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Impact of the evaluators' presence in simulated scenarios focused on Advanced Life Support: a randomized clinical trial

Impacto da presencialidade do avaliador em simulação clínica de suporte avançado de vida: ensaio clínico randomizado

Impacto de la presencia del evaluador en la simulación clínica de soporte vital avanzado: ensayo clínico aleatorizado

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ABSTRACT

Objective: to examine how direct and indirect evaluators' presence affects Nursing students' performance in simulated clinical scenarios focused on Advanced Life Support. **Method**: a randomized clinical trial involving 68 Brazilian Nursing students: 35 allocatged to the Experimental Group and 33 to the Control Group. The Experimental Group participated in simulation activities without visible evaluators' presence, while the Control Group was observed by a visible evaluator. Data analysis included Student's t-test, ANOVA, Mann-Whitney and Shapiro-Wilk tests. The research protocol was approved by the Ethics Committee. **Results**: the mean performance scores reached 4.63 (±1.61) in the Experimental Group and 4.37 (±1.31) in the Control Group, with no statistically significant difference (p=0.477). Significant improvement was found in theoretical knowledge (p<0.001). **Conclusion**: whether visible or not, the evaluators' presence did not influence Nursing students' practical performance in the simulation. Theoretical knowledge increased across the pre-test, immediate post-test, and delayed post-test.
Descriptors: Education, Nursing; Heart Arrest; Advanced Cardiac Life Support; Simulation Training; Patient Simulation.

RESUMO

Objetivo: analisar o efeito das presencialidades direta e indireta do avaliador nas habilidades de estudantes de enfermagem em um cenário clínico simulado sobre suporte avançado de vida. **Método**: ensaio clínico randomizado, com 68 estudantes brasileiros, sendo 35 do grupo experimental e 33 do controle. O grupo experimental acessou cenário clínico simulado sem a presença visível do avaliador, enquanto grupo controle contou com a presença visível do avaliador. Análises realizadas por meio de teste t-Student, ANOVA, Mann-Whitney e Shapiro-Wilk. Protocolo de pesquisa aprovado pelo Comitê de Ética. **Resultados**: a média de acertos no grupo experimental foi de 4,63(±1,61) e, no grupo controle, de 4,37(±1,31), não havendo diferença estatística significativa (p =0,477). Houve melhora nas médias do conhecimento teórico (<0,001). **Conclusão**: a presença direta ou indireta do avaliador não interferiu no desempenho dos estudantes de enfermagem, no que tange às habilidades práticas desenvolvidas, com aquisição de conhecimento teórico entre o pré-teste, o pós-teste imediato e o pós-teste tardio.
Descritores: Educação em Enfermagem; Parada Cardíaca; Suporte Vital Cardíaco Avançado; Treinamento por Simulação; Simulação de Paciente.

RESUMEN

Objetivo: analizar el efecto de la presencia directa e indirecta del evaluador sobre las habilidades de los estudiantes de enfermería en un escenario clínico simulado de soporte vital avanzado. **Método**: ensayo clínico aleatorizado, con 68 estudiantes brasileños: 35 en el grupo experimental y 33 en el grupo control. El grupo experimental estuvo en el escenario clínico simulado sin la presencia visible del evaluador, mientras que el grupo control contó con dicha presencia visible. Los análisis se realizaron mediante la prueba t de Student, ANOVA, Mann-Whitney y Shapiro-Wilk. El protocolo de investigación fue aprobado por el Comité de Ética. **Resultados**: la media de aciertos del grupo experimental fue de 4,63 (±1,61) y la del grupo control de 4,37 (±1,31), no hubo diferencia estadísticamente significativa (p=0,477). Las medias de conocimiento teórico mejoraron (<0,001). **Conclusión**: la presencia directa o indirecta del evaluador no interfirió en el desempeño de los estudiantes de enfermería, en lo que respecta a las habilidades prácticas desarrolladas, en la adquisición de conocimiento teórico entre el pre-test, el post-test inmediato y el post-test tardío.
Descriptores: Educación en Enfermería; Paro Cardíaco; Apoyo Vital Cardíaco Avanzado; Entrenamiento Simulado; Simulación de Paciente.

