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RESEARCH ARTICLE (ORIGINAL)

Knowledge, satisfaction, and self-confidence in health professionals: simulation with manikin versus simulated patient

Conhecimentos, satisfação e autoconfiança em profissionais de saúde: simulação com manequim versus paciente-ator

Conocimiento, satisfacción y autoconfianza en los profesionales de la salud: simulación con maniquí frente a paciente-actor

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Abstract

Background: Combining various teaching strategies that merge theory and practice has been considered an efficient method in health education.
Objective: To compare health professionals' knowledge, satisfaction, and self-confidence regarding clinical simulation with a high-fidelity manikin or a simulated patient.
Methodology: A quasi-experimental study was carried out through the application of a theoretical knowledge test and the Student Satisfaction and Self-confidence in Learning Scale during a theoretical-practical course in prenatal care for health professionals. An inferential statistical analysis was performed.
Results: Considering the 44 participants in the study, the mean of correct answers was 7 in the first theoretical knowledge test, and 8 in the second. Knowledge increased after theoretical explanation and simulation ($p < 0.000$). There was no significant difference between the "Actor" and "SimMan" simulation groups ($p > 0.05$) in the two dimensions concerning satisfaction and self-confidence.
Conclusion: The overall mean of satisfaction and self-confidence was higher in the "Actor" group than in the "SimMan" group.

Keywords: simulation; professional retraining; learning; high fidelity simulation training; patient simulation

Resumo

Enquadramento: A associação de diferentes estratégias de ensino na saúde que articulem teoria e prática tem sido apontada como um mecanismo eficaz no ensino.
Objetivo: Comparar o conhecimento, satisfação e autoconfiança de profissionais de saúde em relação à simulação clínica com manequim de alta fidelidade *versus* paciente-ator.
Metodologia: Estudo quase experimental que ocorreu por meio de aplicação de prova de conhecimentos e Escala de Satisfação dos Estudantes e Autoconfiança na Aprendizagem durante um curso teórico-prático com a temática pré-natal para profissionais da saúde. Procedeu-se a análise estatística e inferencial.
Resultados: Dos 44 participantes, a média de respostas corretas na primeira prova de conhecimentos foi de 7 e na segunda prova de conhecimentos de 8. O conhecimento aumentou após exposição teórica e simulação ($p < 0,000$). Pôde observar-se que não houve diferença significativa entre os grupos "Ator" e "SimMan" ($p > 0,05$) dos dois domínios que abordam a satisfação e a autoconfiança.
Conclusão: A média geral da satisfação e autoconfiança foi maior no grupo com atores comparando com o "SimMan".

Palavras-chave: simulação; reeducação profissional; aprendizagem; treinamento com simulação de alta fidelidade; simulação de paciente

Resumen

Marco contextual: La asociación de diferentes estrategias de enseñanza de la salud que articulan la teoría y la práctica se ha señalado como un mecanismo eficaz en la enseñanza.
Objetivo: Comparar los conocimientos, la satisfacción y la autoconfianza de los profesionales de la salud en relación con la simulación clínica con un maniquí de alta fidelidad frente a un paciente-actor.
Metodología: Estudio casi experimental realizado mediante la aplicación de la prueba de conocimientos y la Escala de Satisfacción de los Estudiantes y Autoconfianza en el Aprendizaje durante un curso teórico-práctico sobre el tema prenatal para los profesionales de la salud. Se realizó un análisis estadístico e inferencial.
Resultados: De los 44 participantes, la media de respuestas correctas en la primera prueba de conocimientos fue de 7 y en la segunda prueba de conocimientos, de 8. El conocimiento aumentó después de la exposición teórica y la simulación ($p < 0,000$). Se pudo observar que no había una diferencia significativa entre los grupos "Actor" y "SimMan" ($p > 0,05$) de los dos dominios que abordan la satisfacción y la autoconfianza.
Conclusión: La media general de la satisfacción y la autoconfianza fue mayor en el grupo con actores en comparación con el "SimMan".

