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RESEARCH

THE SIMULATION OF CARDIOPULMONARY RESUSCITATION AND THE KNOWLEDGE OF RESCUERS: A QUASI-EXPERIMENTAL STUDY

A SIMULAÇÃO DA REANIMAÇÃO CARDIOPULMONAR E O CONHECIMENTO DE SOCORRISTAS: ESTUDO QUASE-EXPERIMENTAL

LA SIMULACIÓN DE LA REANIMACIÓN CARDIOPULMONAR Y EL CONOCIMIENTO DE LOS SOCORRISTAS: ESTUDIO CUASI-EXPERIMENTAL

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ABSTRACT

Objective: to compare the knowledge of rescuers before and after training in cardiopulmonary resuscitation with the realistic simulation method. Method: this is a quasi-experimental study carried out with 41 Basic Life Support rescuers covering 8 bases of the 18th Regional Health of Paraná. The rescuers responded to the Instrument for Assessment of Training in Cardiopulmonary Resuscitation applied before and after the realistic simulation. Results: there was a statistically significant difference ($p < 0.02$) in 6 of the 10 questions, which addressed: the sequence of cardiopulmonary resuscitation maneuvers; the electrical charge of the automatic external defibrillator; the position, depth, and speed of chest compressions; the compression/ventilation ratio; and the handling of the automatic external defibrillator. In the other two questions — recognition of cardiorespiratory arrest and positive pressure ventilation device — there was no change in the answer alternative. There were 60% of correct answers for the questions when assessing prior knowledge and 90% of correct answers after the phases of the realistic simulation. Conclusion: rescuers did not fully complete the pre-test questionnaire; however, after the realistic simulation strategy, there was a significant increase in this knowledge. These results showed an improvement in the cognitive knowledge of rescuers after the simulation, which was confirmed by the increase in knowledge expressed in the post-test. This methodology can also be successfully applied to this professional category.

Keywords: Knowledge; Heart Arrest; Simulation Technique; Cardiopulmonary Resuscitation.

RESUMO

Objetivo: comparar o conhecimento de socorristas antes e depois da capacitação de reanimação cardiopulmonar com o método da simulação realística. Método: estudo quase-experimental realizado com 41 socorristas do Suporte Básico de Vida que contemplam 8 bases da 18° Regional de Saúde do Paraná. Os socorristas responderam ao Instrumento para Avaliação da capacitação em Ressuscitação Cardiopulmonar aplicado antes e depois da simulação realística. Resultados: obteve-se diferença estatisticamente significativa ($p < 0,02$) em 6 das 10 questões, as quais abordaram: a sequência das manobras de reanimação cardiopulmonar; a carga elétrica do desfibrilador externo automático; a posição, a profundidade e a velocidade das compressões torácicas; a relação compressão/ventilação; e o manuseio do desfibrilador externo automático. Já em outras duas questões — reconhecimento da parada cardiorrespiratória e dispositivo de ventilação com pressão positiva — não houve mudança quanto à alternativa de resposta. Encontraram-se 60% de acertos das questões quando avaliado o conhecimento prévio e 90% de acertos após as fases da simulação realística. Conclusão: os socorristas não atingiram com totalidade o questionário de pré-teste; entretanto, após a estratégia da simulação realística, houve um aumento significativo desse conhecimento. Esses resultados demonstraram melhoria no conhecimento cognitivo dos socorristas após simulação, o que foi comprovado pelo aumento de conhecimento expresso no pós-teste. Essa metodologia também pode ser aplicada com sucesso a essa categoria profissional.

Palavras-chave: Conhecimento; Parada Cardíaca; Simulação; Reanimação Cardiopulmonar.