INTRODUCTION

Cardiorespiratory arrest (CRA) represents a highly prevalent medical emergency and remains one of the main outcomes in cardiovascular disease[1,2] progression, with ischemic heart disease as the leading contributor[1]. Estimates indicate over 350,000 annual CRA cases in the United States, approximately 290,000 occurring within hospital environments[3]. In Brazil, roughly 200,000 cases are reported each year, with nearly half taking place in inpatient settings[1]. Survival rates

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vary worldwide depending on location and care quality[4–6], ranging from 3.9% to 24.2% in hospitals and 2% to 11% in out-of-hospital scenarios[5]. In healthcare institutions, early CRA recognition and timely implementation of advanced cardiac life support (ACLS) protocols are linked to improved clinical outcomes[4-7]. ACLS primarily involves immediate cardiopulmonary resuscitation (CPR), prompt defibrillation for shockable rhythms, and initial administration of epinephrine for non-shockable rhythms[7].

Some studies show that high-quality CPR significantly increases survival chances for hospitalized patients[8,9]. In-hospital CRA survival rates vary, with the best results associated with teams consistently trained in resuscitation protocols[4,7-9].

The American Heart Association (AHA) guidelines for CPR emphasize the importance of bridging the gap between knowledge and practice through frequent training, particularly clinical simulation[10]. Clinical simulation serves as an educational method that replicates real-life clinical conditions within controlled environments using predefined technologies and procedures to develop and enhance practical skills[2].

Given studies showing that traditional theoretical-practical education often fails to ensure safe and effective CRA responses[12,13], the use of innovative teaching strategies becomes essential. One investigation involving 89 Australian nursing students evaluated simulation-based CPR training and reported significant improvement in both skill levels ($p<0.001$) and theoretical knowledge ($p<0.001$), along with high satisfaction and self-confidence ratings among participants[11].

Due to its capacity to replicate real-life scenarios, clinical simulation emerges as a promising educational tool. However, elements such as evaluator presence during simulation can influence student performance[2]. Conversely, a U.S.-based study on instructor presence during simulation, which explored student anxiety and self-confidence during medical-surgical training, found no significant performance differences between groups, although it highlighted the need for further research on this variable[14].

This study aimed to assess the effect of direct and indirect evaluator presence on nursing students' performance in an ACLS clinical simulation. As a secondary objective, it also examined students' theoretical knowledge before and after the educational intervention and their satisfaction with the simulation design.

METHOD

This study followed a single-blind, parallel-group, randomized clinical trial (RCT) design. It was conducted with fourth-year undergraduate nursing students at Universidade Federal de Juiz de Fora (UFJF), Minas Gerais, Brazil, between August and December 2023. The trial adhered to CONSORT[15] guidelines for non-pharmacological interventions and was registered at the Brazilian Registry of Clinical Trials (ReBEC) under code RBR-6bc6xcx.

A total of 73 students enrolled in the seventh or eighth semesters were eligible to participate, provided they had not yet attended classes covering advanced cardiovascular life support (ACLS), which is usually offered during the eighth semester. For seventh-semester students, the course schedule was adjusted to accommodate ACLS training in alternative time slots, without affecting other subjects. Exclusion criteria included temporary enrollment suspension or absence from any study activity. Discontinuation criteria involved failure to attend any study session.

Sample size was calculated using R® software (version 3.2.0), based on a 5% significance level, intraclass correlation coefficient of 0.5, medium effect size ($d=0.5$), and 80% statistical power. The minimum required sample included 62 students, with 31 participants per group. However, more students were admitted to ensure group representativeness and meet inclusion criteria.

Block randomization was performed using the R® software by an external professional not involved in data collection. Both students and evaluators remained unaware of group assignments. Only on the day of the intervention did the lead researcher access the group lists. Activity schedules and instructions were emailed individually by an external staff member.

Following randomization procedures, students in the experimental group (EG) participated in the clinical simulation without visible evaluator presence, whereas control group (CG) students were observed by a visible evaluator during simulation activities. Based on the study's primary aim, the proposed hypothesis was that the absence of a visible evaluator would positively impact student performance in the ACLS simulation scenario. In relation to the secondary objective, the hypothesis was that theoretical knowledge would improve in both groups.