Palabras clave: simulación; reentrenamiento en educación profesional; aprendizaje; enseñanza mediante simulación de alta fidelidade; simulación de paciente

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Introduction

Simulation is considered an efficient and innovative method that expands the relations between students' theoretical knowledge and practical knowledge in a controlled and risk-free environment. Simulation also contributes to the professional education of students, providing them with better opportunities to learn and train (Baptista, Martins, Pereira, & Mazzo, 2014).

Health professionals' training based on realistic simulation allows practicing essential skills in an environment that tolerates errors and favors professional growth, without any risk to patient safety. Therefore, it is possible to improve skills without harming the patient during the learning process, where knowledge is developed using simulated situations in protected and controlled scenarios (Negri et al., 2017).

Technological advances have contributed to the implementation of simulation strategies. The market offers low-, medium-, and high-fidelity simulators, with fidelity referring to the level of technology of the simulator, and not to the characteristics of the simulated scenario. Low-fidelity simulators focus on training skills and are low-cost and low-maintenance. The manikins are full or partial body representations, similar to human anatomy, which allow sudden movements but do not provide feedback on the interventions performed. Medium-fidelity simulators go beyond the anatomical representation, allowing the interaction with students in a simple scenario, like more or less complex activities for the development of specific skills. Apart from their humanlike appearance, these manikins make breath and heart sounds, allowing for the monitoring of the heartbeat and heart's electrical system. High-fidelity manikins are physiologically similar to a person. They respond to actions performed during the activity and can move and produce sounds and noises while allowing the monitoring of vital signs and hemodynamic status, and covering a large number of real-life scenarios with multiple interventions. They are computerized (Martins et al., 2012) and require specialized maintenance, making them expensive and, therefore, difficult to afford.

A review study by Oliveira, Prado, and Kempfer (2014) states that simulation contributes to increased confidence and self-efficacy, improves communication, performance and knowledge, besides providing fast feedback and active and reflective learning. The use of simulation also favors teamwork, decision-making, and clinical judgment, associated with students' satisfaction. Considering the study conducted by Ferreira, Guedes, Oliveira, and Miranda (2018), which revealed an increase in students' satisfaction and self-confidence after participating in simulation activities, this study aims to know whether health professionals' satisfaction and self-knowledge change when the simulation is carried out with a simulated patient or a high-fidelity manikin.

Organizing health professionals' training is not simple, as they are overworked and are frequently not allowed to leave work to attend training sessions. Combining various teaching strategies that merge theory and practice has been considered efficient in health teaching, allowing for the development of more observant, reflective, and qualified professionals, mature enough to meet society's needs (Negri et al., 2017).

This study may contribute to the insertion and analysis of new active learning/teaching methods and strategies for health professionals through permanent education. The use of teaching strategies accepted by health professionals tends to increase their participation in training courses.

The purpose of this study is to compare health professionals' knowledge, satisfaction, and self-confidence regarding clinical simulations with a high-fidelity manikin or a simulated patient.

Background

Recent studies have addressed realistic simulation and shown that it is an efficient method for the teaching-learning process, particularly in what regards students' study. This method brings students closer to reality while allowing them to make mistakes, redo their actions, suggest interventions, and care for patients without risks. In clinical settings, these actions could be harmful, leading to longer hospitalization periods and considerable hospital expenses (Rohrs, Santos, Barbosa, Schulz, & Carvalho, 2017).

When describing the importance of simulation and its dimensions, Negri et al. (2017) highlight that simulation is frequently used in the training of students and experienced professionals, being adopted in training programs by educational and health institutions.

In a simulation, educators should have the specific knowledge and skills necessary to prepare their students. They should also consider their students' level of experience and learning before placing them in a simulation activity. Preparing the scenario is an important stage in ensuring the efficacy of the simulation. This preparation includes setting up the situation being reproduced, preparing the manikin or simulated patient, and defining clear objectives for the activity. In this process, mistakes and failures can occur, which, when not handled correctly by the educator, may compromise the success of the strategy and teaching quality. This promotes learning, together with the sharing and adaptability to different teaching contexts (Silva & Oliveira-Kumakura, 2018).

