Revista Brasileira de Enfermagem
REBEn

SUPPLEMENTARY EDITION 6
ADVANCED NURSING PRACTICES

ORIGINAL ARTICLE

Management in clinical simulation: a proposal for best practices and process optimization

Gestão em simulação clínica: uma proposta de boas práticas e otimização dos processos

Gestión en simulación clínica: una propuesta de buenas prácticas y optimización de los procesos

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How to cite this article:
Schuelter PI, Tourinho FSV, Radünz V, Santos VEP, Fermo VC, Barbosa SS. Management in clinical simulation: a proposal for best practices and process optimization. Rev Bras Enferm. 2021;74(Suppl 6):e20200515. https://doi.org/10.1590/0034-7167-2020-0515

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Submission: 07-12-2020 **Approval:** 04-02-2021

ABSTRACT

Objectives: to develop a best practices document with facilitating components and processes for simulation management. **Methods**: the methodological research was conducted between April and October 2017, using four approaches: observational research, conducted in an international simulation institution; Definition of theoretical framework, from the International Nursing Association for Clinical Simulation and Learning; integrative literature review, in international databases; and comparative analysis. It used Bardin's analysis for the categorization of the information. **Results**: creation of a document with good practices in simulation regarding management and practice in simulation and management of resources and data, highlighting the use of technology and the training of professionals as the most important allies for overcoming the main limitations found. **Final Considerations**: the product of this study is a compilation of strategies for simulation management as a tool to enhance the application of the method with greater effectiveness.
Descriptors: Nursing; Simulation; Learning; Nursing Education; Educational Technology

RESUMO

Objetivos: desenvolver um documento de boas práticas com os componentes e processos facilitadores para a gestão da simulação. **Métodos:** pesquisa metodológica realizada entre abril e outubro de 2017, utilizando quatro abordagens: pesquisa observacional, realizada em instituição internacional de simulação; Definição de referencial teórico, da *International Nursing Association for Clinical Simulation and Learning*; Revisão integrativa da literatura, em bases de dados internacionais; e análise comparativa. Utilizou-se a análise de Bardin para categorização das informações. **Resultados:** criação de documento com as boas práticas em simulação no tocante à gestão e prática em simulação, assim como gestão dos recursos e dados, ressaltando o uso da tecnologia e a formação dos profissionais como os mais importantes aliados para a superação das principais limitações encontradas. **Considerações Finais:** o produto deste estudo é um compilado de estratégias para gestão da simulação a ser utilizado como ferramenta potencializadora para aplicação do método com maior efetividade.
Descritores: Enfermagem; Simulação; Aprendizagem; Educação em Enfermagem; Tecnologia Educacional.

RESUMEN

Objetivos: desarrollar documento de buenas prácticas con componentes y procesos facilitadores a la gestión de simulación. **Métodos:** investigación metodológica realizada entre abril y octubre de 2017, utilizando cuatro abordajes: investigación observacional, realizada en institución internacional de simulación; Definición de referencial teórico, de la *International Nursing Association for Clinical Simulation and Learning*; Revisión integrativa de la literatura, en bases de datos internacionales; y análisis comparativo. Utilizado el análisis de Bardin para categorización de informaciones. **Resultados:** creación de documento de buenas prácticas en simulación en lo que respecta a gestión y práctica en simulación, así como gestión de recursos y datos, resaltando el uso de tecnología y formación de profesionales como los más importantes aliados a la superación de las principales limitaciones encontradas. **Consideraciones Finales:** producto de esto estudio es un compilado de estrategias para gestión de la simulación a ser utilizado como herramienta potencializadora para aplicación del método con mayor efectividad.
Descriptores: Enfermería; Simulación; Aprendizaje; Educación en Enfermería; Tecnología Educacional.

