

Characterization of the simulation technician profile in Portugal: a cross-sectional study

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Abstract

Background

Effective simulation-based education (SBE) requires specialized technical expertise to manage increasingly complex equipment. While simulation technicians are recognized as vital to high-quality programs, their roles remain poorly defined internationally and uncharacterized within the Portuguese healthcare context.

Aim

This study aims to provide the first comprehensive cross-sectional analysis of simulation technicians in Portugal, characterizing their academic backgrounds, daily tasks, self-assessed skills, and professional development needs.

Methods

A cross-sectional study was conducted using an online survey developed by a focus group and distributed via the Portuguese Society for Simulation in Health Sciences (SPSim). Data collected included sociodemographics, a 5-point Likert scale skills self-assessment, and training preferences. Statistical analysis included descriptive measures and non-parametric tests for subgroup analysis based on instructor certification.

Results

Nineteen technicians from 11 centers participated. The workforce is heterogeneous, with academic backgrounds ranging from high school to doctoral degrees, primarily in healthcare and engineering. Technicians reported high confidence in administrative tasks like scheduling (4.47 ± 0.70) but significantly lower confidence in pedagogical or advanced technical areas such as debriefing (2.79 ± 1.48) and virtual/augmented reality (2.42 ± 1.02). Subgroup analysis revealed that instructor-certified technicians had significantly higher confidence in scenario development ($p = 0.028$) and debriefing ($p = 0.017$). The most requested training area was clinical scenario development (31.58%), with a strong preference for short, in-person courses (68.4%).

Conclusion

Portuguese simulation technicians constitute a dedicated but non-standardized professional group. A critical disconnect exists between infrastructure and personnel, as several centers operate without dedicated technical staff. Establishing a national, hands-on training program is essential to bridge the confidence-competence gap in pedagogical tasks and ensure the long-term sustainability of simulation-based education in Portugal.

INTRODUCTION

Simulation-based education (SBE) has been used extensively in high-risk fields such as aviation, the military, and healthcare [1]. In the modern healthcare industry, simulation serves to improve patient outcomes by training learners to manage complex problems and behaviors, using critical thinking, communication, and teamwork skills, among other non-technical skills [1]. Effective simulation-based training requires not only expertise in education and clinical practice but also significant expertise in simulation technology [2]. A staff that lacks technical knowledge and skills will be unable to leverage the full potential of simulation equipment and environments [2].

As existing technology has improved, encouraging the incorporation of new equipment and software, the need for broadened technical skills has increased [2]. Institutions have responded by hiring simulation technicians, individuals who provide dedicated expertise related to the technological components of SBE [2]. This role's growth is evidenced by the doubling of attendance at international conferences dedicated to simulation technology [2]. Dedicated simulation technicians are now recognized as one of the main strengths of high-quality simulation programs, and their absence is often viewed as a significant barrier to program success [2, 3]. Despite this recognized value, there is much ambiguity surrounding the role, and its responsibilities are often performed by other personnel out of necessity [2, 4].

The terminology used to describe this professional is remarkably varied, including titles such as simulation operations specialists, simulation technology specialists, resource technicians, simulation technicians, simulationists, and learning technologists [1, 2, 3, 4]. This lack of standardized nomenclature contributes to a lack of role clarity, which can hinder recruitment and training, and may contribute to job dissatisfaction or talent retention issues [2, 4, 5]. Currently, the roles and responsibilities of a simulation technician vary widely depending on the type of program they support—such as nursing, medical, or allied health—and the type of center they inhabit [1].

Research has identified a core set of responsibilities that constitute the foundation of the simulation technician role regardless of their specific background or facility type [1]. In a landmark survey-based study, five core tasks were frequently identified: equipment setup and breakdown, programming scenarios into software, operation of software during simulation, audiovisual (AV) support for courses, and on-site simulator maintenance [1, 2]. Setup and breakdown involve preparing patient simulators, task trainers, hospital equipment, and supplies [1]. Programming involves utilizing proprietary software to control physiological changes and interventions, while operation refers to running these scenarios "on-the-fly" or using pre-programmed scripts during activities [1]. AV support is essential for live streaming and recording simulation activities for debriefing sessions [1]. On-site maintenance ranges from simple cleaning to complex troubleshooting of electrical and networking issues [1].