RESUMEN

Objetivo: comparar el conocimiento de los socorristas antes y después de la capacitación de la reanimación cardiopulmonar con el método de la simulación real. Método: estudio cuasi-experimental, realizado con 41 socorristas del Soporte Vital Básico cubriendo 8 bases de la 18 Regional de Salud de Paraná. Los socorristas respondieron al Instrumento para la Evaluación de la Formación en Reanimación Cardiopulmonar, aplicado antes y después de la simulación real. Resultados: se encontraron diferencias estadísticamente significativas ($p < 0,02$) en 6 de las 10 preguntas, que abordaban: la secuencia de maniobras de reanimación cardiopulmonar; la carga eléctrica del desfibrilador externo automático; la posición, profundidad y velocidad de las compresiones torácicas; la relación compresión/ventilación; y el manejo del desfibrilador externo automático. En dos preguntas -reconocimiento de la parada cardíaca y dispositivo de ventilación

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con presión positiva- no hubo cambios en la respuesta alternativa. Hubo un 60% de respuestas correctas para las preguntas al evaluar los conocimientos previos y un 90% de respuestas correctas después de las fases de la simulación real. Conclusión: los socorristas no responden totalmente a la cuestión de la prueba previa, mientras que, tras la estrategia de simulación realista, se produjo un aumento significativo de este conocimiento. Estos resultados demostraron una mejora en el conocimiento cognitivo de los socorristas después de la simulación, comprobada por el aumento del conocimiento expreso en el post-test, que esta metodología también puede ser aplicada con éxito a esta categoría profesional.

Palabras clave: Conocimiento; Paro Cardíaco; Simulación; Reanimación Cardiopulmonar.

INTRODUCTION

Active methodologies that use realistic simulation have been gradually implemented and their use as an educational modality has increased. This is because these methodologies are better than traditional teaching/learning models, linked to better performance of competence and clinical reasoning, technical and non-technical skills, leadership, and teamwork.[1]

However, this active methodology goes beyond professional training, extending to continuous or permanent training in health, based on the service's problem. The realistic simulation takes place in a controlled environment, with the possibility of errors, which minimizes the psychological impact of the professional and increases self-confidence, considering that simple conventional learning has been replaced by learning in simulators.[2]

This strategy is adaptable to any teaching area, including training in emergency and critical situations. Such situations have a complex scenario, requiring immediate decisions and quick technical skills from professionals working in this context.[3]

Cardiopulmonary arrest (CPA), in particular, requires a quick and efficient decision from professionals, and good technical skills.[4,5] This is because CPA can be defined as the absence of cardiac electrical conductivity, reversible if treated quickly or fatal if there is not a prompt intervention.[5] It is confirmed by the signs of unconsciousness, apnea, and absence of a central pulse.[6]

The initial minutes of this emergency are decisive for the return of spontaneous circulation (SCR), which begins with Basic Life Support (BLS) maneuvers. These maneuvers include recognizing the clinical signs of CPA, requesting the Automated External Defibrillator (AED) for early defibrillation, starting chest compressions, and opening the airway for ventilation with a bag-valve-mask.[6]

The survival rate after cardiopulmonary resuscitation (CPR) maneuvers, when properly applied, ranges from 2 to 49%. Therefore, it is a situation responsible for high morbidity and mortality, even in ideal care. Thus, training a greater number of professionals is linked to a better survival rate.[7]

This is a very common scenario for rescuers of the Mobile Emergency Care Service (SAMU), especially for the team that includes BLS ambulances, whose members can be the first to perform the approach and start CPR maneuvers.[5] Success of CPR is extremely time-sensitive, with a drop of 7% to 10% per minute in the survival rate if there is no intervention.[6] These teams, when frequently trained, are closely linked to excellent care, which makes a great difference in the survival of the CPA victim.[8]

Given the above and considering that the first rescuers in the pre-hospital environment are on the front line to perform the care of this important emergency, this study aimed to contribute to the strengthening of work and the quality of care. Therefore, it aimed to compare the knowledge of rescuers before and after training in cardiopulmonary resuscitation with the realistic simulation method.