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Study variables were collected using: a sociodemographic questionnaire (gender, age, race, semester); closed questions regarding prior simulation experience and first aid training; a five-item multiple-choice knowledge test on ACLS, each item offering four answer options[16]; and a validated skills checklist[17] featuring six essential ACLS actions, marked as “performed” or “not performed”.

Data collection took place from October to December 2023 and was divided into six stages (S1 to S6) as part of an educational intervention. During S1, the students completed the theoretical knowledge pre-test. The intervention included both theoretical and practical activities, with skills assessment conducted in a simulation lab during S5. In S6, theoretical knowledge was reassessed immediately after the intervention (immediate post-test) and one month later (delayed post-test) to evaluate knowledge retention. The same instrument was used for all three assessments, enabling direct comparison over time.

During S1, prior to content delivery and assessment, students filled out the sociodemographic questionnaire and answered validated multiple-choice questions on ACLS[16].

In S2, immediately following S1, theoretical content on ACLS was presented using audiovisual aids, including PowerPoint slides and explanatory videos. Materials and instructional content were developed by the researchers, based on AHA guidelines[10].

Seven days after S2, during S3, students attended clinical simulation training focused on ACLS skills, particularly protocol-driven responses to shockable and non-shockable CRA rhythms. Training utilized a full-body high-fidelity manikin (Model 4D-406-5, Style 500) with realistic anatomical features.

Activities occurred on different days for EG and CG, with each group split into subgroups of eight students to maximize learning. Identical procedures were followed across subgroups, with guidance provided by evaluators previously trained by the lead researcher. Sessions were conducted independently for EG and CG by different teams. Each team consisted of two nurses and two final-year nursing students.

S4 took place seven days after S3 and served as a review period. Students were encouraged to revisit content from S2 and S3 using the simulation lab, which remained available according to a scheduled rotation for each group.

Held seven to eight days after S4, S5 involved the actual simulation session using a validated medium-complexity scenario and structured script[17]. This phase included prebriefing, simulation, and debriefing. To prevent interaction between CG and EG, sessions were held on separate days. By random draw, CG completed simulation first, followed by EG the next day. The lab was prepared according to validated protocols, and student performance was assessed using the same validated skills checklist[17]. Each student received five minutes for prebriefing, ten minutes for scenario execution, and fifteen minutes for debriefing.

In CG, the nurse evaluators remained inside the simulation room, standing approximately two meters from the scenario, and recorded skills using the checklist. In EG, nurse evaluators stayed in an adjacent room, not visible to students, approximately two meters from the scenario, and observed through a one-way mirrored glass installed on two perpendicular panes (2.5 meters wide, 2.0 meters high), providing equivalent viewing conditions.

The activity was conducted individually for each student. Those awaiting their turn stayed in a separate room with a facilitator. Food, water, coffee and juice were provided.

Before evaluation began, each student underwent individual prebriefing. The evaluator nurse explained the learning objectives, available resources for managing shockable CRA rhythms in ACLS, and the time allowed for the scenario. Students were informed that they could delegate tasks to the two previously trained nursing students present. The evaluator maintained a supportive approach to reduce student anxiety. The high-fidelity manikin (4D-406-5 model) was used for both groups during this stage, as well as in the previous training stage (S4).

After completing the simulation, the students returned to the waiting room for debriefing, which was conducted collectively. Evaluator nurses discussed strengths and weaknesses with each student, encouraging self-assessment. Immediately afterward, students completed the first part of stage S6 (immediate post-test). The second part, the delayed post-test, was administered thirty days later. The same theoretical test was used in all three assessments (S1, immediate S6, delayed S6).

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All data were double-entered into Excel® and then exported to Stata® version 16.0 for analysis. Descriptive statistics were applied (absolute and relative frequencies for categorical variables; central tendency and dispersion for quantitative ones). Categorical variables were tested using Chi-square or Fisher's Exact test. Quantitative variables were analyzed with Student's t-test or Mann-Whitney test. Shapiro-Wilk test was used to assess normality. For normally distributed variables, parametric tests were applied (Student's t-test, ANOVA, Bonferroni). Significance level was set at 5%.