The simulated patient consists of an actor trained to portray patient behaviors in various scenarios and health care units. Meetings are held with the researchers to prepare actors, defining and explaining the objectives of their performance (Costa, Medeiros, Coutinho, Mazzo, & Araújo, 2020). High-fidelity manikins are computerized and respond according to the answers provided by the operating system.

Studies point out that combining various teaching strategies, such as the traditional ones (expository method and skill training), and simulation activities, promotes students' satisfaction and self-confidence (Costa et al.,

2020; Ferreira et al., 2018). This way, satisfied and self-confident students should be able to acquire the knowledge presented to them and develop skills and abilities that they will apply in clinical practice, thus changing reality in their professional environment (Costa et al., 2020).

Research hypothesis

High-fidelity simulation with health professionals showed better results than the simulation with an actor in the domains of knowledge, satisfaction, and self-confidence.

Methodology

A quasi-experimental study was conducted with primary health care professionals that perform prenatal consultations.

The study was developed within the context of the Evidence-Based Prenatal Course (PRENABE) held by the Nursing Department in partnership with the Postgraduate Degree in Health Education (EnSa) of the Federal University of Vales do Jequitinhonha and Mucuri (UFVJM). It was a 40-hour course. Theoretical classes were taught by an obstetrician from Sofia Feldman Hospital (HSF), using expository and interactive methods, and were based on clinical cases. Practical classes were held in the laboratories, and the teaching strategy was solving complex scenarios in a realistic environment.

The event was promoted on the UFVJM website and social networks. Promotional posters were also printed and put up in health care units or circulated in meetings or sent to municipal managers' e-mails. Sixty vacancies were distributed among nurses and doctors. The study material was sent one week before the course for prior reading to those who registered. When registering, the participants filled out an online form with their name, data regarding the service at the prenatal consultation, their age, city, and profession.

Before the in-person activities of the course began, participants were invited to be part of the study. The refusal to participate in the study did not exclude them from conducting the PRENABE activities.

To evaluate their knowledge, participants took a theoretical knowledge test, with a total of 10 questions, on the topic of prenatal care, before (pre-test) and after (post-test) the course.

The knowledge test included questions from Brazilian tenders available online. Five experts in the area validated the knowledge test and case studies used in the simulation in prenatal care. The expert panel was selected based on Fehring's criteria (1987). The questions in the knowledge test and clinical cases were evaluated concerning the clarity, objectivity, and relevance of the evaluation items. Suggestions were accepted, respecting the minimum agreement degree of 80% for each item, according to the Kappa index. The agreement degree of this study was 100% in each item.

Forty-four health professionals attended the course. After theoretical classes, participants were divided into two groups: one group (22 individuals) participated in a high-fidelity simulation with an actor, and the other group with a high-fidelity manikin, the SimMan 3G (22 participants). Participants were divided by drawing lots of each professional category, with each group being made up of physicians and nurses in equal proportion. Participation in the three scenarios had a total of 63 participants in the simulations with an actor and 53 participants in the simulation with high-fidelity manikins. For professional reasons, not all health professionals could participate in all scenarios.

Each scenario lasted approximately 30 minutes, with 5 minutes for scenario recognition, 15 for development, and 10 for debriefing.

The scenario themes were first trimester bleeding, vaccines, and gestational diabetes mellitus. The choice of topics was based on another study conducted by the same authors, who identified an inadequate practice by the professionals identified in the registrations for the prenatal patient card. The reproduction of the scenarios followed the simulation design guidelines regarding the teaching-learning objectives, fidelity, problem-solving, student support, and debriefing (Lemos, 2011). The scenarios were built based on literature review and in collaboration with experts in the clinical area.

