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# BASIC LIFE SUPPORT: KNOWLEDGE ASSESSMENT CONSIDERING THE ARTICULATION OF ACTIVE TEACHING STRATEGIES

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## ABSTRACT

**Objective:** to assess the effect of an educational intervention called "Basic Life Support with the use of the automated external defibrillator" on knowledge development in Nursing professionals, considering the articulation of active teaching and learning strategies.
**Method:** a quasi-experimental intervention study, without a control group and of before-and-after type, carried out with 113 nurses working in the Urgency and Emergency Network of an inland city in the state of São Paulo, through a course presented between March and June 2019 on cardiopulmonary resuscitation with Basic Life Support and use of automated external defibrillator. Three active teaching and learning strategies were articulated: inverted classroom, video lesson, and clinical simulation. Knowledge was assessed by applying a pre- and post-test, and the paired *t* test was used for the analysis.
**Results:** the best performance regarding knowledge development was presented by the nurses from the hospital area, identifying a mean of 11.90 points in the pre-test and of 16.9 points in the post-test. In general, better scores of knowledge regarding Basic Life Support were obtained, evidenced by statistically significant results, with a p-value<0.001.
**Conclusion:** the articulation of the adopted strategies can enhance knowledge development in Nursing regarding Basic Life Support in adult patients, due to the emphasis on the development of critical thinking, the encouragement of clinical judgment, reflective discussion and active participation of individuals in their learning process, factors that positively impact on the acquisition of the individuals' cognitive ability/knowledge.

**DESCRIPTORS:** Cardiopulmonary resuscitation. Knowledge. Education, Nursing. Strategies. Learning.

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## SUPORTE BÁSICO DE VIDA: AVALIAÇÃO DO CONHECIMENTO CONSIDERANDO A ARTICULAÇÃO DE ESTRATÉGIAS ATIVAS DE ENSINO


### RESUMO

**Objetivo:** avaliar o efeito de uma intervenção educativa denominada “Suporte Básico de Vida com o uso do desfibrilador automático externo” no desenvolvimento de conhecimento em profissionais de enfermagem, considerando a articulação de estratégias ativas de ensino e aprendizagem.
**Método:** estudo de intervenção quasi-experimental, sem grupo controle, do tipo antes e depois, realizado com 113 profissionais de enfermagem pertencentes à Rede de Urgência e Emergência de uma cidade do interior do Estado de São Paulo, por meio de um curso apresentado entre março e junho de 2019, sobre ressuscitação cardiopulmonar com Suporte Básico de Vida e uso do desfibrilador externo automático. Articularam-se três estratégias ativas de ensino e aprendizagem: a aula invertida, a videoaula e a simulação clínica. Avaliou-se o conhecimento aplicando um pré e um pós-teste, e utilizou-se o teste *t* pareado para análise.
**Resultados:** o melhor desempenho quanto ao desenvolvimento de conhecimento foi apresentado pelos enfermeiros da área hospitalar, identificando-se média de 11,90 pontos no pré-teste e de 16,9 no pós-teste. Obteve-se, em geral, aumento dos escores de conhecimento quanto ao Suporte Básico de Vida, evidenciado por resultados estatisticamente significativos, com valor de $p<0,001$.
**Conclusão:** a articulação das estratégias adotadas pode potencializar o desenvolvimento de conhecimento em enfermagem quanto ao Suporte Básico de Vida em pacientes adultos, devido à ênfase no desenvolvimento do pensamento crítico, ao estímulo do julgamento clínico, à discussão reflexiva e à participação ativa dos indivíduos em seu processo de aprendizado, fatores que impactam positivamente na aquisição da habilidade cognitiva/conhecimento dos indivíduos.