METHOD

This is a quasi-experimental, before-and-after study, developed on eight bases with ambulances for SAMU's BLS care fixed at the 18th Health Regional of Paraná.

We invited 70 rescuers who have been working for more than six months in the BLS ambulances of all bases of the 18th regional health of Paraná to compose the study. The inclusion criterion was to work in the role within the institution for at least six months. The exclusion criterion was being on leave and/or vacation on the date of the study. Sampling was non-probabilistic, of the conventional type, and sample losses occurred due to the non-participation of the professional in all phases of data collection. Finally, the study had a sample of 41 rescuers, organized into 20 Nursing technicians and 21 drivers that make up the BLS of SAMU.

The invitation to participate was sent by the researcher and reinforced by the Nursing coordination of (SAMU) via a mobile phone application, such as scheduling the day and time.

First, a pilot study was carried out with 9 first rescuers from the most recent base of the 18th Regional Health, who were not included in the study. Through this pilot study, we verified weaknesses in each phase proposed for the realistic simulation and adjust them. Some adjustments identified as necessary were: increasing the time for the briefing; decreasing the simulation scenario time; repositioning the mannequin, and adding a (familiar) character to the scene to report the victim's history

if questioned by rescuers. Data collection took place from January to February 2020.

For data collection, we used the validated "Instrument for Assessment of Training in Cardiopulmonary Resuscitation"[9,10]. The instrument was applied individually, before and after the phases of the realistic simulation. The original instrument consists of 18 multiple-choice closed-ended questions, with 5 answer alternatives, only one of which is correct. Such questions address the American Heart Association[11] guidelines for basic and advanced adult life support. However, for this study, 10 questions were selected regarding the care provided by the BLS, which included the identification of clinical signs of CPA; the conduct of CPR maneuvers, such as the quality of chest compressions; positive pressure ventilation; knowledge and handling of the Automated External Defibrillator (AED); and the correct sequence for the application of the maneuvers.

Data collection was transversal, carried out by the researchers in the 8 different cities in four moments: 1) exposure to the study objectives and reading of the Informed Consent Form for the acceptance to participate in the study as a volunteer; 2) sociodemographic and professional characterization and application of the theoretical pre-test before the intervention; 3) Intervention that used the realistic simulation method; 4) immediate post-test after the intervention. All steps were conducted by the facilitator with experience in a pre-hospital environment.

The collected data were entered into Microsoft Excel® spreadsheets and then analyzed using the Statistical Package for the Social Sciences (SPSS), version 20.0, considering a significance level of 5%. Shapiro Wilk's statistical normality test was also applied and, for the significant difference between the means of proportions, we used the t-test. To compare the professionals' knowledge before and after training, we analyzed the percentage of correct answers and errors for each question.

The educational intervention that used realistic simulation as a continuing education strategy took place respecting the steps proposed by Jeffries: Pre-briefing and briefing, simulation scenario.[2]

The realistic simulation was planned and based on the NLN/Jeffries Simulation Theory model,[2] organized into 5 components: 1) facilitator; 2) participants; 3) characteristics of the simulation design; 4) educational practices, and 5) results. To carry out the three stages of the realistic simulation, the researcher randomly grouped the rescuers into pairs, which should be formed by a Nursing technician and a rescuer conductor.

In the first stage (Pre-briefing), material resources (bag-valve-mask, portable oxygen, AED - which guided the shock or not - and cell phone to contact the regulation center) and physical resources (tips on the history of the victim from a character-daughter) available during the scenario. We also addressed the essence of this methodological strategy, the objectives to be achieved, and the time for resolution. Sequentially, they received the briefing - clinical case - with the following information: "male victim, 48 years old, with a previous complaint of chest pain and who, at the moment, does not respond and does not breathe".