The research protocol complied with Resolution CNS No. 466/12 and received approval from the institutional Ethics Committee. All participants signed an informed consent form.

RESULTS

Among the 73 eligible participants, five were absent due to medical leave. Thus, 68 students were included in the study and randomly assigned to the corresponding groups: 35 to the Experimental Group (EG) and 33 to the Control Group (CG). During the study, seven students from EG and 17 from CG were lost to follow-up (Figure 1).

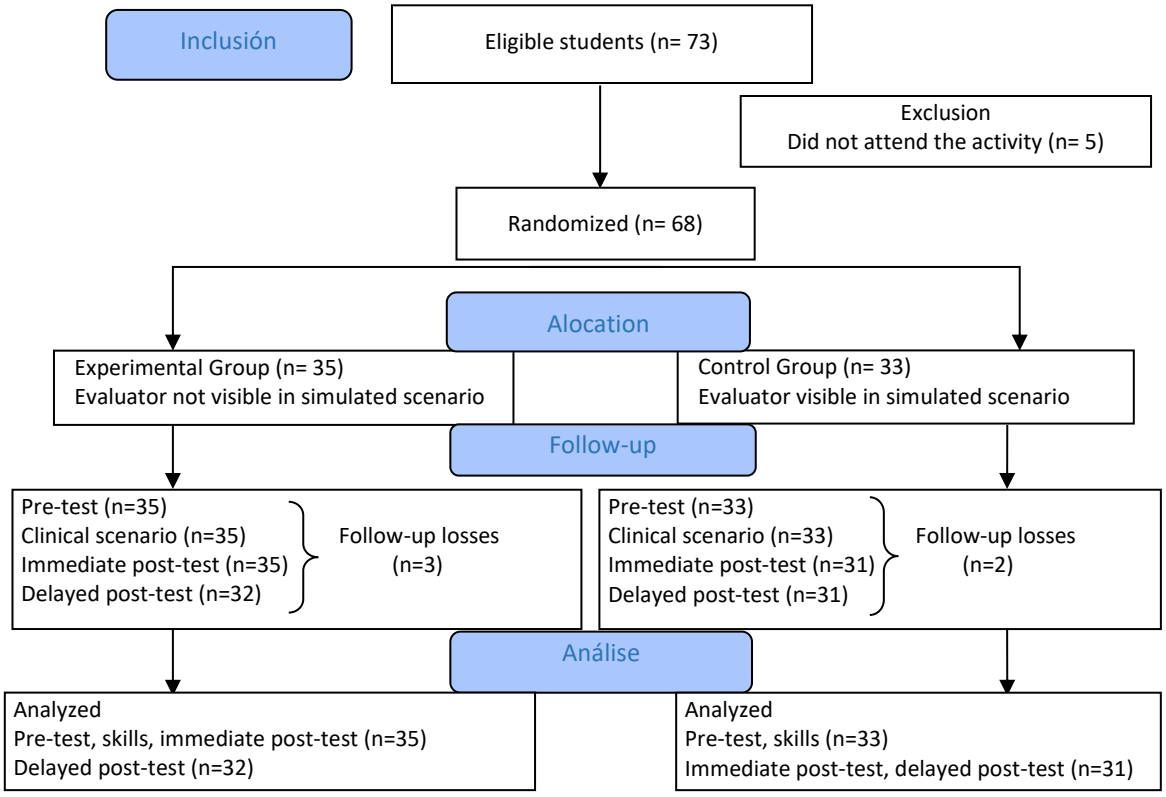

Figure 1: Flowchart showing the Randomized Clinical Trial according to the *Consolidated Standards of Reporting Trials* (CONSORT)[15]. Juiz de Fora, MG, Brazil, 2023.

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Table 1 presents the participants' characteristics.