Beyond these core tasks, technicians often engage in additional responsibilities such as inventory management, scheduling simulation activities, and maintaining specialized medical equipment like ventilators or anesthesia machines [1]. They are also frequently responsible for preparing and applying moulage—simulated injuries or wounds—to enhance realism for standardized patients and simulators [1]. In some settings, they may even lead technology training for faculty and staff [1]. Those working in

in-situ simulation (training within real clinical environments) have unique responsibilities, such as interfacing with department schedulers and ensuring that simulated supplies do not accidentally reach real patients [1].

The complexity of the role requires a multifaceted competency profile [4]. Recent mixed-methods research has categorized these competencies into nine distinct domains [4]. These include three knowledge domains: technical (hardware and software), clinical (medical terminology and anatomy), and pedagogic (adult learning principles). There are four skills domains: resourcefulness, pedagogic, team, and technical. Resourcefulness is particularly critical, as it involves the ability to solve problems on the fly and innovate to overcome barriers. Finally, there are two attitude domains: professionalism and a "can-do" mentality. A "can-do" attitude, characterized by a willingness to learn and an inquisitive nature, is often what allows a technician to succeed despite the steep learning curves associated with the role [4].

A Polish nationwide study further emphasized that a "good" simulation technician is defined by interpersonal attributes like involvement, helpfulness, and trustworthiness [5]. The ability to cope with technical or organizational failures was rated as the most valued skill, highlighting the need for technicians to remain calm and creative when things go off-plan. Furthermore, context-specific knowledge, such as familiarity with the facility layout and the specific details of simulation scenarios, was found to be more critical than broader theoretical knowledge of the healthcare system or a formal computer science degree [5].

The clinical significance and impact of a simulation technician on the healthcare education team are profound [1, 3]. A technician's presence allows clinical instructors to focus on their own areas of expertise—healthcare content and the evaluation of learners—rather than being distracted by technical challenges [1, 3].

Despite their essential nature, many simulation technicians feel unprepared when they first take the position [2]. Less than 50% of surveyed technicians felt that their prior education and work experience adequately prepared them for the role [2]. While most simulation technicians come from healthcare or technical backgrounds, the majority attribute their professional growth to experience over time and self-taught learning rather than formal instruction. However, technicians consistently identify a need for formal training to improve skills like moulage, research involvement, and course design [2].

Several national initiatives have attempted to address this training gap. In Australia, the AusSETT Program was developed as a national train-the-trainer model for both simulation educators and technicians [6]. This program offered a curriculum covering foundational learning theory, various simulation modalities, and technical maintenance. Evaluation of such programs suggests that a nationwide approach to training is valuable for supporting a competent simulation workforce and fostering a community of practice. Standardizing orientation and training would give incoming technicians a better understanding of role expectations and core concepts, while also refining existing certification programs [6].

In Portugal, the evolution of healthcare simulation followed a steady trajectory, beginning in the 1970s with the use of basic anatomic models and part-task trainers. It was formally recognized as a research area in 1998 at the Institute for Biomedical Engineering (INEB), and the first formal, structured simulation center was established in 2003 at the Faculty of Medicine of the University of Porto [7]. The field has matured significantly, leading to the creation of the Portuguese Society for Simulation in Health Sciences (SPSim) in 2011, which serves to promote research, establish national strategies, and foster international partnerships.

Recent mapping of the Portuguese landscape reveals a network of 23 formally constituted simulation centers [8], primarily concentrated in coastal regions and major urban hubs like Lisbon and Porto. A vast majority of these facilities (71,93%) are affiliated with academic institutions, with all Portuguese medical schools now housing a dedicated center. These centers provide training across all levels—pre-graduate, post-graduate, and continuing education—focusing heavily on areas such as emergency care, anesthesiology, and intensive care medicine [8].

