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The use of clinical simulation in technical nursing education

O uso da simulação clínica no ensino técnico de enfermagem

Uso de simulación clínica en la formación técnica en enfermería

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ABSTRACT

Objective: to discuss the use of clinical simulation in technical nursing education by identifying, synthesizing, and analyzing the scientific knowledge produced, as well as describing a case involving the implementation of simulation in technical-level training. **Method:** descriptive and exploratory study conducted in two phases: a scoping review and a single case study addressing the implementation of technical education at a private technical nursing school, with exemption from ethical approval. **Results:** the review showed that simulated practices in technical education include activities designed for research purposes, which are not part of the standard curriculum and have not been used to strengthen or expand professional training in the country. The case study demonstrates that well-structured projects with institutional support can make the use of simulation feasible in technical nursing education, generating impact and ensuring and enhancing patient care. **Conclusion:** clinical simulation is a viable approach in the education of nursing technicians.
Descriptors: Education, Nursing; Inventions; High Fidelity Simulation Training; Licensed Practical Nurses.

RESUMO

Objetivo: discorrer sobre o uso da simulação clínica na formação do nível técnico em enfermagem por meio da identificação, síntese e análise do conhecimento científico produzido e da descrição de um caso de uso da implantação da simulação no nível técnico. **Método:** estudo descritivo, exploratório, realizado em duas etapas: revisão de escopo e estudo de caso único da implantação do ensino técnico numa escola privada de ensino técnico de enfermagem, com dispensa de apreciação ética. **Resultados:** na revisão, observou-se que as práticas simuladas no ensino técnico incluem atividades executadas para procedimentos de pesquisa que não fazem parte do conteúdo programático e não têm sido utilizadas para fortalecer e ampliar a formação do profissional no país. O caso, demonstra que projetos bem estruturados e com apoio institucional, podem tornar o uso da simulação factível na formação dos profissionais de nível técnico de enfermagem, impactando, assegurando e fortalecendo o cuidado ao paciente. **Conclusão:** a simulação clínica é viável na formação de técnicos de enfermagem.
Descritores: Educação em Enfermagem; Inovação Tecnológica; Treinamento com Simulação de Alta Fidelidade; Técnicos de Enfermagem.

RESUMEN

Objetivo: discutir el uso de la simulación clínica en la formación a nivel técnico en enfermería a través de la identificación, síntesis y análisis del conocimiento científico producido y la descripción de un caso de uso de la implantación de la simulación a nivel técnico. **Método:** estudio descriptivo, exploratorio, realizado en dos etapas: revisión de alcance y estudio de caso único de implantación de educación técnica en una escuela privada de educación técnica en enfermería, con exención de evaluación ética. **Resultados:** en la revisión, se observó que las prácticas simuladas en la educación técnica incluyen actividades realizadas para procedimientos de investigación que no forman parte del contenido del programa y no se han utilizado para fortalecer y ampliar la formación de profesionales en el país. El caso demuestra que proyectos bien estructurados con apoyo institucional pueden tornar viable el uso de la simulación en la formación de profesionales técnicos en enfermería, que afectan, garantizan y fortalecen la atención al paciente. **Conclusión:** la simulación clínica es viable en la formación de técnicos en enfermería.
Descriptores: Educación en Enfermería; Invenciones; Enseñanza Mediante Simulación de Alta Fidelidad; Enfermeros no Diplomados.

INTRODUCTION

Over recent decades, health and nursing education has undergone significant transformations, with simulation-based teaching emerging as a noteworthy innovation[1]. Among the various modalities, clinical simulation has become particularly prominent. This method employs technological tools to recreate realistic scenarios in controlled settings that closely resemble actual clinical environments[2]. Within these simulations, students engage actively in the teaching-

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learning process, allowing them to practice repeatedly, acquire knowledge, reflect on their experiences, and assess both the outcomes and procedures involved[2].

A growing body of literature has demonstrated numerous benefits of this methodology, including enhanced interpersonal skills, improved communication, stronger problem-solving abilities, greater student satisfaction and confidence, and notable gains in cognitive performance and clinical competence[1,3-5].