INTRODUCTION

Simulation is a reality in the curricula of healthcare courses and professional training processes. The technologies and methods for its implementation have been discussed, as well as the competencies to be achieved by professionals for its application. To enhance the value of simulation laboratories and expand the method, there is a need to incorporate them into the pedagogical project of courses, teacher training, and contextualization to the local reality and studies and best practice guidelines to guide it. The teaching-learning process must allow for the training of technical skills, communication, and clinical reasoning[1].

The use of simulation as a teaching strategy for skill development has become the international gold standard in the training of students, professionals, and healthcare teams. To this end, it is necessary to implement the method according to its principles and techniques through planning, the definition of strategies, and constant evaluation[2]. In this context, educators should have the same teaching conduct[3-4], and the management of material resources should be carried out using a conference system that allows double-checking and replacement without waste, requiring a high level of preparation and guidance regarding this management[5-7].

Programming a simulated activity requires the educator/facilitator's preparation in terms of educational design and management, a process that is still lacking today. Mistakes and failures are likely to happen during the activity; if not anticipated and prevented by the simulation developers, they may compromise the strategy's success and create trauma in the participants. In this sense, institutions have decided to standardize and validate their simulation scenarios, developing good practices with error prevention and process optimization, but there is still a need for further development and practical application for this training[8].

This study brings, with unprecedentedness, the search for issues that go beyond the opportune moment of application of simulated teaching and that permeate the entire process involving the simulation regarding the preparation of its administrative management and resources, planning and articulation of all points that culminate in teaching and learning through the method.

OBJECTIVES

To develop a document of good practices with the components and processes that facilitate the simulation management.

METHODS

Ethical aspects

The study respected the ethical precepts laid out in CNS Resolution Nº. 466 of 12/12/2012. It was submitted to and approved by the Research Ethics Committee through submission on *Plataforma Brasil*. Due to international characteristics and respecting requirements, it was approved and authorized by the Administration and Ethics Committee of the Simulation Center.

Type of study

Methodological study[9] employs four approaches (Figure 1) to create a protocol with facilitating components and processes for simulation management development. It was used the COREQ instrument to guide the methodology[10].

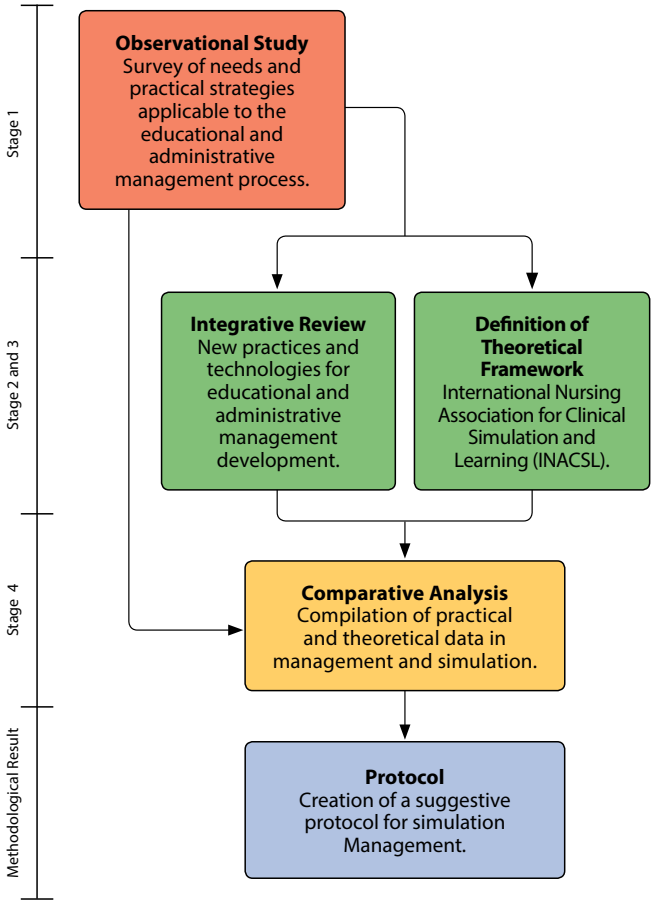

Figure 1 – Methodological approaches

Methodological procedures – Stage 1

A qualitative observational study to raise the real needs and strategies present in the practice of simulation.