Within this expanding network, the role of the simulation technician has become increasingly vital for institutional sustainability. National literature identifies a stable group of both instructors and technicians as a fundamental factor for the long-term success and sustainability of simulation programs. Data indicates that 82,61% of Portuguese simulation centers now include "technicians" as a specific target group for their training and educational activities, acknowledging their role as a distinct professional category within the simulation team [8].

However, despite the growth of these facilities and the recognized importance of technical support, a significant research gap remains. While recent studies have successfully mapped the geographical distribution and general characteristics of the centers themselves, there is currently no specific characterization of the simulation technician profile in Portugal. We lack data regarding their specific academic backgrounds, the range of tasks they perform daily, and their unique professional development needs within the Portuguese healthcare context. This study aims to fill that void by providing the first comprehensive cross-sectional analysis of these professionals, moving beyond the mapping of physical infrastructure to understand the human resources that drive simulation excellence in Portugal.

METHODS

This is a cross-sectional study, conducted in Portugal, through the voluntary participation of simulation technicians by filling an online survey (Appendix A). All activities described were implemented in partnership with the Portuguese Society for Simulation in Health Sciences (SPSim).

The study protocol received ethical approval from the Faculty of Medicine of University of Porto (251/CEFMUP/2024). Collected data was pseudonymized with unique study IDs, and participants agreed with their participation.

The STROBE reporting guideline [9] was followed.

Participants and sample size

A convenience sample was used to recruit simulation technicians, using SPSSim contacts network (emails), these contacts included simulation centers' general emails, simulation coordinators/directors' emails and simulation technicians' emails. Inclusion criteria required participants to be active simulation technicians in Portugal. Portuguese technicians working abroad were excluded.

The sample size was calculated based on a t-test, considering mean differences from a constant, with a significance level (α) of 0,05 and a power ($1-\beta$) of 0,80. An effect size of 0,80 was considered, based on an estimated large effect size. The sample size was estimated to be 12 participants using G*Power software [10].

Study design

The online survey (Appendix A) was developed by focus group. The group was comprised by 4 participants, led by the first author. Only one online meeting was done, taking around 3 hours. The survey collected three sets of data: (1) sociodemographic data, including age, gender, training background and simulation center location; (2) skills self-assessment, through a 5-point likert-scale for several common simulation tasks; and (3) training needs, including preferred training modalities. The skills self-assessment was based on several tasks and roles found on the literature [1, 2], and adapted by the focus group to the Portuguese context.

Participants were asked to participate voluntarily from June to July 2025.

Outcomes and Statistical Analysis

The primary outcome of this study is the skills self-assessment rating. Covariates included age, gender, training background, instructor course certification and simulation center location;

Descriptive and inferential statistical analysis was conducted using IBM SPSS Statistics software (version 30.0). Inferential statistics were performed to compare continuous variables between presence/absence of instructor course certification (subgroup analysis). Given the small and unequal sample sizes, non-parametric Mann-Whitney U tests were employed to assess differences between groups. To account for potential differences in variance and the small sample size, Glass's delta was calculated as an effect size measure. A two-sided p-value < 0.05 was considered statistically significant, and a Glass's delta ≥ 0.8 was interpreted as a large effect size. Findings were identified as robust only when they met both criteria: a statistically significant p-value and a large effect size.

RESULTS

Participants' characteristics

This study included 19 simulation technicians from Portugal, who answered the online survey. Participants were from 11 simulation centers, from different Portuguese regions: 10 (52.6%) from Porto, 3 (15.8%) from Lisbon, 2 (10.5%) from Algarve, 2 (10.5%) from Castelo Branco, 1 (5.3%) from Madeira and 1 (5.3%) from Viseu. Data analysis revealed institutional clusters, with multiple participants originating from the same simulation centers. Conversely, the total number of identified simulation centers [8] exceeds the number of reported technicians, suggesting that a subset of centers operates without dedicated technical staff.