Significant progress has been achieved in defining concepts, establishing methodological guidelines, and standardizing procedures for clinical simulation. Technological advances have expanded its reach beyond physical laboratories, introducing innovative formats such as telesimulation, *in situ* simulation, mobile training units, and virtual reality, all of which enable interaction between participants in different locations[5].

In Brazil and other Latin American nations, clinical simulation has gained increasing traction through the efforts of academic institutions, professional associations, governmental agencies, and private organizations[6,7]. Collectively, training programs, funding opportunities, events, and academic discussions have contributed to the widespread adoption of this educational approach. On a global scale, robust evidence highlights the practical benefits of clinical simulation, particularly its impact on healthcare quality, often referred to as simulation best practices[6-8].

Despite its importance, access to simulation-based education remains uneven across healthcare and academic settings. Commonly cited obstacles include a shortage of specialists, trained educators, dedicated facilitators, and experts in simulation. In Brazil, such limitations are especially evident in remote regions and underserved areas, where the absence of resources intensifies existing challenges[6,8,9-11].

Within nursing education, clinical simulation has been implemented across multiple levels, including technical, undergraduate, and graduate programs. However, technical education has received minimal investment in terms of infrastructure, materials, and human resources. This is concerning, given the critical role nursing technicians play in Brazil's healthcare system. As of February 2024, Brazil's nursing workforce numbered approximately 3 million professionals, 59% of whom were nursing technicians[12].

Nursing technicians are licensed professionals who operate under the supervision of registered nurses, delivering patient care, promoting health education, and supporting treatment processes. National regulations mandate a minimum of 1,200 instructional hours and at least 400 hours of supervised clinical practice[13]. Nevertheless, many graduates enter the workforce with insufficient procedural knowledge, inadequate professional attitudes, and limited exposure to realistic learning environments. Reports indicate that many training institutions lack proper equipment, materials, and clinical simulation settings[14,15].

These educational shortcomings are compounded by the limited recognition of nursing technicians. A recent study analyzing wage data from federal, state, and private sources revealed substantial discrepancies in compensation across the country. Many salaries fall below the recommended minimum wage for the profession (Figure 1)[16]. As a result, many technicians are forced to work multiple jobs, leading to physical and mental fatigue, diminished motivation for continued education, and compromised care quality[17].

Given these challenges, there is a pressing need to improve the training and qualification of healthcare professionals capable of responding to current healthcare demands and social needs. Considering the high representation of nursing technicians in the national workforce and the proven effectiveness of clinical simulation as an educational strategy, it is essential to reflect on its current and future role in technical nursing education. This requires promoting research, strengthening professional collaboration, securing institutional support, and developing accessible technologies.

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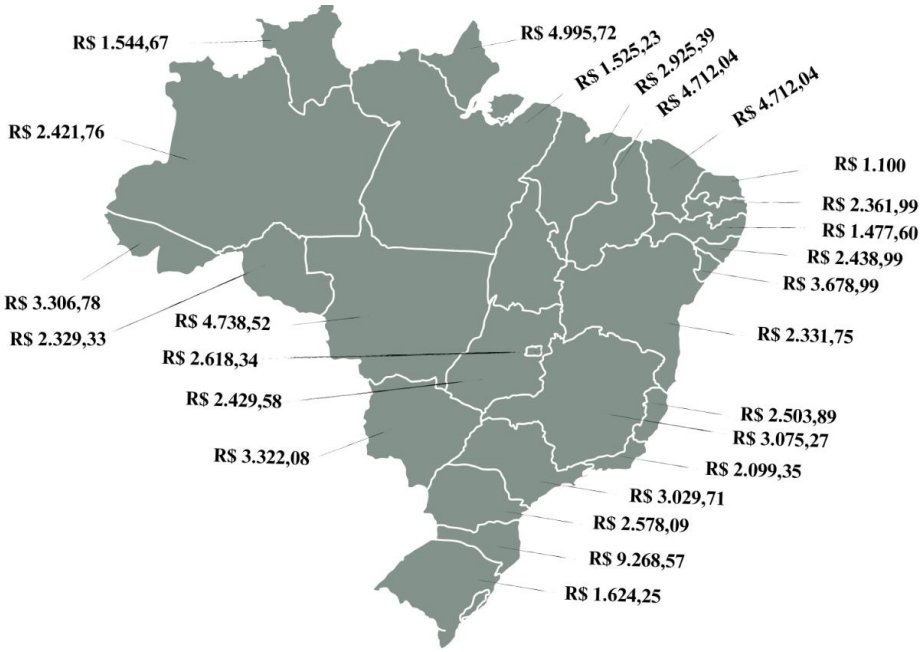

Figure 1: Mean nursing technician salaries by state in Brazil. São Paulo, SP, Brazil, 2023.