**DESCRITORES:** Reanimação cardiopulmonar. Conhecimento. Educação em enfermagem. Estratégias. Aprendizagem.


## SOPORTE VITAL BÁSICO: EVALUACIÓN DEL CONOCIMIENTO CONSIDERANDO LA ARTICULACIÓN DE ESTRATEGIAS DE ENSEÑANZA ACTIVAS


### RESUMEN

**Objetivo:** evaluar el efecto de una intervención educativa denominada “Soporte Vital Básico con el uso de desfibrilador automático externo” en el desarrollo de conocimiento en profesionales de Enfermería, considerando la articulación de estrategias activas de enseñanza y aprendizaje.
**Método:** estudio de intervención cuasiexperimental, sin grupo control y del tipo antes y después, realizado con 113 profesionales de Enfermería pertenecientes a la Red de Urgencias y Emergencias de una ciudad del interior del estado de San Pablo, por medio de un curso presentado entre marzo y junio de 2019 sobre reanimación cardiopulmonar con Soporte Vital Básico y uso de desfibrilador externo automático. Se articularon tres estrategias activas de enseñanza y aprendizaje: clase invertida, videoclase y simulación clínica. El conocimiento se evaluó aplicando una prueba previa y una prueba posterior, y se utilizó la prueba de *t* emparejada para el análisis.
**Resultados:** el mejor desempeño en cuanto al desarrollo de conocimiento lo presentaron los enfermeros del área hospitalaria, identificándose una media de 11,90 puntos en la prueba previa y de 16,9 puntos en la prueba posterior. En general, se obtuvo una mejora en las puntuaciones del conocimiento en relación con el Soporte Vital Básico, evidenciado por resultados estadísticamente significativos, con un valor de $p<0,001$.
**Conclusión:** la articulación de las estrategias adoptadas puede potenciar el desarrollo de conocimiento en Enfermería con respecto al Soporte Vital Básico en pacientes adultos, debido al énfasis en el desarrollo del pensamiento crítico, al estímulo del buen juicio clínico, a la discusión reflexiva y a la participación activa de los individuos en su proceso de aprendizaje, factores que ejercen un efecto positivo en la adquisición de la habilidad cognitiva/conocimiento de las personas.



**DESCRIPTORES:** Reanimación cardiopulmonar. Conocimiento. Educación en enfermería. Estrategias. Aprendizaje.

## INTRODUCTION

Nursing performs its work process in constantly changing scenarios due to the fast pace of technological advancement, which makes continuous learning and the adoption of pedagogical mechanisms that stimulate its development essential.[1] Faced with this challenge, the development of cognitive ability in nurses requires the use of innovative and effective teaching and learning strategies, which arouse interest and promote quality of care.[2]

Specifically regarding the teaching and learning process of Basic Life Support (BLS) of adult patients by Nursing professionals, the difficulties to develop knowledge effectively and the challenges to establish pedagogical strategies for this objective have been well documented in the literature.[3–4]

The difficulty in promoting a consistent professional education process for BLS in Nursing is an important discussion point in patient care, since cardiac arrest is a serious public health problem and a cause of mortality worldwide; survival can be three times higher when this event is monitored by professionals capable of providing immediate and quality cardiopulmonary resuscitation (CPR).[4]

Thus, CPR education is mainly focused on ensuring a broad and uniform implementation of this science during the health care practice, encouraging, for this purpose, the articulation of educational strategies aimed at optimizing knowledge based on the recommendations of the American Heart Association (AHA).[5]

In view of the incipience of scientific studies that propose to explore the articulation of pedagogical teaching strategies for Nursing in the context of cardiopulmonary resuscitation,[6] the following question was raised: can the articulation of active teaching strategies for the BLS of adult patients using the automated external defibrillator (AED) favor knowledge development in Nursing professionals?

This study aimed to assess the effect of an educational intervention called “Basic Life Support with the use of the automated external defibrillator” on knowledge development in Nursing professionals, considering the articulation of active teaching and learning strategies.

## METHOD

This is a quasi-experimental intervention study, without a control group and of the before-and-after type[7] that was based on the recommendations of the TREND Statement checklist for non-randomized design studies.[8]

This study was conducted in the Ribeirão Preto Nursing School at the University of São Paulo (USP), specifically on the premises of the Center for Simulation of Nursing Practices. The population consisted of nurses and nursing technicians from the fixed pre-hospital and hospital area of the Urgency and Emergency Network of an inland city in the state of São Paulo, who volunteered to participate in this study.

A convenience sample of 113 individuals was determined, considering the dependence on the health professionals’ availability to participate in the proposed intervention, mainly due to the existence of more than one employment contract and because they live in other cities.

