesimulation, highlighting the need to obtain a sufficient, humane and competent technological structure to enable live and online transmission of the intended scenario[3,7,17–20].

A study carried out in Mexico in 2021 was similar to this context, as it identified the technological aspects and a stable internet connection as being essential factors to perform telesimulation associated with technical support and financing[20]. The need to obtain a virtual platform capable of transmitting the simulated scenario to the learners remotely is a condition which hinders adoption of synchronous and observational telesimulation in the pedagogical plans of undergraduate health courses[4]. Added to this context is the incipience of specific training aimed at forming a faculty with telesimulation planning and execution potential[3,17–19].

While the technological/virtual aspects are challenges inherent to telesimulation, the lack of knowledge and skill of the facilitators for adequately handling this practice can be considered similarities in the difficulties detected to operationalize the face-to-face simulation and a limitation to achieve the learning objectives[20]. In this perspective, it is recommended that educators and facilitators master clinical simulation in principle before practicing telesimulation, since this modality also requires dexterity to solve technological problems[8].

The absence of the “Postgraduate Education” descriptor in the search strategy is understood as a limitation in this study; in addition, the scarcity of manuscripts on the subject, especially in the national context, which instigates developing research which presents strategies capable of circumventing the challenges inherent in operationalizing telesimulation in teaching and learning in health[6,18,30].

The results of this review are useful in future research in the health field and nursing, in addition to being applicable to care and teaching, as they promote knowledge advancement in the scope of simulation by presenting the steps and components necessary to establish a design of synchronous and observational telesimulation with the potential to support facilitators and teachers in the face of this pedagogical practice, supporting and encouraging educational institutions to look differently at telesimulation, mainly in relation to the educational impositions of a pandemic period.

CONCLUSION

This scoping review mapped the steps and specific components for operationalizing synchronous and observational telesimulation, highlighting the importance of establishing an instructional design based on the planning steps; preparation; participation; teledebriefing; learner assessment/feedback collection; and additional learning, which culminate in developing the learner's cognitive and affective skills. The need to obtain a sufficient technological structure to remotely transmit the telesimulated scenario and a properly trained faculty is also highlighted as challenges for its operation.

Thus, a suggestion is to develop future research which appropriates the findings presented herein in order to subsidize the construction and validation of telesimulation protocols aimed at teaching and learning in health, as well as experimental and quasi-experimental studies capable of evaluating the effectiveness of telesimulation when compared to other pedagogical strategies.

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NOTES

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