Table 1: Participants' characteristics by sociodemographic profile and prior exposure to realistic simulation or first aid training (n=68). Juiz de Fora, MG, Brazil, 2023

Variables	Experimental Group	Control Group	p-value
Gender (n/%)			
Female	33 (48.5)	32 (47.0)	0.356*
Male	2 (2.9)	1 (1.6)	
Mean Age (SD†)	24.7(±3.89)	24.3 ± 2.47	0.868‡
Race (n/%)			
White	21 (30.9)	22 (32.3)	0.371*
Black	3 (4.4)	2 (3.0)	
Brown	10 (14.7)	10 (14.7)	
Others	0	0	
First Aid Training (n/%)			
No	24 (35.3)	24 (35.3)	1.000*
Yes	10 (14.7)	10 (14.7)	
Simulation Experience (n/%)			
No	26 (38.2)	25 (36.8)	0.975*
Yes	9 (13.2)	8 (11.8)	

Key: *Chi-square test; †Standard Deviation; ‡Independent samples t-test

Most of the participants were female (n=65; 95.6%) and self-identified as white-skinned (60.6%), with a mean age of 25.01 (±3.18) years old. Seventeen students (25%) reported prior experience with realistic simulation, and 20 (30%) had completed first aid training. No statistically significant differences were identified between baseline characteristics of EG and CG.

Table 2 presents result from theoretical knowledge assessments at different time points for both groups.

Table 2: Comparison of theoretical knowledge scores across three time points in the control and experimental groups (n=63). Juiz de Fora, MG, Brazil, 2023.

Group	Time Point	μ	SD*	Median	Min	Max	p-value†
Control	Pre-test‡	5.8	2.3	6.0	2.0	10.0	
	Immediate post-test§	9.0	1.1	9.0	6.0	10.0	<0.001
	Delayed post-test§	8.2	1.3	8.0	6.0	10.0	
Experimental	Pre-test‡	5.9	1.9	6.0	3.0	9.0	
	Immediate post-test§	8.8	1.0	9.0	7.0	10.0	<0.001
	Delayed post-test§	8.5	1.0	9.0	6.0	10.0	

Key: μ - Mean; *Standard Deviation; †One-way ANOVA with Bonferroni correction; ‡Significant mean difference compared to both post-tests; §Significant mean difference compared to pre-test only.

In the theoretical knowledge test, 33 CG participants completed the pre-test and immediate post-test, while 31 completed the delayed post-test. In EG, 35 students completed the pre-test and immediate post-test, with 32 completing the delayed post-test.

Significant improvements were observed in both groups when comparing mean scores between the pre-test and immediate post-test. In the delayed post-test, scores declined slightly in both groups, more noticeably in CG.

However, no statistically significant differences were found when comparing mean scores between groups at any time point. This includes comparisons of pre-test scores (p=0.953), immediate post-test scores (p=0.411), and delayed post-test scores (p=0.501).

For skill assessment in the simulation scenario, a six-item checklist was used to evaluate required ACLS actions. CG students achieved a mean score of 4.37 (±1.31), while EG students scored a mean of 4.63 (±1.61), with no statistically significant difference (p=0.477).

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DISCUSSION

Most participants in both groups were young female students with little or no previous exposure to clinical simulation or training related to advanced life support (ALS). These findings align with prior studies that implemented simulation to teach cardiopulmonary resuscitation (CPR) to nursing students[18,19]. Conversely, a quasi-experimental study that applied clinical simulation to teach sepsis management found a mean student age of 23.3 (±3.6) years old, with 92% identifying as female[20].

In this study, students in both groups showed a progressive increase in theoretical knowledge over time. Comparisons of mean scores within and between groups revealed that students from both CG and EG improved after the educational intervention, with a slight reduction one month later. Nonetheless, scores remained above pre-test levels. Similar findings were reported in a Brazilian study[21] involving 50 medical students, which evaluated CPR knowledge retention across pre-test, immediate post-test, and a delayed post-test conducted six months after training. That study showed improvement in the immediate post-test, followed by a significant increase in errors after six months ($p<0.001$)[21]. Another research study[22] involving 154 nurses across three hospitals in Botswana demonstrated a 14.5% decline in CPR knowledge and skills six months after training. These findings are consistent with previous studies that reported notable knowledge deterioration within six months, underscoring the need for regular continuing education in CPR for healthcare professionals[23,24].