Technicians had an average of 41.42 ± 6.86 years old, being 12 (63.2%) females and 7 (36.8%) males. Regarding education and background, as shown in Table 1, 6 (31.6%) participants have no degree, while 6 (31.6%) participants have a bachelor degree, 5 (26.3%) participants have a master degree and 2 (10.5%) participants have a doctor degree. Among those with degrees, the field of study is 5 (26.3%) in healthcare (mainly nursing) and 4 (21.1%) in engineering (mainly biomedical engineering). Only 7 simulation technicians reported to have attained a simulation instructor course, mostly EuSim Level 1 course.

Table 1 – Sociodemographic characterization (n = 19). Categorical data is presented as number of answers and percentage (%). Continuous data is presented as mean $\pm$ SD. SD represents standard deviation.

Gender		
Female		Male
12 (63.2%)		7 (36.8%)
Age (years)	41.42±6.86	
Simulation Center Location		
Porto	Lisbon	Algarve
10 (52.6%)	3 (15.8%)	2 (10.5%)
Castelo Branco	Madeira	Viseu
2 (10.5%)	1 (5.3%)	1 (5.3%)
Education Level		
High School	Bachelor (BSc)	Master (MSc)
6 (31.6%)	6 (31.6%)	5 (26.3%)
Doctor (PhD)		
2 (10.5%)		
Area of Degree (n = 13)		
Healthcare	Engineering	Other
5 (26.3%)	4 (21.1%)	4 (21.1%)
Instructor Course		
Yes		No
7 (36.8%)		12 (63.2%)
Simulation Experience (years)	7.05±5.31	
Sim. Dedication (hours/week)	28.58±14.86	
Salary (€, gross)(optional: n = 6)	1740.00±491.85	
Simulation Tasks		
Simulator Operation	Room Setup	Equipment Maintenance
16 (84.21%)	18 (94.74%)	15 (78.95%)

		Instructor - Undergraduate
Technical Support during Sessions	Staff Training	5 (26.32%)
13 (68.42%)	8 (42.11%)	
		Admin. – Financial
Instructor - Postgraduate		5 (26.32%)
2 (10.53%)	Admin. – Logistics	
	14 (73.68%)	
Researcher		
1 (5.26%)		

The participants reported to have 7.05 ± 5.31 years of simulation experience, with an average of 28.58 ± 14.86 hours per week of dedication. Most simulation technicians (12, 63.16%) work full-time in a simulation center (≥ 35 hours per week of dedication). The average gross salary reported ($n = 6$) is 1740.00 ± 491.85 €, per month, representing almost 2-times the Portuguese minimum gross salary of 2026 (920,00€) [11].

As shown in Table 1, the most executed simulation tasks are room setup (18, 94.74%), simulator operation (16, 84.21%) and equipment maintenance (15, 78.95%). The least executed tasks are research (1, 5.26%), postgraduate simulation instructor (2, 10.53%), undergraduate simulation instructor (5, 26.32%) and financial administration (5, 26.32%).

Skills Self-Assessment and Training

The global average rating of skills self-assessment is 3.54 ± 1.21 , in a scale from 1 (not very skilled) to 5 (very skilled), as shown in Table 2. Technicians, on average, reported less skills in “Use/Maintenance of Virtual and/or Augmented Reality Equipment” (2.42 ± 1.02), “Moulage” (2.79 ± 1.03) and “Debriefing” (2.79 ± 1.48). The tasks with higher skills reported, on average, are “Scheduling/Calendar Logistics” (4.47 ± 0.70), “Inventory Management” (4.21 ± 0.86) and “Handling of Medical Supplies/Equipment” (4.16 ± 0.77). This analysis reveals that the three highest-rated tasks are not related with the technical or technological dimensions of clinical simulation, focusing instead on administrative components.

Table 2

– Skills Self-Assessment Ratings (n = 19). Data is presented as mean $\pm$ SD. SD represents standard deviation. Likert-Scale (5-points) represents: 1 – Not Very Skilled; 5 – Very Skilled. Tasks were ordered from highest score to lowest score. Highlighted tasks represent ratings below the global average rating.