The following inclusion criteria were adopted: belonging to the Nursing team of certain health units (emergency care unit – *Unidade de Pronto Atendimento*, UPA –, Basic District Health Units - *Unidades Básicas Distritais de Saúde*, UBDS –, and general hospitals), components of a health foundation in the aforementioned research locus and being 18 years or older. Participants who were absent at any stage of the proposed course, who were on sick leave, maternity leave or vacation during the data collection period were excluded.

To proceed with data collection, a course was carried out from March to June 2019, entitled “Cardiopulmonary Resuscitation for Nursing Professionals with Basic Life Support and Use of the Automated External Defibrillator”, together with the Rho Upsilon Chapter of the Sigma Theta Tau Honorific Society, based in the Ribeirão Preto Nursing School at the USP, in three stages, described below.

In the first stage, the proposed activity was planned, delimiting the active teaching and learning strategies addressed, namely: inverted classroom, video lesson and clinical simulation, in addition to training the team of instructors for the course.

In the second stage, the course was publicized on posters displayed at the institution; enrollments were made electronically and previous study activities were sent to the participants, such as a video lesson on CPR in adults with BLS and the use of the AED in a hospital environment;[9] a video of clinical CPR simulation in adults in BLS using the AED in a hospital environment[10] and the 2015 AHA CPR guideline[5], which supported the execution of the inverted classroom.[11] The recommendations described in the AHA 2017 and 2018 CPR updates were not addressed as a framework, since the changes made did not interfere with the BLS teaching and learning process, main object of this study.

The third stage of the collection comprised the welcoming of the participants, the presentation of the instructors and the invitation to participate in the research, through the Free and Informed Consent Form. Subsequently, the participants filled out the sociodemographic characterization instrument and the knowledge assessment instrument about BLS in adults using the AED (pre-test).[12]

Immediately after that, at the Low Fidelity Simulated Practices Laboratory, the active teaching strategy of the associated video lesson was applied,[13] providing immediate CPR skills training performed on the floor through a *Little Anne*® Low Fidelity torso-based simulator and the *Trainer 2* AED from Laerdal®, followed by CPR skills training with the *Resusci Anne Simulator* medium fidelity simulator with QCPR® and AED.

Finally, the teaching strategies already applied and the clinical simulation were articulated,[14–15] addressing pre-briefing/briefing, scenario and debriefing. The simulation scenario involved an adult victim in CPA in the hospital environment for assistance with BLS and AED. Subsequently, the assessment instrument for knowledge about BLS in adults using the AED (post-test) was applied.[12]

Two instruments were used for data collection. The first encompassed the sociodemographic characterization of the participants and included gender, age, professional/technical training, and workplace. The second instrument allowed assessing the cognitive ability (knowledge) about CPR in adults in BLS using the AED in the hospital environment, previously validated[12] and based on the AHA guidelines,[5] composed of a multiple choice questionnaire, with 20 questions of four alternatives each, one of them being incorrect, with a value of 0.5 points for each question, totaling 10 points.[12]

The intended outcome addressed the increase in the scores of cognitive ability (knowledge) development about CPR in adults in BLS using the AED in the hospital environment of the nurses involved, after the proposed intervention.

The categorical sociodemographic characteristics were presented by absolute and relative frequencies; and the quantitative variables, by dispersion and centrality measures. To assess knowledge, the paired *t*-test was used. p-values<0.05, a significance level (alpha) of 0.05 or 5, and a confidence interval (CI) of 0.95 or 95% were considered statistically significant. The data collected were tabulated in spreadsheets in the Microsoft Excel® 2013 program, with double entry by two different people, exporting and analyzing them, later, to the *Statistical Package for the Social Sciences* (SPSS), version 23.

This research was submitted to the Research Ethics Committee of the Ribeirão Preto Nursing School at the USP, in accordance with what is set forth in Resolution 466/2012 of the National Health Council. The participants were invited and formalized their acceptance by signing the Free and Informed Consent Form, and the anonymity and confidentiality of the data collected in all phases of the research was ensured.

## RESULTS

Of the 113 participants, 32 (28.5%) were nurses working in the fixed pre-hospital area, 39 (34.5%) were nursing technicians working in the fixed pre-hospital area, 21 (18.5%) were nurses at the hospital, area and 21 (18.5%) were nursing technicians at the hospital area. The female gender was predominant in this research, represented by 94 (83%) participants. The youngest professionals were the nursing technicians, with a minimum age of 20 years old, and the highest mean age was in the category of fixed pre-hospital nurses (43.30 years old), with a maximum age of 68 years old.