It was observed the activities carried out in an institution that is an international reference in Clinical Simulation from April to July 2017. The following were considered inclusion criteria for the observations: (1) activities accompanied in its entirety; (2) actions that involved research themes. Exclusion criteria: actions that depended on processes external to the simulation center.

The following actions were: 11 medical training classes (undergraduate), with theoretical approaches and practical activities with low and medium-fidelity simulation; 14 high-fidelity clinical simulation sessions for medical specialization; 21 medium-fidelity simulation sessions for scientific research; 14 high-fidelity clinical simulation sessions for multidisciplinary training; 2 professional training courses for simulation educators; 3 resource management meetings; 2 simulation educational planning meetings; 3 simulation research group meetings. There was also daily monitoring of

the professional educators and technicians in managing human resources and daily maintenance of the center.

Study setting – Stage 1

This stage was conducted in a French reference laboratory in Clinical Simulation, which has several healthcare courses at different training levels. The institution has the essential services and resources recommended for establishing a highly efficient and faithful simulation center, with a planning, management, and educational and technical execution team, high-tech facilities, and resources, as well as the provision of specific consumable supplies.

Collection and organization of data – Stage 1

Data collection took place through observation without intervention in the scenario. The observer was not part of the research universe. Information was collected through the construction of an observation diary during the performance of the activities, filling out an instrument with the following information: (1) origin of the action - resource management, educational management, simulation practice, data and instrument manipulation; (2) type of activity - routine activity, direct simulation activity, planning activity, educational activity, research activity, evaluation activity; (3) description of the activity - which activity was being performed; (4) limitations - listing of limitations in the execution of the action; (5) strategies and facilities contributing to the performance of the activities; (6) general observations.

Methodological procedures – Stage 2

The second methodological stage was the choice of an international theoretical framework. The choice was defined as a stage, as it included a process of assessment and indication of international experts in the simulation area, through a form suggesting referrals and pointing out the positive and negative points of each referral. After collecting this information, it was compiled and validated by an evaluating panel.

The International Nursing Association for Clinical Simulation and Learning (INACSL) benchmark was chosen due to its relevance in the participation of international simulation communities, which follow the quality standard in education and health, serving as a reference for creating protocols and evidence-based studies[11].

The following standards were used to support this study: Simulation℠ Operations; Simulation℠ Debriefing; and Simulation℠ Design - which are the main types that oversee the management and practice in simulation[11].

Methodological procedures – Stage 3

In the third methodological stage, an integrative review[12] was performed to find studies that contemplated solutions, strategies, and technologies for the qualification of the management of the simulation process (educational and administrative aspects), answering the question: "What knowledge has been produced regarding methodologies in simulation management and the use of technology?".

An integrative review research protocol was developed, validated by a researcher expert in integrative review methods and by an expert in the field of clinical simulation.

Study setting – Stage 3

One search for articles occurred by accessing the following databases: Latin American and Caribbean on Health Sciences Literature (LILACS); and Medical Literature Analysis and Retrieval System Online - MEDLINE.

Data source – Stage 3

The following inclusion criteria were stipulated: (1) Studies that contained the predefined descriptors via the Medical Subject Headings (MESH) platform: Health Information Management AND Simulation Training; Management Information Systems AND Simulation Training; Materials Management, Hospital AND Simulation Training; Practice Management AND Simulation Training; Planning Techniques AND Simulation Training; Methods AND Simulation Training; Technology AND Simulation Training; (2) original articles; (3) articles that referred to Clinical Simulation and its stages of development, educational and resources management, and new technologies (4) articles available in Portuguese, Spanish, English, and French; (5) articles published from January 1, 2013, to January 1, 2017, with the last update in June 2019; and (6) articles available in its entirety.