The second stage — the simulation scenario —, lasting eight minutes, started inside the ambulance after a call that simulated the dispatch of the team via the medical regulation center, with the same information as the clinical case presented in the briefing. Then, the couple moved to the scene in a simulated room, elaborated within the SAMU's bases, and found the victim - a low-fidelity Laerdal Little Anne® mannequin - on the floor, unconscious, without breathing, and without a central pulse, starting the CPR maneuvers.

The third stage (debriefing) had a maximum duration of 20 minutes and was conducted according to the needs of each couple in a reserved room. The facilitator, with experience in a pre-hospital environment, conducted the moment based on the "good judgment" model, providing rescuers with an opportune environment for the expression of feelings and self-reflection of their strengths and weaknesses through generic questions directed to the attitudes applied during the scenario,[9] aimed at the return of spontaneous circulation.

The research was approved by the Research Ethics Committee (CEP- Comitê de Ética em Pesquisa) by a public university in Paraná, under opinion n° 3,572,640, and was authorized by SAMU. The study was developed in compliance with all the ethical precepts recommended by Resolution 510/16 and Resolution 466/2012.

RESULT

Table 1 shows the sociodemographic and professional characterization of the participants.

Other means for updating the BLS AHA/2015 protocol: Reading books, reading the internet, and courses outside the institution.

Figure 1 shows the proportion of correct answers to the pre-test and post-test questions applied to the participants before and after the phases of the realistic

simulation. The t-test was used to detect the existence of a difference between the proportions of correct answers.

The issues are 1) correct sequence of CPR requesting the AED; 2) electrical charge of the biphasic AED; 3) identification of CPA; 4) justification for choosing to check the pulse in the carotid artery; 5) hand position and depth of compressions; 6) speed of compressions; 7) compression/ventilation ratio with one and two rescuers; 8) ventilation in CPR performed by the BLS; 9) correct sequence using the AED; 10) time interval to assess heart rate.

We observed that, of 70 questions, 7 reached the total correctness after the training that used the realistic simulation method. In two questions, the percentage was maintained, while in one of them there was no statistically significant difference.

The average of correct answers found in the pre-test was 60.1 with a standard deviation of 22.60. The mean in the post-test was 89.77 with a standard deviation of 12.40. With the application of the Shapiro-Wilk test, normality was observed in both data sets: pre-test ($p = 0.49$) and post-test ($p = 0.48$). Furthermore, the existence of a significant difference between the means of proportions was detected using the t-test for paired data ($p = 0.002$).

DISCUSSION

By tradition or possible culture of the profession, women are predominant in the area of Nursing, as found in the sociodemographic and professional characterization in this study. We found that 85% of professionals at the technical level of Nursing are female, a result also obtained in other studies.[12,13] However, in the role of rescuer driver, males were 100% of the sample. One of the possible predominances of males among SAMU drivers is because it is considered a dynamic, more rational function that requires greater physical strength, which are more characteristic requirements of men.[14]

The predominant age of rescuers for both professions was between 29 and 50 years old (78%). In the literature, a survey conducted with pre-hospital professionals[16] and conducted with in-hospital professionals[15] showed similar ages.

The International Liaison Committee on Resuscitation (ILCOR) exposes the relevance of training and updating CPR and emphasizes that it must be adapted to the target audience in different methodological alternatives, aiming at retaining knowledge and skills for an excellent service.[6] Thus, a positive result was found in our research: among the rescuers, 100% claimed to have participated in the AHA update, and 83% performed it within the institution.

One of the most powerful teaching-learning and current training strategies in and outside the country for professionals, students, and teams in the health area is a clinical or realistic simulation.[17] It provides real situations to provide care to critical patients or in an environment uncontrolled, with the possibility of errors to improve professional conduct.[18]

In this study, there was a positive impact, as 97.6% of the rescuers, even before training, were able to identify the clinical signs of CPA, which differs from a descriptive study with a quantitative approach carried out in Maranhão, Brazil,[14] in that 66.6% of professionals were able to correctly identify, and a study carried out in Pernambuco, Brazil,[19] whose result was even lower.