Task	Rating
Scheduling/Calendar Logistics	4.47 $\pm$ 0.70
Inventory Management	4.21 $\pm$ 0.86
Handling of Medical Supplies/Equipment	4.16 $\pm$ 0.77
Operation of Medium-High Fidelity Clinical Simulators	3.89 $\pm$ 1.15
Use of Audiovisual Equipment	3.89 $\pm$ 1.10
Assembly and Maintenance of Task Trainers	3.89 $\pm$ 1.10
Support for the Development of Clinical Scenarios	3.79 $\pm$ 0.92
Implementation/Assembly of Clinical Scenarios	3.74 $\pm$ 1.05
Equipment Acquisition Processes	3.58 $\pm$ 1.31
Maintenance of Medium-High Fidelity Clinical Simulators	3.42 $\pm$ 1.26
Support for scenarios with patients Standardized	3.37 $\pm$ 1.17
Research, Development and Innovation	3.21 $\pm$ 1.13
Being a standardized patient	3.00 $\pm$ 1.25
Debriefing	2.79 $\pm$ 1.48
Moulage	2.79 $\pm$ 1.03
Use/Maintenance of Virtual and/or Augmented Reality Equipment	2.42 $\pm$ 1.02
Global Average Rating	3.54 $\pm$ 1.21

Subgroup analysis based on instructor certification revealed statistically significant differences regarding "Support for the Development of Clinical Scenarios" ($p = 0.028$) and "Debriefing" ($p = 0.017$), as detailed in Table 3. These findings suggest that technicians with formal instructor training report higher confidence levels in scenario development and debriefing than their non-certified counterparts. While instructor-certified technicians generally assigned higher ratings across most tasks, these further differences did not reach statistical significance ($p \geq 0.05$).

Table 3

– Skills Self-Assessment analysis based on instructor course certification on simulation technicians. Data is presented as mean $\pm$ SD. SD represents standard deviation. Likert-Scale (5-points) represents: 1 – Not Very Skilled; 5 – Very Skilled.

Task	With Instructor Course (n = 7)	Without Instructor Course (n = 12)	p-value*	Glass's delta*
Operation of Medium-High Fidelity Clinical Simulators	4.57 $\pm$ 0.79	3.50 $\pm$ 1.17	0.056	0.918
Maintenance of Medium-High Fidelity Clinical Simulators	3.43 $\pm$ 1.51	3.42 $\pm$ 1.17	0.902	0.010
Support for the Development of Clinical Scenarios	4.43 $\pm$ 0.79	3.42 $\pm$ 0.79	0.028	1.276
Implementation/Assembly of Clinical Scenarios	4.29 $\pm$ 0.76	3.42 $\pm$ 1.08	0.083	0.802
Use of Audiovisual Equipment	4.14 $\pm$ 0.90	3.75 $\pm$ 1.22	0.592	0.323
Assembly and Maintenance of Task Trainers	4.00 $\pm$ 1.16	3.83 $\pm$ 1.12	0.773	0.150
Use/Maintenance of Virtual and/or Augmented Reality Equipment	2.71 $\pm$ 1.38	2.25 $\pm$ 0.75	0.432	0.616
Inventory Management	4.29 $\pm$ 1.11	4.17 $\pm$ 0.72	0.536	0.166
Scheduling/Calendar Logistics	4.71 $\pm$ 0.49	4.33 $\pm$ 0.78	0.384	0.489
Handling of Medical Supplies/Equipment	4.43 $\pm$ 0.54	4.00 $\pm$ 0.85	0.340	0.503
Moulage	3.14 $\pm$ 1.07	2.58 $\pm$ 1.00	0.482	0.562
Support for scenarios with patients Standardized	3.71 $\pm$ 0.95	3.17 $\pm$ 1.27	0.340	0.432
Being a standardized patient	3.57 $\pm$ 1.13	2.67 $\pm$ 1.23	0.120	0.735
Debriefing	3.86 $\pm$ 0.90	2.17 $\pm$ 1.40	0.017	1.205
Equipment Acquisition Processes	3.43 $\pm$ 1.40	3.67 $\pm$ 1.30	0.711	-0.183
Research, Development and Innovation	3.71 $\pm$ 0.95	2.92 $\pm$ 1.17	0.227	0.685
*Non-parametric test: Mann-Whitney U. p-value < 0.05 is statistically significant. Glass's delta $\geq$ 0.8 is considered a large effect size. Small p-value (< 0.05) and large delta ($\geq$ 0.8) is considered a robust finding.				