Collection and organization of data – Stage 3

The search was done for each database individually, without pre-defining a starting base. The information extracted from the articles was (1) year of publication; (2) country of production; (3) focus worked within the theme; (4) origin of the action described in the article - resource management, educational planning, educational action, simulation practice, simulation planning, data, and instrument handling; (5) limitations; (6) strategies and facilities; (7) new themes and technologies.

After searching the articles classified by the selected descriptors, the inclusion and exclusion criteria (Stage 1) were applied to select the articles and read the titles and abstracts (Stage 2), excluding those repeated between the bases and descriptors composing, the final selection of articles.

Data analysis

For data analysis, it was used Content Analysis[13]. The categorization and subcategorization occurred in a non-aprioristic way, in which the instrument previously defined the main categories, and the subcategories and contextual information emerged entirely from the context of the research material[13]. We did not consider quantitative data of repetitions of actions and problems or strategies, but the depth, origin, and uniqueness of the information.

Besides, Stage 4 of the study was also part of the content analysis, which was characterized by a qualitative method comparing the categories defined and needs found in Stage 1 with the reference literature, the findings of the integrative review, and the adopted framework.

RESULTS

Chart 1 represents the information obtained from Stage 1 of the study, named "observational research," after data analysis and categorization.

As a result of Stage 3, literature review, the first search for articles classified by the selected descriptors showed a total of 19,426 articles, of which 17,565 in MEDLINE; and 1,861 in LILACS.

Next, by applying the inclusion and exclusion criteria, the study excluded 17,831 articles. Soon after, the titles and abstracts were read, and 1,565 publications were excluded since they did not contemplate the present study's scope. In the third phase, the survey identified 11 articles that were repeated in databases and descriptors and were excluded, according to the flowchart shown in Figure 2.

Therefore, 19 studies were selected[4-7,14-27]. Afterward, articles were exhaustively read to extract the units of meaning related to this review's objective. Categories and subcategories were created based on the studies' focus themes to discuss the information, dialoguing with other authors and realities.

After carrying out Stages 1, 2, and 3 of the research and the comparative analysis, Chart 2 was created with the compilation of the results by analysis categories, presenting the suggestions of processes and components needed to qualify the practical and managerial process of simulation.