Accordingly, the aim of this study was to examine the use of clinical simulation in technical nursing education by identifying, synthesizing, and analyzing the existing scientific literature, while also describing a case study of clinical simulation implementation in a vocational training setting.

METHOD

This descriptive and exploratory study was conducted in two distinct stages: (1) a scoping review designed to identify, synthesize, and analyze scientific literature on the use of simulated clinical practices in vocational nursing education; and (2) a single case study intended to describe and analyze the implementation of clinical simulation in a nursing technician training institution.

Scoping review

The scoping review followed the Joanna Briggs Institute methodological framework, comprising the following steps: 1) formulation of the research question and objective; 2) development of the search strategy; 3) database selection and search; 4) screening of titles and abstracts; 5) full-text article selection; 6) synthesis of results; and 7) presentation and interpretation of findings[18].

To construct the guiding question and define the search strategy, the Population–Concept–Context (PCC) mnemonic was applied. The definitions adopted were, as follows: Population – students enrolled in vocational health programs; Concept – simulated practices; Context – vocational education. Based on these elements, the guiding question was formulated as follows: *"How have simulated clinical practices been applied in the education of vocational health students?".*

Inclusion criteria comprised articles incorporating all three PCC components and addressing the research question, regardless of language or publication date. Exclusion criteria included literature reviews, expert opinions, brochures, articles unrelated to the research question, and those without full-text availability online.

The search was conducted from May 17 to 23, 2022, with librarian support, using the following databases: National Library of Medicine (PubMed/MEDLINE), Scopus, Embase, Web of Science, Scientific Electronic Library Online (SciELO), CINAHL, and LILACS. Descriptors from DeCS and MeSH, along with keywords and alternative terms (e.g., nursing technicians, patient simulation, health education), were combined using Boolean operators (OR, AND, NOT) (Figure 2).

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Mnemonic	Descriptors/Keywords	DeCS/MeSH
Population	Técnicos de Enfermagem *Licensed Practical Nurses* *Enfermeros no Diplomados* Pessoal Técnico de Saúde *Allied Health Personnel* *Técnicos Medios en Salud*	Técnico de enfermagem *Nursing technicians*
Concept	Simulação de Paciente *Patient Simulation* *Simulación de Paciente* Treinamento por Simulação *Simulation Training* *Entrenamiento Simulado* Treinamento com Simulação de Alta Fidelidade *High Fidelity Simulation Training* *Enseñanza Mediante Simulación de Alta Fidelidad*	Simulação clínica *Clinical simulation* Exercício de Simulação *Simulation Exercise* Simulação *Simulation Technique*
Context	Educação em Saúde *Health Education* *Educación en Salud* Educação Continuada em Enfermagem *Education, Nursing, Continuing* *Educación Continua en Enfermería* Capacitação Profissional *Professional Training* *Capacitación Profesional* Educação Profissionalizante *Education, Professional* *Educación Profesional* Prática Profissional *Professional Practice* *Práctica Profesional* Capacitação de Recursos Humanos em Saúde *Health Human Resource Training*	Formação profissional *Professional formation*

Figure 2: Descriptors and keywords used for each PCC element. São Paulo, SP, Brazil, 2022.

Out of 1,336 initially retrieved records, 168 duplicates were removed using Mendeley. A total of 1,170 titles and abstracts were screened, from which five articles were selected for full-text review. Additional records were identified in gray literature sources, resulting in two more articles. After full-text analysis, two articles met the eligibility criteria and were included in the final sample. The entire selection process was conducted independently by two reviewers and is illustrated in Figure 3.