The Student Satisfaction and Self-confidence in Learning Scale (ESEAA), validated into the Portuguese language by Almeida et al. (2015), was applied to verify students' satisfaction and self-confidence with the method. The scale aims to measure the individual's satisfaction and self-confidence acquired during a high-fidelity simulation experience. It is composed of 13 five-point Likert-type items, divided into two dimensions (Satisfaction - item 1 to 5, and Self-confidence in Learning - item 6 to 13).

Data were organized in Microsoft Excel and analyzed with IBM SPSS Statistics software, version 23.0, and in R, version 3.5.1. The absolute and relative frequencies were used in the descriptive analysis of the categorical variables for sample characterization. Measures of position, central tendency, and dispersion were used in the description of numerical variables and construct items. One of the measures used was the bootstrap confidence interval of 95%.

The indicators were created from the mean value of their respective items. The Mann-Whitney test was used to compare scores between the participant groups, actor and SimMan, with a significance level of 5%. The Wilcoxon test was used to assess equity between paired samples.

The project was approved by the Research Ethics Committee of the Federal University of Vales do Jequitinhonha e Mucuri (CEP/UFVJM; Opinion no. 2.781.672).

Results

Of the 44 participants, 25 (55.6%) were female, 13 (28.9%) male, and 7 (15.5%) did not provide this information. The mean age was 32.80 years (*SD* = ± 8.25 years). Twenty-two (50%) were nurses, and the other 22 (50%) were doctors. The individuals' mean training time was 7.78 years (*SD* = ± 7.20 years).

The mean of correct answers in the first theoretical knowledge test (pre-test) was 7 (minimum of 4 and maximum of 9), and 8 (minimum of 6 and maximum of 9) in the second test (post-test), after theoretical and simulation classes. There was a statistically significant difference between the scores obtained in the two tests ($p < 0.000$), with the level of knowledge increasing after theoretical classes and simulation.

All items on the scale show a mean higher than 3, meaning that all participants agreed with the items on it. In the domain of satisfaction with current learning, the item with the mean closest to *strongly agree*, regarding the simulation with an actor, was statement 1 (The teaching methods used in this simulation were useful and effective) and, regarding the SimMan simulation, it was statement 5 (The way my instructor(s) taught the simulation was suitable to the way I learn). In the domain Self-confidence in Learning, the item that presented the mean closest to *strongly agree*, for the simulation with an actor, was statement 11 (I know how to get help when I do not understand the concepts covered in the simulation) and, for the SimMan simulation, it was statement 10 (It is my responsibility as the student to learn what I need to know from this simulation activity).

Table 1 provides the description and comparison of the items in the scale (Simulated Patient and SimMan).

Table 1
Description of the items in the ESEAA questionnaire

Construct	Items	Simulated Patient				SimMan*			
		n	Mean	*SD*	CI - 95%[1]	*n*	Mean	*SD*	CI - 95%[1]
Satisfaction with current learning	QS1	63	4.30	0.50	[4.19; 4.43]	53	3.89	0,89	[3,64; 4,13]
	QS2	63	3.95	0.87	[3.73; 4.16]	53	3.79	0,88	[3,55; 4,02]
	QS3	63	4.11	0.60	[3.97; 4.27]	53	4.08	0,73	[3,89; 4,26]
	QS4	63	3.92	0.79	[3.71; 4.11]	53	3.89	0,95	[3,62; 4,13]
	QS5	63	4.10	0.71	[3.92; 4.27]	53	4.09	0,71	[3,91; 4,28]
	Overall	63	4.08	0.59	[3.94; 4.21]	53	3.95	0,71	[3,75; 4,15]
Self-confidence in learning	QS6	63	4.05	0.73	[3.87; 4.22]	52	4,21	0,72	[4,00; 4,40]
	QS7	63	4.03	0.80	[3.81; 4.22]	53	3,92	0,90	[3,70; 4,17]
	QS8	63	4.24	0.53	[4.11; 4.37]	53	4,13	0,76	[3,92; 4,30]
	QS9	63	4.14	0.53	[4.02; 4.27]	53	4,06	0,66	[3,89; 4,21]
	QS10	63	4.25	0.69	[4.08; 4.41]	53	4,32	0,64	[4,15; 4,49]
	QS11	63	4.27	0.57	[4.14; 4.40]	53	4,15	0,72	[3,94; 4,32]
	QS12	63	4.19	0.59	[4.05; 4.33]	53	4,09	0,71	[3,91; 4,28]
	QS13	63	3.90	0.84	[3.68; 4.11]	53	3,77	1,07	[3,47; 4,04]
	Overall	63	4.13	0.44	[4.03; 4.24]	52	4,07	0,56	[3,92; 4,23]