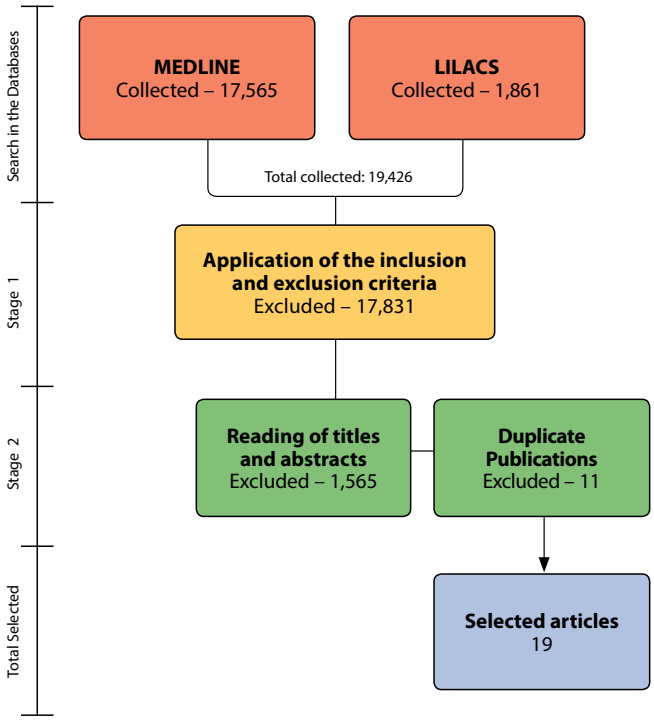

Figure 2 – Flow of article collection in Stage 3

Chart 1 - Results of Stage 1

Management Unit	Type of activity	Limitations	Strategies and facilities
Educational Management	Pedagogical Action - *educational activity*	Contact of the participant with the content only at the time of the simulation session or the update of the references without the participant's knowledge	Face-to-face, collective training, and individual meetings for the creation of the simulation stages
		Content development only by the facilitator/ professor without the collaboration of the participant	Specialized professionals to guide the process involving simulation
		Methodological lack of knowledge of the simulation stages by facilitators/professors and participants/ students	
	Planning and building documents for simulation - *planning activity*	Building and updating schedules and documents for simulation in alternative ways by generating multiple versions	Printed delivery of the latest version of the schedule and documents at the time of the simulation
Simulation Practice	Pre-briefing - *direct simulation activity*	Lack of data in the clinical setting to achieve the desired outcome	Media facilities that allow clear explanation of the clinical case (presentation of imaging examinations, and others)
		Case description only at the time of simulation	
	Simulation - *direct simulation activity*	Need of previous presence of the facilitator in the simulation center for checking and inserting the data in the simulator	High-tech, high-fidelity simulators
			Hybrid simulation possibilities
		Use of forms to follow the script and evaluate the simulation	Technology that allows interaction between the simulation site and the pre-briefing environment
		A superficial review of the accompanying data from the script for *debriefing*	
	Debriefing - direct simulation activity	Use of mixed methods not compatible with the intended purpose of the simulation	Technologies that enable metrics of the interaction between the participant and the simulator
		Objective-only data records and technical standards	
		Participant does not have access to the performance data and video feature after the simulation.	
Resources Management	Materials - *routine activity*	Manual count of the material	Adequate storage place for the specific materials
		Availability of the material by free demand, with flawed control	

To be continued

Chart 1 (concluded)

Management Unit	Type of activity	Limitations	Strategies and facilities
Resources Management	Human - *planning* activity	Centralization of the simulation conduction actions in the technical team	Constant communication about the planning processes via e-mail
	Technological - *planning* activity	Use of various instruments for building the processes (Word, e-mail, filming software, simulation software) generating multiple data in multiple locations	Compatible simulation networks, software, and hardware
	Maintenance - *routine activity*	Manually daily checking of activities (counting materials, equipment control, room reservation)	Financial self-sustainability with the development of activities for third parties
Handling of Data and Instruments	Simulation Evaluation - *evaluation activity*	Manual registration, some illegible and losses due to volume at delivery	Pre-defined instruments for simulation evaluation.
		Abstention of answers due to non-practicality	
	Collection of Evaluative Data - *Evaluation Activity*	Data collected by printed instruments	
	Data Analysis - *research activity*	Data transcribed manually, time-consuming, and error-prone	
	Instruments - *planning activity*	Lack of instruments that standardize the information for planning the simulation of the technical part and data for the simulator	Availability of methodologists for analysis
	Data Availability – r*esearch activity*	Delay in making data available for improvement of the center and educational activities	
		Search for data when there is a need to use it; there is no routine for analysis and disclosure.	

Chart 2 - Final result of the study: instrument with the suggestion for process optimization