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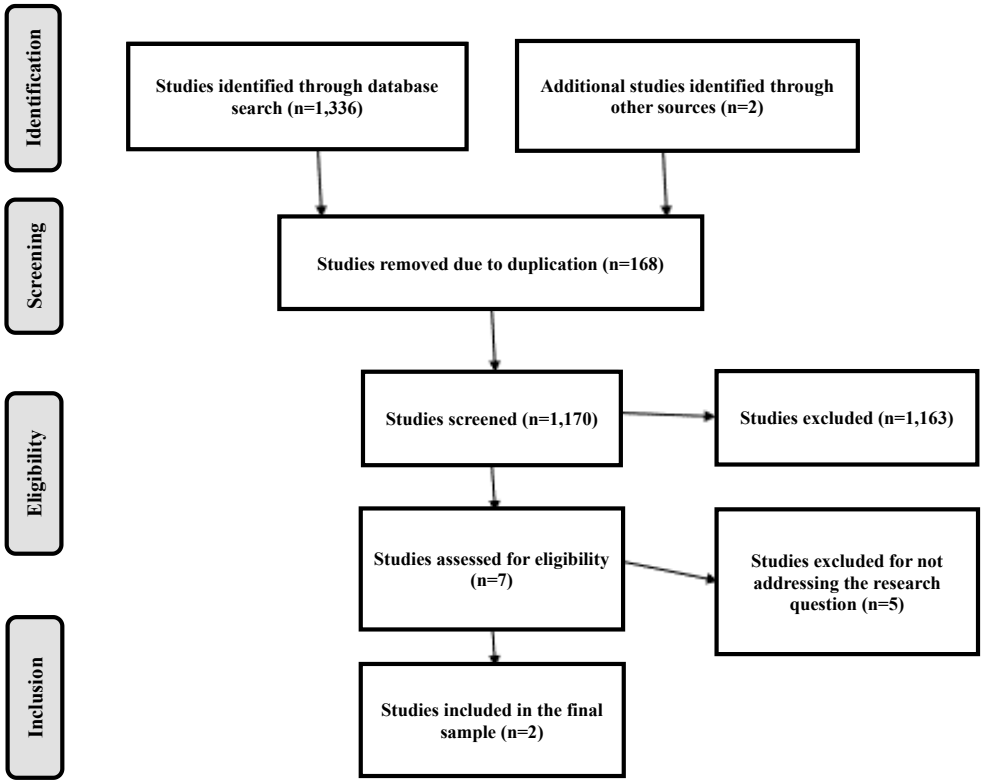

Figure 3: Flowchart of the study selection process. São Paulo, SP, Brazil, 2022.

The included studies were coded as 1 and 2 and referred to as "study" in the tables. To ensure methodological rigor, the PRISMA-ScR checklist was applied[19].

Stage 2: Single case study

The second stage consisted of a single case study[20-22], structured in three phases: (1) case selection and delimitation; (2) fieldwork; and (3) report preparation. The selected case was chosen based on its relevance as a reference model for investigation[23].

It focused on the implementation of simulated clinical practices in a vocational nursing education institution. This institution plays a prominent role in technical health education nationwide and, to date, represents the only documented case of this nature in the country.

Data collection involved direct researcher participation during the case. In the planning phase, all documentation produced between November 2021 and August 2023 was gathered, including field diaries and personal records from participating researchers.

A chronological timeline of relevant events was then created and analyzed. Supporting materials included institutional documents, meeting agendas, field notes, and other records related to the activities.

The report was organized in a timeline format, presented in tables, based on events deemed significant by the researchers during the case development process.

This study protocol did not require ethics committee approval, as it was based on secondary data from the scoping review and did not involve human subjects. Institutional consent was obtained for the case study description.

RESULTS

As outlined in the Method section, the findings are presented according to the two stages of the study.

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Knowledge produced

In relation to the application of clinical simulation in vocational health education, two studies published in Brazil over the past five years were included. Figure 4 summarizes the authors, objectives, materials and methods, and main findings and conclusions of these studies.

Author/year	Objective	Materials and methods	Main findings and conclusions
Araújo et al. 2021[24]	To identify the impact of clinical simulation on the cognitive performance of nursing technician students in responding to emergencies in primary health care.	Quasi-experimental study with non-equivalent control group	Students who participated in clinical simulation sessions demonstrated superior long-term cognitive performance compared to those taught using traditional strategies.
Bianchini et al. 2018[25]	To assess whether clinical simulation contributes to the training of nursing technicians regarding their communication skills with patients and families.	Randomized experimental study	Participants in the intervention group did not exhibit greater confidence or performance compared to the control group. The authors emphasized the limitations of isolated educational activities.