Note. *SimMan = high-fidelity manikin; QS = statement; SD = standard deviation; CI = confidence interval. [1]Bootstrap confidence interval.

Table 2 shows the comparison between the scale answers obtained in the Actor and SimMan scenarios regarding questionnaire indicators.

There was no significant difference between Actor and SimMan groups ($p > 0.05$) in the two domains concerning satisfaction and self-confidence.

Table 2
Comparison between the Actor and SimMan manikin simulation groups regarding the ESEAA questionnaire

Construct	Group	*n*	Mean	SE	1st St.	2nd St.	3rd St.	*p*-value[1]
Satisfaction with current learning	Actor	63	4,08	0,07	3,80	4,00	4,40	0,369
	SimMan	53	3,95	0,10	3,60	4,00	4,20	
Self-confidence in learning	Actor	63	4,13	0,06	3,94	4,00	4,38	0,575
	SimMan	53	4,07	0,08	3,69	4,00	4,44	

Note. SE = Standard Error; Q. = Quadrant. [1] Mann-Whitney Test.

Discussion

Considering sample characterization, the majority of the 44 study participants were female (55.6%), a fact also occurring in another simulation study in which the majority of the participants were female (84.3%; Ferreira et al., 2018).

However, the mean age of 32.8 years differs from the other studies found, possibly because the majority of the studies were carried out with undergraduate students (Nascimento & Magro, 2018).

The mean grade in the theoretical knowledge test, both pre-test and post-test, was considered good, with classifications of 7 and 8 respectively, on a 1-10 scale. It should also be noted that the study sample is composed of professionals already working in the area and that the previous reading of relevant literature contributed to their performance in the knowledge tests.

The use of simulation as a teaching method applies to permanent education in health, in which problem-solving is based on real professional practice. Thus, teaching and practice are linked and, consequently, technical skills and science are updated (Miccas & Batista, 2014).

The level of satisfaction had a mean score of 4.08 for the simulation with the actor and 3.95 with the SimMan manikin. Studies show that undergraduate students were very satisfied with learning using high-fidelity simulation, with mean scores between 4.1 and 4.6 (Kuznar, 2007; Smith & Roehrs, 2009; Swenty & Eggleston, 2010). Similar data were found regarding the analysis of each item in the scale, indicating that students agree with all statements concerning satisfaction with simulation-based learning. One study applied the scale to 68 nursing students, who reported satisfaction in simulation-based learning (Mean = 4.5; Smith & Roehrs, 2009).

Students express their satisfaction with high-fidelity simulation practice because it is a new teaching-learning strategy that allows them to objectively perceive their evolution and become increasingly aware of their performance (Baptista et al., 2014). Another recent study emphasizes that, despite the disadvantages and advantages of using simulation as a teaching method, students' satisfaction with the activity is evident, as well as their level of knowledge acquired and their responsible participation during the development of the activity. Facts that reinforce the benefits of simulation for quality of work, teaching, and learning (Souza, Silva, & Silva, 2018).

Oliveira and collaborators (2014), in a review study, state that simulation contributes to increase confidence and self-efficacy and improve communication, performance, and knowledge, besides providing fast feedback and active and reflective learning. Furthermore, simulation favors teamwork, decision-making, and clinical judgment, associated with students' satisfaction. It should also be noted that these contributions occur in safe and realistic settings, being reflected in clinical practice, but without causing any risks to patients.