Management Unit	Activity	Action orientation	Indicated resource
Educational Management	Pedagogical action - *educational activity*	Provide study guides or references prior to the session[7].	Virtual Teaching and Learning Environments. Use of *Serious Games* and Virtual Patient[16,19].
	Planning and building documents for simulation - *planning activity*	Create standard guides for each stage of the simulation and create training and orientation courses for the educators[4,8,14].	Cloud-like instant document sharing, editing, and updating location[4,17].
Simulation Practice	Pre-briefing - *direct simulation activity*	Provide (prior to or during) data, guidance and/or case studies in a visual manner that can be consulted at any time during the simulation[4,7,26,28].	A place to share, edit, and update instant cloud-like documents. Use of printouts or display technology such as monitors[4,6,17].
	Simulation - *direct simulation activity*	Develop easy-to-fill and easy-to-follow procedure guides, considering order changes and intercurrences[4,7,26,28].	Use of printouts or technology with quick-fill potential[4,17,28].
	Debriefing - direct simulation activity	Use developmental metrics, explore feelings, apply self-assessment, and discuss practices based on the references and videos in the session. Training courses and educator orientation[5,8,18,22-24,29].	Communication systems with manikins and metrics processors. Printed self-assessment questionnaire, peer assessment and video resource[5,8,17-18,21,23-24].
Resources Management	Materials - *routine activity*	Update daily by double-checking stocks[4,14].	Computerized material management programs[6].
	Humans - *planning activity*	Train the educators in the development of all the center's activities. A reference professional for each area[4,20,25].	To have professionals working exclusively in the research center, with educational and health backgrounds[10,25].
	Technological - *planning activity*	Use technologies that provide compatible adaptations and resources[4,6,17].	Network of computerized or mutually compatible programs[6,17].
	Maintenance - *routine activity*	Create a routine maintenance spreadsheet for the equipment according to the manufacturer[14].	Direct contact and maintenance network with suppliers[14].
Handling of data and Instruments	Avaliação da Simulação - *atividade de avaliação*	Create standard instruments for scenario evaluation[6,20-21].	Use of printouts or technology with quick-fill potential[6,17].
	Collection of Evaluative Data - *Evaluation Activity*		
	Data Analysis - *research activity*	Create routine quantitative and qualitative data analysis and improvement of instruments. Professionals specialized in methods and analysis[15,21,25].	Construction of articles and publications, layout of printed or online reports. Discussion Meetings[14-15,20].
	Instruments - *planning activity*		
	Data Availability - *research activity*		

DISCUSSION

In the *Educational Management* category, when we point out that the simulation is an active methodology, the role of the student/professional must be rethought. The student/professional must take an active position in the teaching-learning process, while the educator/facilitator takes a facilitating position. By placing one as totally responsible for the simulation, and the other passive to the process, just executing what was thought for him, we regress to traditional methods, in which the professor holds the knowledge and the teaching choice, and the student is limited to submission and reproduction of what is transmitted[30].

Another problem found is related to the unpreparedness of educators/professionals for the development of simulation in terms of planning and application. That happens due to lack of training and delay in keeping up with the method's rapid evolution. In some education centers, the educators in charge lack simulation training, resulting in management limiting these centers' expansion and potential[20].

New simulation hybridization strategies are increasingly present, using distance learning resources (*e-learning*) for pedagogical internships, or even other simulated practices (*e-simulation*), such as the *serious game* resource, games that allow the development of theoretical skills complementary to the simulated practice. The Virtual Patient, a system that helps in the decision-making and clinical evaluation according to the patient's deterioration, using 2D visual resources, can be a complementary practice to the simulation and theoretical instrumentalization[16,31-32].

As for the *Simulation Practice* category, education, assessment, research, and integration of the healthcare system as objectives of the simulation are unanimous in the literature, and its origin is linked to the actual application of patient safety[33-34].

A fundamental principle found in the articles is related to simulation stages. The references produce diversified names, applications, and strategies, but all within the same design and scope, bringing at least three of the four stages described below: (1) Informative or pedagogical session - face-to-face or distance phase in which participants receive study guidance being *e-learning* of great use; (2) Pre-*briefing or briefing* - is a moment of contextualizing the clinical situation that will be experienced (3) Simulation - is the phase of scene development; and the (4) *Debriefing* - the moment of reflection on the experience experienced, which allows the exploration, analysis, and synthesis of the actions developed, the thought processes formulated and the emotions triggered, to improve performance in real situations[4,28,35].

The Clinical Guides, documents that guide the simulation in its planning and execution, were indispensable strategies in good practices. They are subdivided into Management, Procedure, and Study Guides. The Management Guides help in the assembly and maintenance of simulators and scenarios and help laboratory coordination. The Procedure Guides are checklists containing the procedures' steps, guiding the study of the participants in skills training, and facilitating the verification of strengths and weaknesses to be improved or enhanced. Study Guides present the clinical case, the simulator to be used, and require further development of the participant's theoretical knowledge to articulate the resources, knowledge, and scenario with the learning[4,14,27-28,34].