Figure 4: Summary of included studies by objectives, methodology, and main findings. São Paulo, SP, Brazil, 2022.

Single case

The second stage of the study consisted of a single case analysis focused on the implementation of clinical simulation in a nursing technician program at a private institution with a public service mission. This organization operates in over 1,800 municipalities across Brazil, with more than 600 schools, training units, and mobile centers. In the state of Rio de Janeiro, where the case is located, there are 30 campuses, 17 of which offer health-related programs and are nationally recognized for training nursing technicians.

Although the institution already conducted practical activities in skills labs, it had not yet implemented structured simulation-based instruction. Figures 5, 6, and 7 present details of the case development.

Selected unit
This is a vocational training center within a private institution that maintains a commitment to public service. Its mission is to provide high-quality professional education aligned with labor market demands in the areas of commerce, services, and tourism.
Location: Rio de Janeiro Unit
The Rio de Janeiro unit includes 38 campuses, a college, a publishing house, a corporate solutions center, a distance learning division, and a social responsibility unit. It also operates three mobile simulation units that provide training in underserved areas. Realistic practical training is conducted in facilities such as beauty salons, instructional kitchens, and wellness and nursing laboratories.
Motivation
The initiative sought to integrate innovative technologies into health education by utilizing existing simulation equipment. The initial focus was on the nursing technician course, aiming to boost student engagement and enhance training outcomes by developing core technical skills, knowledge, and attitudes required for quality patient care.
The unit's strategic plan revised to prioritize innovation as a value
Planning – Staff members' participation in the Institution's Innovation event.
Since 2017, the Innovation Event has encouraged collaboration, idea generation, and cultural change. Starting in 2021, the event included a project journey in which teams were tasked with creating and implementing proposed solutions. The simulation initiative described here was the winning project of the 2021 edition.

Figure 5: Location, motivation and planning of the case study. São Paulo, Brazil, 2024.

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Clinical simulation lab project
The target audience includes students, healthcare professionals, hospitals, care networks, and health education institutions. The lab functions as a hub for connecting various health sector stakeholders and includes three main innovation-driven axes: **Axis 1 – Realistic Simulation Center (CSR)** (name assigned by the institution): focused on clinical training to develop professional skills and deliver safe, humanized care. **Axis 2 – HealthTech Startup Incubator:** aims to foster health technology startups, train professionals and entrepreneurs, and enhance educational solutions for health programs. **Axis 3 – Health Innovation Center:** a multifunctional space that brings together all lab activities, disseminates trends and innovations, and promotes research and market-driven educational development.
Objectives of activities conducted at the lab
The simulation lab is designed to provide nursing technicians and healthcare professionals with the following: a) safe, realistic training environments; b) experiences involving both complex and routine situations; c) development of practical and advanced skills, decision-making, critical thinking, and effective communication; d) integration of innovative, interactive educational technologies; e) flexible, market-oriented training models; f) national recognition as a leader in technical-level health education.
Infrastructure
The lab includes neonatal and adult intensive care beds, general wards, and emergency units, along with dedicated debriefing and control rooms. It also features a 4K multidisciplinary interactive platform with 3D anatomical modules and multiple simulation software systems.
Ongoing activities include: - Technical visits with students and partner institutions; - Skills training and clinical scenario simulations aligned with curricular content; - Clinical simulations in wound care, venipuncture, cardiopulmonary resuscitation, and basic life support (adult and pediatric); - Remote simulation (telesimulation) for other municipalities via SimCapture® data capture tool; - Instructor training in simulated teaching methods, including peer-based learning and the use of the Body Interact® virtual patient software;
Educational competitions to promote educational initiatives, encourage representation, establish shared management processes, transfer autonomy and knowledge, equalize educational processes, and identify talent, together with regional units. These units attract a variety of students, particularly nursing technician students, due to their institutional recognition and visibility and their significant enrollment volume. Students are selected based on the following criteria: being enrolled in a nursing technician program and being under 21 years of age on the date of the international competition. During the competition, competitors undergo intense simulated training, usually in pairs, at a skills and simulation training center (TC). These laboratories mimic clinical environments in the case of nursing technicians, and practical training is performed with the support of a trainer. Even before the proposal and implementation of the project described in this case, this activity already existed and was enhanced with the resources available from the project. The competition stages are held at the local, regional, national, and international levels. The stages function as a selective competition, so the winners of the local stage advance to the state stage. State medalists represent their respective states at the national level. The top-ranked students in each area at the national level represent their country at the international level. The international level is a major professional education competition. After receiving awards at the national level, students travel to the institution's other regional units, sharing the knowledge gained during training with other students in their field. Furthermore, the top-ranked student at the national level represents their country at the international level.
Planned activities - Expansion of the project to other campuses; - Launch of new simulation-based health technician training programs; - Opening the simulation lab for training professionals from public and private health institutions.
Scaling of the lab's additional platforms.