A scoping review analyzing CPR knowledge retention identified key influencing factors such as professional experience, teaching methodology, and training frequency. The review emphasized the importance of continuous training based on the latest CPR guidelines to maintain knowledge and skill levels among healthcare providers[25].

In relation to the six essential skills for managing CRA using ACLS protocols, mean checklist scores exceeded 70% in both groups and showed no statistically significant difference. This homogeneity contradicts the study's alternative hypothesis (H1) and confirms that the absence of a visible evaluator during simulation did not affect students' ability to recognize CRA or apply ACLS protocols. In other words, evaluator visibility had no measurable impact on student performance in the simulated scenario.

From an educational perspective, the findings suggest that visible evaluator presence during simulation does not compromise students' technical performance in executing assessed skills. Although some studies indicate that being observed can increase anxiety and contribute to errors during clinical procedures[26,27], current evidence remains limited and inconclusive regarding the direct impact of this factor on performance. Therefore, the results reinforce the need for further investigations that systematically explore how evaluator visibility affects both technical performance and emotional factors, including anxiety.

Additionally, learner satisfaction and self-confidence, both associated with better performance, should be considered when designing educational strategies[28]. Acknowledging that direct evaluation may trigger anxiety can guide the development of teaching approaches aimed at enhancing emotional safety without hindering technical skill acquisition.

In this study, efforts were made to deliver interactive prebriefing sessions, during which evaluators fostered student engagement to reduce potential anticipatory anxiety. These sessions served as a strategy to mitigate emotional triggers that could influence intervention outcomes or bias group comparisons.

The International Nursing Association for Clinical Simulation and Learning (INACSL) reports that psychologically safe simulation environments promote learning effectiveness and clinical practice quality. Therefore, both the prebriefing and debriefing phases are essential components of the simulation process[29].

INACSL guidelines recommend using the prebriefing phase to explain simulation equipment and environment, outline the timeline for each stage, review rules and agreements, and clarify learning objectives and clinical scenarios. During the simulation, a neutral, judgment-free space should be maintained, allowing participants to pause or repeat activities or request guidance when needed. In the debriefing phase, educators should promote reflective discussion, identify knowledge gaps, and encourage content review[29]. The current study followed these recommendations by ensuring structured prebriefing and debriefing moments[16,29].

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Finally, the secondary objectives were also confirmed. Both groups demonstrated improved theoretical knowledge and expressed high levels of satisfaction with the simulation scenario design.

Study limitations

This study presents a single-blind randomization design as a limitation, where participants remained unaware of their group assignment, while researchers knew the allocation in advance. This design may introduce potential bias, as researcher knowledge, even if unintentional, might influence study execution.

Additionally, participant losses during follow-up represent another important limitation. Non-random attrition may compromise internal validity by affecting group comparability and reducing statistical power, which may influence the interpretation of theoretical knowledge test results.

Therefore, although the findings are relevant, they should be interpreted with caution. Future research should incorporate participant retention strategies and adopt double-blind randomization methods to strengthen evidence robustness.

CONCLUSION

In comparison, visible or non-visible evaluator presence did not affect nursing students' performance regarding practical skills developed in a simulated advanced life support scenario. A progressive increase in theoretical knowledge was observed across pre-test, immediate post-test, and delayed post-test in both groups. Students from both groups achieved satisfactory mean scores in practical activities, with no statistically significant differences between them. Regarding the Simulation Design Scale, participants rated the scenario design as appropriate or highly appropriate for the learning process.

From a pedagogical standpoint, these findings suggest that removing the visible evaluator during simulation scenarios may be implemented in educational programs as a strategy to reduce potential anxiety triggers without impairing the development of essential competencies. This approach can help foster a safer learning environment, promoting greater student autonomy and stronger clinical reasoning skills.

Therefore, this study may contribute to the enhancement of educational practices in both undergraduate training and ongoing professional development in healthcare. It offers support for adopting theoretical-practical models based on clinical simulation that incorporate diverse assessment strategies.

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Use of artificial intelligence tools

Authors declare that no artificial intelligence tools were used in the composition of the manuscript "*Impact of the evaluators' presence in simulated scenarios focused on Advanced Life Support: a randomized clinical trial*".