The release of data for the development of the simulation was a practical aspect that presented difficulties due to the absence of information noticed only during the session. To this end, the pre-briefing *or briefing*, which is the informative meeting stage of the simulation to score the necessary aspects for the case's contextualization and development, must be well structured and follow the objectives competencies to be addressed. The literature's good practice strategy was the early release of this information and keeping it available during the simulation in the form of exams and images, which allow realism and instrumentalization for the practice, either by monitors or printed medical charts[4,17,28,34-35].

The *debriefing* is considered the most significant step in the simulation because it connects and reflects the intended competencies and objectives with the actions performed. It is the opportunity to weave together theoretical and practical knowledge and generate a moment of self-reflection and self-learning. Several methods were pointed out for its development, and each one related to the objective of the simulation in question[5,8,18,22-24,28,35].

There is a need for a trained educator/facilitator to conduct and employ the appropriate technique; and instruments that provide sufficient objective and subjective data for an efficient evaluation, which show the points for improvement for the participant to achieve the objectives and competencies. *Debriefing* can be developed in different techniques, but all be based on confidentiality, truth, open communication, self-analysis, participant-centered feedback, and reflection[8,18,29,35].

The *Resource Management* category did not appear linked to failures or errors but rather to aspects such as the difficulty of controlling materials, the division of tasks, and the time spent by human resources for its execution. For the comprehensive performance of the simulation, there must be a support network with a clear division of roles so that this aspect is not overloaded or expected in a single professional role[6,20].

It is not easy to find articles that address simulation management. Most of them deal only with methodological and educational issues or bring the experience of deployment and implementation of simulation centers, and the production of methodologies for management and maintenance by managers is still scarce. In this regard, it should be noted that these professionals are more connected to the educational area and do not have training directed to administrative and organizational domains. These aspects have been proven to be related to simulation quality and potential as an educational method[3,14,20].

As for the category *Handling of Data and Instrument*, studies show that this is a necessary item, especially in evaluating the simulation and its organization, generating data to improve the simulation center and the resources and methods[8,18,29]. The proposal is to create a routine for implementing data evaluation and analysis to serve as punctual teaching-learning actions and be presented as results for improving simulation as a method. It is necessary to develop the instruments used to improve data and take advantage of the technology to obtain results quickly[15,21,25].

Finally, it is essential to reflect on new technologies in the context addressed since most of the recommended strategies and actions are related to technology as a facilitator of the processes. That is because simulation involves many technological devices (such as mannequins, computers, and equipment), which require, in their planning and evaluation, resources that keep up with the rapid evolution of these components, besides generating data that need storage devices and technological evaluation[6].

Study limitations

The study does not present rigor in the choice of references regarding their evidence level. That could be justified by the lack of research about the subject concerning the management of simulation resources.

Contributions to the Fields of Nursing, Health or Public Policy

This study resulted in an instrument that provides a compilation of strategies based on the best practices for simulation management, which can be used to enhance the training, qualification, and improvement programs of health professionals, consequently allowing greater effectiveness in their educational and management actions.

FINAL CONSIDERATIONS

Simulation is an effective method in health education because it promotes patient safety and the development of skills related to students' safe educational practice. The evaluation and dissemination of systems and processes that optimize simulation can enhance the method's action, regardless of the material and human resources available, taking it to all institutions and contributing to the training and qualification of health professionals.

The development and implementation of methods and instruments that clarify both the educational and managerial stages of the simulation process are essential to ensure the methodology's effectiveness and potential. The usage of technology and its good application can facilitate the implementation, management, and evaluation of these processes, contributing to practice and research in Health and Nursing. Likewise, one must invest in training professionals in simulation and the best use of technological tools.

FUNDING

The authors would like to thank the *Centro Nacional de Desenvolvimento CiêntificoCientífico e Tecnológico* (National Council for Scientific and Technological Development (CNPq) for granting a doctoral scholarship to conduct the study that generated this article.

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