Figure 6: Conceptual structure and infrastructure of the case study in technical nursing education. São Paulo, SP, Brazil, 2024.

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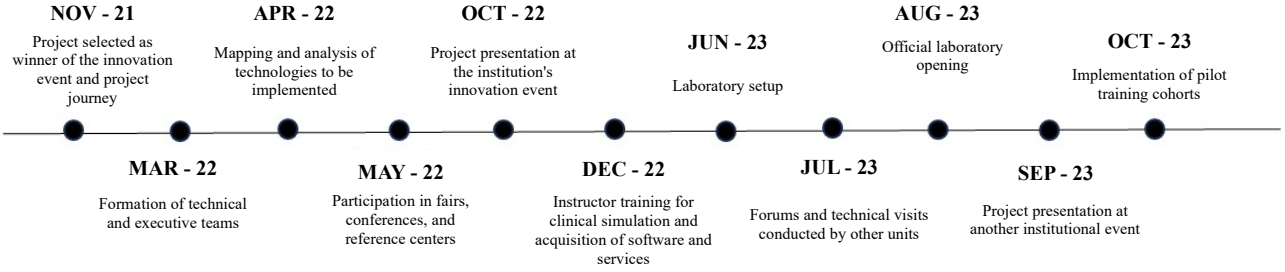

Figure 7: Timeline of the case study in technical nursing education. São Paulo, SP, Brazil, 2024.

DISCUSSION

Clinical simulation is an effective educational strategy that can significantly enhance healthcare training, making its integration into nursing technician curricula essential. This study revealed the limited availability of scientific evidence concerning the application of simulated practices in vocational nursing education. However, it also demonstrated the feasibility of addressing this gap through ambitious initiatives supported by technological development and structured implementation.

Nursing practice in Brazil is historically shaped by the country's socio-political context. The Federal Nursing Council (COFEN), together with the Regional Nursing Councils (Coren), forms an autonomous regulatory system linked to the Ministry of Labor and Social Security. This system is composed of three main components: a regulatory body responsible for establishing professional guidelines, a disciplinary body in charge of investigating ethical violations, and an oversight body tasked with ensuring compliance with nursing legislation[27]. Alongside this framework, the Brazilian Nursing Association (ABEn) has played a pivotal role in advancing nursing education, grounded in ethical principles and aligned with its mission. By working collaboratively with other organizations, ABEn promotes political, social, and scientific progress in the nursing field, with a particular focus on strengthening professional education[28].

Despite the prominent role of nursing technicians in Brazil's healthcare system, the integration of simulation-based teaching remains significantly underexplored in vocational programs compared to undergraduate curricula[6]. The first phase of this study applied a rigorous scoping review methodology, supported by experienced researchers, and included both peer-reviewed and gray literature without restrictions on publication date, study type, or methodology. This comprehensive approach revealed that while numerous studies address vocational nursing education, few focus on simulation-based strategies, resulting in their exclusion from the review.

The limited number of included studies, which focused on themes commonly addressed in undergraduate nursing education, such as communication and knowledge retention, suggests that simulation practices in vocational programs remain scarce and are not adapted to the unique characteristics of this educational level[29,30,31]. Additionally, the objectives of the included studies revealed that simulation was primarily used as a research tool rather than as an integrated curricular strategy in nursing technician training in Brazil[24,25].

When vocational education does not meet students' specific needs or fails to incorporate evidence-based strategies such as simulation, the quality of professional preparation declines. Aligning vocational training with the realities of clinical practice becomes even more critical in such scenarios. A fragile educational process jeopardizes public safety by producing underprepared professionals. It also places these professionals at risk of ethical misalignment and regulatory penalties.