Continuing the rescuer's previous knowledge regarding the sequence of the 5 links of the out-of-hospital survival chain, which are sequential actions that increase the chance of survival in CPA — identify CPA early; activate

Table 1 - Sociodemographic and professional characterization of the participants. Paraná, Brazil, 2020 (N=41)

Variables	Professional category	N	%
	Nursing Technician (NT)	20	48.8
	Rescue Driver (RD)	21	51.2
Gender	NT – Female	17	85.0
	NT – Male	3	15.0
	RD – Male	21	100.0
Age group	18 to 28 years old	6	14.6
	29 to 39 years old	16	39.0
	40 to 50 years old	16	39.0
	> 50 years old	3	7.3
Operating time in SAMU	1 to 3 years	11	26.8
	3 years and 1 month to 5 years	8	19.5
	> 5 years	22	53.7
Update of the BLS AHA/2015 protocol	Institutional Training	24	82.9
	Other ways	17	17.0

Source: Prepared by the author

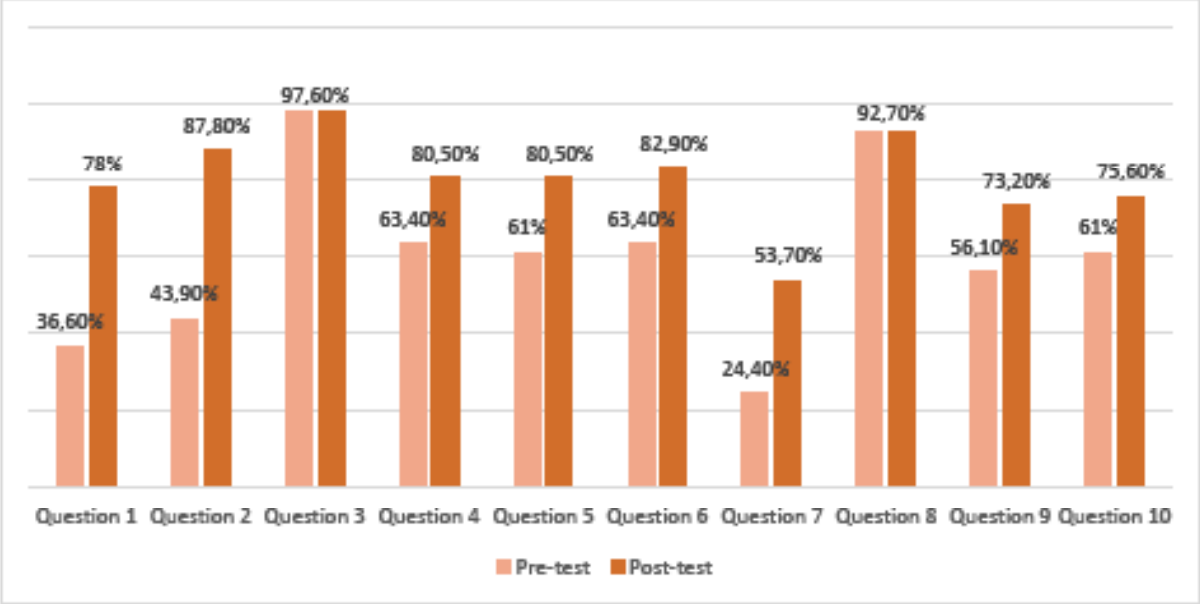

Figure 1 - Proportion of correct answers in the pre-test and the post-test, related to the PCR/CPR theme. Paraná, Brazil, 2020
Source: Prepared by the author.

emergency services; initiate quality CPR; defibrillate early; and Advanced Life Support (ALS) —[6] only 36.6% fully addressed the question. The same weakness was observed in other studies.[19,20] However, some findings showed high percentages of correct answers for the same question.[14,21]