Regarding preferred training modality, simulation technicians reported that they prefer Short In-Person Courses (up to 1 day) (13, 68.4%) and Workshops (13, 68.4%), as shown in Table 4. The least preferred training modality is webinars (4, 21.1%). Participants self-reported their training needs as clinical

scenario development (31.58%), virtual and/or augmented reality (15.79%), simulator operation and maintenance (15.79%), debriefing (10.53%) and moulage (10.53%).

Table 4
– Preferred training modality (n = 19). Categorical data is presented as number of answers and percentage (%). Modalities were ordered from highest to lowest.

Training Modality	n (%)
Short In-Person Courses (up to 1 day)	13 (68.4%)
Workshops	13 (68.4%)
Asynchronous Online Courses	10 (52.6%)
Technical/Scientific Meetings	8 (42.1%)
Long In-Person Courses (> 1 day)	6 (31.6%)
Synchronous Online Courses	6 (31.6%)
Webinars	4 (21.1%)

The skills self-assessment has shown less confidence in tasks identified as training needs. However, the most requested training need is related with clinical scenario development.

DISCUSSION

The present study provides the first comprehensive characterization of simulation technicians in Portugal, offering critical insights into a professional group that has remained largely invisible in national healthcare literature. By analysing the demographic profiles, self-assessed competencies, and training needs of these professionals, we can begin to define the human infrastructure required to sustain the growing network of Portuguese simulation centers.

The primary aim of this study was to characterize the profile of simulation technicians in Portugal. Our findings reveal a remarkably heterogeneous group. Unlike some international counterparts where technicians often emerge from specific backgrounds like information technology or emergency medical services [2, 4], Portuguese technicians present a wide academic spectrum, ranging from individuals with no degree to those holding doctoral degrees. The predominant fields of study, nursing and biomedical engineering, suggest that the role in Portugal is being filled by professionals who bridge the gap between clinical practice and technical expertise.

While it brings a multidisciplinary perspective to simulation centers, the lack of a standardized educational pathway contributes to variable experience levels and fragmented role identities. The fact that the average age is 41 years with approximately seven years of experience suggests a mid-career workforce that has likely transitioned into simulation from other sectors, necessitating robust and specific professional development strategies.

A significant finding of this study is the disconnect between physical infrastructure and human resources. While recent mapping identified 23 formally constituted simulation centers in Portugal [8], our data shows that these centers are not uniformly staffed. We observed institutional clusters where single centers employ multiple technicians, yet a comparison with the total number of centers suggests that a subset of facilities operates without any dedicated technical staff.

This "empty center" phenomenon is concerning. As noted in the literature, the absence of dedicated technicians is a significant barrier to program success [3]. When centers lack technical staff, the burden of equipment maintenance, setup, and software operation falls into clinical instructors. This increases the cognitive load on educators, potentially detracting from the quality of student feedback and pedagogical engagement. In Portugal, the concentration of technicians in coastal urban hubs like Porto and Lisbon reflects the broader geographic disparity in healthcare resources, suggesting that smaller or more peripheral centers may be struggling to justify the financial investment in dedicated technical personnel.

The fact that the reported average salary is nearly double the national minimum suggests that the role is being recognized as a specialized position. However, to ensure long-term sustainability and talent retention, these salary levels must be paired with clear career progression pathways and standardized job descriptions.