Chart 1 shows the professional Nursing categories and their respective work areas arranged in questions 1 to 20, which comprised the knowledge assessment instrument, considering the participants who answered correctly each question during the pre- and post-test.

For comprehension, it is important to describe the approach to each question present in Chart 1 and the professionals who stood out the most in terms of knowledge development.

Question 1 addressed the need to implement a detailed clinical evaluation for the patient in a hospital environment and to define the interventions necessary for the prevention of CPA in the surveillance and prevention of the survival chain. The nursing technicians in the fixed pre-hospital area stood out in terms of knowledge development on this issue, since five (12.8%) participants answered correctly in the pre-test and 15 (38.4%) did so in the post-test.

Early recognition of CPA and the request for help from medical support, with an emergency cart and defibrillator, were considered the first attitude that must be taken by the professional in a CPA situation, in question 2. The technicians working in the fixed pre-hospital area obtained a significant improvement in the percentage of correct answers in this question, from 23 (58.9%) in the pre-test, to 28 (71.7%) in the post-test; however, the nurses working in the hospital area already showed excellent performance during the pre-test, being represented by 16 participants (76.1%) and by 18 participants (85.7%) in the post-test.

An intense touch at the level of the victim's shoulders and auditory stimulation were the actions indicated to recognize the absence of responsiveness of a victim suspected of having CPA in question 3. The nursing technicians working in the fixed pre-hospital area stood out, with 17 (43.5%) correct answers in the pre-test and 32 (82.0%) in the post-test. However, all the professional categories achieved important knowledge development on the theme of this question.

Question 4 stated that the professional should check the victim's carotid pulse in CPA simultaneously with breathing, in less than 10 seconds, showing greater knowledge development by the nurses in the fixed pre-hospital area: 12 (37.5%) participants answered correctly the pre-test and 16 (50.0%) did so in the post-test.

In question 5, it was recommended that, when hospitalizing a victim in CPA, the Nursing team in a hospital environment should ask for help and immediately start external chest compressions. The nurses in the fixed pre-hospital area performed better, with 17 (53.0%) participants who answered correctly in the pre-test and 26 (81.2%) did so in the post-test.

Immediately after that, question 6 addressed that the recommended time for changing professionals during external chest compression (ECC) in a victim under CPA should be 120 seconds. The hospital area nurses maintained an excellent performance on this question, evidenced by 19 (90.4%) participants who answered correctly in the pre-test and 21 (100%) who did so in the post-test. However, in general, all the professional categories showed improved knowledge on this topic.

The lower half of the sternum was indicated as the correct place for the professional's hands to be placed on the victim's chest during the ECC in question 7. Despite the low number of correct answers obtained in this question, an increase in knowledge can be noticed in all the professional categories.

**Chart 1** – Participants who answered correctly the questions regarding the assessment of knowledge about Basic Life Support using the automated external defibrillator (n=113), Ribeirão Preto, SP, Brazil, 2019.