Given the inherent safety concerns of this issue, COFEN has expressed concern about the development of nursing professionals at all levels and has established partnerships aimed at minimizing such issues. Notable in the higher education sphere is the partnership between COFEN and the Ministry of Education's Coordination for the Improvement of Higher Education Personnel (CAPES) for the implementation of the Professional Master's Program; at the medical level, the updating of procedures for specialization registration (Post-TEC Program); and the comprehensive digital platform COFENplay by COFEN/Coren, an initiative of COFEN and the Regional Councils that offers educational content, information, entertainment, and services, among other things. However, to date, none

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of the initiatives described by the councils or nursing associations related to nursing technician training in the country mention the dissemination of the simulation-based teaching method. Unlike undergraduate training, there is no emphasis on incorporating and better using technologies in teaching, nor is there any discussion about training teachers for skills training and/or the development of competencies and simulation scenarios.

Simulation is a teaching strategy aimed at meaningful learning through active learner engagement. The simulation facilitator must master the methodology, while learners must perform their tasks effectively. The adoption of clinical simulation in training is not limited to acquiring physical and material resources but requires a reassessment of pedagogical approaches. These resources are used to recreate clinical environments as realistically as possible, and often to play the role of the patient, preventing real patients from becoming the initial training subjects for professionals. Therefore, as in undergraduate programs, it is crucial to incorporate simulation-based teaching into nursing technician training through faculty development and the creation of appropriate environments and resources.

Skills training and the use of simulated resources have always been part of vocational nursing education. However, in recent years, these practices have been increasingly affected by low investment and have become secondary in institutions that now rely exclusively on patient-based training. To transform this reality, initiatives like the one described in the case study presented here demonstrate that it is possible to implement simulation practices and integrate technology into training institutions through feasible and scalable projects, especially when supported by institutions committed to the serious development of vocational education. In the institution examined, although skills training was already routinely conducted, a new environment was created through the integration of additional technologies, in order to highlight the importance of simulation in nursing technician training. Planning these actions involved proactivity and creativity through competitions that demanded both physical and cognitive effort. Events such as hackathons, increasingly common in corporate settings or in contexts requiring rapid problem-solving, have proven effective in generating innovative ideas, projects and implementations[33].

Other noteworthy aspects of the case include its step-by-step implementation plan, which allows for careful investment and cost analysis, as well as the opportunity it offers students to participate in national and international activities. These experiences help students compare the quality of their education with external standards and demonstrate the institution's ongoing interest in evaluation and the dissemination of results.

Study limitations

This study presents some limitations, such as the small number of studies included in the review and the discussion of a single case within a private institution, which may have hindered the interpretation and full achievement of its objectives. Although the review results were not fully aligned with some of the aims of this study, the decision to include them was based on their relevance. These findings may help explain the limited or still recent investment in knowledge production in this field and highlight the urgent need to explore and discuss this topic across different political and educational levels within the profession.

FINAL CONSIDERATIONS

The results of the case presented suggest that clinical simulation in vocational nursing education in Brazil is feasible. With institutional investment and the strengthening of well-structured projects in this teaching modality, simulation-based learning can support and enhance vocational nursing education, contributing to the quality and safety of patient care.

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Conceptualization, A.M. and R.R.O.C.; methodology, A.M. and R.R.O.C; formal analysis, A.M. and R.R.O.C.; investigation, A.M. and R.R.O.C.; A.H.G.S., M.M.T.S., C.P., R.G.S.A. and M.S.A.; resources, A.M.; data curation, A.M., R.R.O.C., R.G.S.A. and R.S.F.; manuscript writing, A.M., R.R.O.C., A.H.G., R.G.S.A. and M.S.; review and editing, A.M., R.R.O.C., A.H.G., R.G.S.A. and M.S.; visualization, A.M. and R.R.O.C.; supervision, A.M.; project administration, A.M.; financing acquisition, A.M. All authors read and agreed with the published version of the manuscript.

Use of artificial intelligence tools

Authors declare that no artificial intelligence tools were used in the composition of the manuscript "*The use of clinical simulation in technical nursing education*".