During CPR in adults without an advanced airway, US guidelines recommend that synchronizing 30 compressions every two ventilations should be performed regardless of whether there are one or two rescuers on the scene.[6] In this study, when asked about the compression ratio/ventilation with one or two rescuers, the participants, with their previous knowledge, did not reach complete correctness, scoring 24.4%. In contrast, a study that also evaluated the prior knowledge of rescuers about the American Heart Association guidelines in Brazil found that 80% of professionals got the question correct.[14]

Therefore, the guidelines recommend that adult chest compressions should be applied at a rate of not less than 100 and not more than 120/minute, at a depth of at least 5 cm, not exceeding 6 cm.[6]

As for the position of the hands, depth, and speed for chest compressions, evaluated in questions 5 and 6, the percentages of correct answers were close to the pre-test — 61% and 63%, with a corresponding increase in the post-test of 80.5% and 82.9%. This percentage of correct knowledge reinforces the need for services to be kept up to date through constant training.

We also noted that the survival of CPA victims can double or triple when CPR maneuvers are performed with quality and following protocols.[23]

In the pre-test, the question about the electrical charge of the AED (43.9%), and the planning and handling for its use (56%) did not reach the proposed integrity, since all professionals have, within their ambulance, the equipment available for use. However, after the phases that make up the realistic simulation, this knowledge increased to 87.8% and 73.2%, respectively. The same weaknesses of prior knowledge about the equipment were found in the literature.[16,22,24]

An international review indicated that prior training for the use of AEDs in BLS positively influences the performance of non-medical professionals in the care of intra- or extra-hospital CPA since this device makes a difference in the Spontaneous Circulation Return (SCR).[25] We proved that the objective of the simulation activity was achieved, as 61% of the questions were correct before the intervention and 90% after the intervention. Consequently, there was a possible transformation of professional preparation for more qualified health care. When accessing the literature, we noted that studies with the same theme are developed all over the world, whose results are similar to those of this research.[3,12,18,22]

In a study carried out at the Centro Universitário Ritter dos Reis, in Porto Alegre, the use of simulation as a teaching strategy in continuing education for health

professionals in the in-hospital environment contributed to a significant improvement, such as the consideration that this tool is effective in qualifying care for critically ill patients.[3]

In this study, the data found by some authors are corroborated and the recognition that simulation is an important strategy for teaching, learning, evaluation, and training of health professionals is highlighted, regardless of the scope of action. This study is relevant, as it qualifies these first-aid professionals, who are often the first contact and the only chance of survival in the care of the patient who is in a situation of urgency/emergency outside the hospital environment.

On the other hand, a study was carried out in São Paulo[24] that evaluated the teaching-learning of 84 students in the health area about CPR maneuvers. The study indicated that teaching using the theoretical class and only a demonstration of practice was not enough for the development of psychomotor skills used in CPR, requiring practical training.

Therefore, to save lives, rescuers must be trained efficiently, and realistic simulation has proven to be an effective method of training. Perhaps, better physical, scientific and material investments for the pre-hospital environment could reflect in the reduction of morbidity and mortality, given that a modern and technological intra-hospital era is useless if the professionals who are in the front line of care are not trained to use it.

The main limitation of this study concerns the non-verification of psychomotor and affective skills, and the immediate assessment of the training result, not having been carried out a reassessment of professionals over a period to identify the retention of acquired knowledge. New studies should address this knowledge gap, which was not possible in this study.

CONCLUSION

The study showed the potentialities and challenges of the theoretical knowledge of rescuers for the desired success of care for victims of CPA, reinforced by the relevance of constant training, for the maintenance or updating of such a common scenario attended in urgency and emergency.

The results revealed that, when comparing the participants' knowledge on the topic of cardiopulmonary resuscitation before and after the training that had the realistic simulation method, the evidence clearly shows the potential of the method to increase immediate cognitive knowledge, ratified by the statistical significance.

In this sense, due to the complexity of providing timely care to these victims, we suggest new studies identify the impact of training on this same topic on mortality rates or the reversal of CPA conditions.

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