| Question | Fixed pre-hospital nurse (n=32) | | Fixed pre-hospital technician (n=39) | | Hospital area nurse (n=21) | | Hospital area technician (n=21) | | Total of participants (n=113) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre-test | Post-test | Pre-test | Post-test | Pre-test | Post-test | Pre-test | Post-test | Pre-test | Post-test |
| 1 | 12 (37.5) | 10 (31.2) | 5 (12.8) | 15 (38.4) | 8 (38.0) | 11 (52.3) | 6 (28.5) | 6 (28.5) | 31 (27.43) | 42 (37.16) |
| 2 | 21 (65.6) | 24 (75.0) | 23 (58.9) | 28 (71.7) | 16 (76.1) | 18 (85.7) | 16 (76.1) | 12 (57.1) | 76 (67.25) | 82 (72.56) |
| 3 | 18 (56.0) | 28 (87.5) | 17 (43.5) | 32 (82.0) | 11 (52.3) | 18 (85.7) | 12 (57.1) | 15 (71.4) | 58 (51.32) | 93 (82.30) |
| 4 | 12 (37.5) | 16 (50.0) | 15 (38.4) | 17 (43.5) | 12 (57.1) | 13 (61.9) | 4 (19.04) | 5 (23.8) | 43 (38.05) | 51 (45.13) |
| 5 | 17 (53.0) | 26 (81.2) | 24 (61.0) | 29 (74.3) | 15 (71.4) | 17 (80.9) | 12 (57.1) | 16 (76.1) | 68 (60.17) | 88 (77.87) |
| 6 | 20 (62.0) | 29 (90.6) | 21 (53.8) | 25 (64.1) | 19 (90.4) | 21 (100) | 13 (61.9) | 15 (71.4) | 73 (64.60) | 90 (79.64) |
| 7 | 14 (44.0) | 18 (56.0) | 10 (25.6) | 16 (41.0) | 5 (23.8) | 11 (52.3) | 2 (9.5) | 8 (38.0) | 31 (27.43) | 53 (46.90) |
| 8 | 19 (59.0) | 32 (100) | 19 (48.7) | 35 (89.7) | 19 (90.4) | 19 (90.4) | 10 (47.6) | 18 (85.7) | 67 (59.29) | 104 (92.03) |
| 9 | 24 (75.0) | 29 (90.6) | 29 (74.3) | 37 (94.8) | 19 (90.4) | 20 (95.2) | 9 (42.8) | 19 (90.4) | 81 (71.68) | 105 (92.92) |
| 10 | 22 (69.0) | 30 (93.7) | 26 (66.6) | 31 (79.4) | 13 (61.9) | 19 (90.4) | 9 (42.8) | 15 (71.4) | 70 (61.94) | 95 (84.07) |
| 11 | 25 (78.0) | 26 (81.2) | 23 (58.9) | 21 (53.8) | 12 (57.1) | 16 (76.1) | 11 (52.3) | 13 (61.9) | 71 (62.83) | 76 (67.25) |
| 12 | 10 (31.0) | 22 (69.0) | 7 (17.9) | 19 (48.7) | 13 (61.9) | 18 (85.7) | 6 (28.5) | 10 (47.6) | 36 (31.85) | 69 (61.06) |
| 13 | 27 (84.0) | 31 (96.8) | 30 (76.9) | 38 (97.4) | 15 (71.4) | 19 (90.4) | 15 (71.4) | 19 (90.4) | 87 (76.99) | 107 (94.69) |
| 14 | 3 (9.3) | 16 (50.0) | 5 (12.8) | 15 (38.4) | 5 (23.8) | 12 (57.1) | 7 (33.3) | 8 (38.0) | 20 (17.69) | 51 (45.13) |
| 15 | 21 (65.6) | 22 (69.0) | 19 (48.7) | 25 (64.1) | 16 (76.1) | 20 (95.2) | 7 (33.3) | 9 (42.8) | 63 (55.75) | 76 (57.25) |
| 16 | 20 (62.0) | 23 (72.0) | 14 (35.8) | 30 (76.9) | 9 (42.8) | 18 (85.7) | 8 (38.0) | 11 (52.3) | 51 (45.13) | 82 (72.56) |
| 17 | 18 (56.0) | 22 (69.0) | 16 (41.0) | 23 (58.9) | 11 (52.3) | 14 (66.6) | 11 (52.3) | 8 (38.0) | 56 (49.55) | 67 (59.29) |
| 18 | 18 (56.0) | 21 (65.6) | 8 (20.5) | 22 (56.4) | 7 (33.3) | 19 (90.4) | 4 (19.0) | 10 (47.6) | 37 (32.74) | 72 (63.71) |
| 19 | 23 (72.0) | 25 (78.0) | 26 (66.6) | 26 (66.6) | 17 (80.9) | 17 (80.9) | 19 (90.4) | 13 (61.9) | 85 (75.22) | 81 (71.68) |
| 20 | 18 (56.0) | 17 (53.0) | 14 (35.8) | 18 (46.1) | 8 (38.0) | 14 (66.6) | 13 (61.9) | 7 (33.3) | 53 (46.90) | 56 (49.55) |

Results expressed by n (%).

A depth of 5 cm and no more than 6 cm in the ECC of an adult victim was recommended in question 8. The nurses in the fixed pre-hospital area stood out, with 19 (59.0%) participants who answered correctly in the pre-test right and 32 (100%) who did so in the post-test. However, all the professional categories developed knowledge and showed excellent performance on this topic.