Self-confidence is a feeling constantly associated with repeated experiences and the realistic reflection on the limitations and particular capabilities of each person, which can be provided by clinical simulation. Self-confidence is the perception of the ability to perform tasks successfully. Self-confidence expectations are necessary prerequisites for the occurrence of positive changes in students' behavior and actions. Reactions and feelings can directly influence the development of self-confidence, as they stimulate the courage to act according to one's skills, values, and objectives. The experiences acquired during training contribute to positive academic self-confidence and make students aware of appropriate patterns of behavior throughout their education. Therefore, nurses and physicians with higher levels of self-confidence have better chances of being successful in their interventions because they can promptly test and apply their skills and knowledge, having the courage to assume greater responsibility in their professions (Hicks, Coke & Li, 2009; Baptista et al., 2014). Besides, studies such as this show that, after performing realistic simulation activities, students' self-confidence is improved (Ferreira et al., 2018; Nascimento & Magro, 2018; Smith & Roehrs, 2009).

Different studies report that participants demonstrated high levels of self-confidence (Smith & Roehrs, 2009; Kimhi, Reishtein, Cohen, Hurvitz, & Avraham, 2016). In the studies analyzed which used Likert-type scales and obtained values between 1 (*strongly disagree*) and 5 (*strongly agree*), students showed self-confidence mean scores that varied between 3.81 and 4.5. These data support the results presented in this study, in which the mean scores found were 4.13 for simulation with an actor and 4.08 for SimMan simulation. A study revealed that simulation favors self-confidence in nursing students, even among those who have already experienced real clinical situations (Kimhi et al., 2016).

The results in Table 2, which presents the answers for the two dimensions of the scale, determine that there was no statistically significant difference in the scenario. This means that a simulated patient can be used to ensure a high-fidelity and low-cost simulation.

Dudley (2012) corroborates this study by stating that clinical simulation using actors can be a viable strategy for rethinking the way students are taught. It is a relatively low-cost teaching strategy, and actors' participation can make scenarios more realistic when exploring communication, which promotes the clinical simulation process.

The overall satisfaction mean was higher in the group with actor simulation (4.08) than with the SimMan group (3.95). The self-confidence level was also higher in the simulation with the actor (4.13) than in the SimMan simulation (4.08). Simulation with high-fidelity manikins is more expensive and high-maintenance. Also, it is a known fact that Brazilian public universities have faced large budget cuts, so the use of simulated patients is more sustainable.

Technological advances and the use of the Internet have proven to be a challenge to training programs for professionals due to the easy access to articles and applica-

tions. Thus, traditional methods tend to be less attractive to professionals, particularly to those with a high workload. The use of theoretical materials followed by the traditional approach of study case analysis based on scientific evidence and clinical simulation proved to be efficient teaching methods to adopt with health professionals.

The participation of health professionals during the entire course hours limited the scope of this study. As the health professionals were working, they were not able to participate 100% in all three simulations.

Conclusion

The study concluded that the use of different teaching strategies is welcomed by health professionals and contributes to their knowledge increase.

The simulations facilitated the teaching-learning process and facilitated the professionals' experience in scenarios that could occur at the primary health care unit where they work. The professionals' levels of satisfaction and self-confidence were high. This is relevant for permanent education in health, proving that training with simulation benefits practice.

The study demonstrates that simulation with actors can be a low-cost method that contributes positively to students' learning, satisfaction, and self-confidence.

It was also observed that the simulation activities allowed health professionals to feel safer and more confident when performing the procedures, as they were able to identify and reformulate their attitudes.

Although many studies focus on active methods for professional training, few studies address permanent education for health professionals. In this sense, futher studies should be conducted with health professionals, using realistic simulation to improve health practices and reinforce multi/interprofessional work.

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