The three highest-rated tasks by technicians' self-assessment - scheduling, inventory management, and handling clinical supplies/equipment - are primarily administrative and organizational rather than technical or technological. However, a clear confidence-competence gap emerges when looking at advanced or pedagogical tasks. Participants reported the least confidence in "Moulage," "Debriefing," and the "Use/Maintenance of VR/AR Equipment." This lack of confidence in VR/AR is particularly relevant as healthcare education trends toward immersive technologies. If technicians do not feel skilled in maintaining these tools, the likelihood of successful institutional adoption is low.

Furthermore, the data shows that the skills self-assessment scores are inversely related to identified training needs. Technicians feel the least confident in the areas where they most desire instruction. Additionally, the most requested training need is related to clinical scenario development. This is a pivotal finding; it indicates that technicians are looking to move beyond "button-pushing" and equipment setup toward a more integrated role in the pedagogical design process.

Our subgroup analysis highlights the transformative power of formal training. Technicians who had completed an instructor course (such as EuSim Level 1) reported statistically significant higher confidence in "Support for the Development of Clinical Scenarios" and "Debriefing" compared to their non-certified peers.

This suggests that when a technician understands the "why" (the pedagogy) behind the "how" (the technology), they become a more effective collaborator. This supports the "pedagogic domain" of competency identified in recent research [4]. Certified technicians are not just operators; they are

partners who can ensure that educational cases are compatible with available technology, thereby enhancing the overall realism and efficacy of the simulation.

The findings underscore an urgent need for a structured, nationwide training program for simulation technicians in Portugal. Participants expressed a clear preference for short, in-person courses and workshops over digital modalities like webinars. This preference likely stems from the "hands-on" nature of the profession, where tactile skills like moulage or hardware troubleshooting are best learned through direct practice.

A national training initiative, perhaps led by SPSim or in collaboration with academic institutions, should prioritize: (1) Pedagogical Integration: training in scenario design and the basics of debriefing to bridge the gap between technical support and clinical education; (2) Advanced Technology: Focused workshops on VR/AR and simulator maintenance to future-proof the workforce; and (3) Creative Realism: Moulage training to enhance the fidelity of simulated environments;

Limitations

While this study provides valuable baseline data, several limitations must be considered. First, the findings are subject to selection bias, as participation was voluntary and the survey may not have reached all active simulation technicians in Portugal. Consequently, the perspectives of those who did not respond may differ from the current sample. Second, the sample size is relatively small ($n = 19$); however, it is important to note that the total population of simulation technicians in Portugal remains limited, as many simulation centers currently operate without dedicated technical staff.

CONCLUSIONS

Simulation technicians in Portugal are a dedicated but heterogeneous group. The existence of centers without technicians remains a critical weakness in the national simulation infrastructure. To leverage the full potential of simulation-based education in Portugal, investment must shift from purely physical equipment to the professional development of the human resources that operate it. Building a standardized, hands-on training program is not just a benefit for the technicians, it is a necessity for the safety and quality of healthcare education in Portugal.

Declarations

CONFLICTS OF INTEREST AND FUNDING

The authors declare that there is no conflict of interest. This study was conducted in partnership with the Portuguese Society for Simulation in Health Sciences (SPSim).

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AVAILABILITY OF DATA AND MATERIALS

The dataset supporting the conclusions of this article is available and can be requested to the corresponding author.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study protocol received ethical approval from the Faculty of Medicine of University of Porto (251/CEFMUP/2024). Collected data was pseudonymized with unique study IDs, and participants agreed with their participation. The survey presented a disclosure with information regarding the study participation, including the purpose of the study, data anonymity and right to withdraw. Reading the disclosure and voluntarily completing the survey served as implied consent. The authors declare that all procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975 (In its most recently amended version).

CONSENT FOR PUBLICATION

Not applicable.

Author Contribution

• AN, CG and IP contributed to the conception and design of the study;• AN and EG implemented the study and collected the data;• AN analysed and interpreted the data;• AN drafted the article. CG and IP made important and critical contributions to the content;• All authors reviewed it critically;• All authors have approved the manuscript version submitted and agree with its submission.

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Supplementary Files

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- [AppendixA.docx](#)