Question 9 recommended maintaining a frequency of 100 to 120 compressions per minute for ECC. The nurses in the hospital area had already stood out since the pre-test with 19 (90.4%) participants, increasing in the post-test, with 20 (95.2%) participants who answered the question correctly. Excellent performance on this theme was evidenced in all the professional categories.

Allowing complete recoil, decompressing the chess during the ECC to guarantee the chest wall recoil, was the topic addressed in question 10. All the categories achieved knowledge development for this theme, with emphasis on the nurses from the fixed pre-hospital area, with 22 participants (69.0%) who answered correctly in the pre-test correctly 30 (93.7%) who did so in the post-test.

The elevation of the head of a victim in CPA due to hyperextension of the neck to permeabilize the airways, in the situation where there is no suspicion of cervical injury, was addressed in question 11. The nurses in the hospital area showed greater knowledge development, evidenced by 12 (57.1%) participants who answered correctly in the pre-test and 16 (76.1%) who did so in the post-test.

Question 12 addressed the need to press the center of the bag-valve-mask apparatus in one second with each ventilation to provide adequate ventilation in CPR. The hospital nurses stood out, with 13 (61.9%) participants who answered correctly in the pre-test and 18 (85.7%) who did so in the post-test.

The recommendation to perform cycles of 30 ECCs accompanied by two rescue breaths, synchronized with ventilation with bag-valve-mask apparatus in an adult CPA victim, was pointed out by question 13. The technicians working in the fixed pre-hospital stood out, with 30 (76.9%) participants who answered correctly in the pre-test and 38 (97.4%) who did so in the post-test. However, on this question, all the professional categories showed excellent knowledge development.

Triggering the AED immediately after arriving at the place where the CPA victim is located was the theme addressed by question 14. The nursing technicians in the fixed pre-hospital area stood out regarding knowledge development in this topic, considering three (9.3%) participants who answered correctly in the pre-test and 16 (50.0%) who did so in the post-test.

Question 15 highlighted that the AED indicated the delivery of shock to victims who had ventricular fibrillation and pulseless ventricular tachycardia and contraindicated shock in asystole and pulseless electrical activity (PEA) in question 16. The nurses working in the hospital area stood out in both questions.

Question 17 addressed CPR as a recommendation in a scenario in which the AED assessed heart rate and did not indicate shock. The performance regarding the knowledge development of nurses in the pre-hospital area was superior to the other participants, being evidenced by 18 (56.0%) participants who answered correctly in the pre-test and 22 (69.0%) who did so in the post-test.

The recommendation not to turn the AED off and keep the blades adhered to the victim's chest in face of the return of spontaneous circulation was mentioned in question 18. The hospital area nurses showed a significant increase in the number of participants who answered the pre-test correctly: from seven individuals (33.3%) to 19 (90.4%) in the post-test.

The use of Advanced Life Support (ALS) and post-CPR care was highlighted in question 19. In this question, the nurses in the hospital area maintained a good performance, with 17 (80.9%) participants who answered the questions correctly before and after the test.

Question 20 addressed the recording of information about CPR in the In-hospital Utstein Style instrument. It was noticed that the hospital area nurses stood out, with eight (38.0%) participants who answered correctly in the pre-test and 14 (66.6%) who did so in the post-test.

Table 1 shows the correct answers between the pre- and post-tests to assess knowledge development by professional category and respective fields of work in health.

**Table 1** – Correct answers obtained in the pre-test and post-test per professional Nursing category and work environment regarding knowledge about Basic Life Support in adults using the automated external defibrillator (n=113). Ribeirão Preto, SP, Brazil, 2019.

| Variable | Pre-hospital area nurse | | p-value | Pre-hospital area technician | | p-value | Hospital area nurse | | p-value | Hospital area technician | | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre-test | Post-test | p<0.001 | Pre-test | Post-test | p<0.001 | Pre-test | Post-test | p<0.001 | Pre-test | Post-test | 0.041 |
| Mean | 10.70 | 14.62 | | 8.84 | 12.36 | | 11.90 | 16.19 | | 9.14 | 10.95 | |
| Standard deviation | 3.05 | 2.80 | | 3.27 | 3.46 | | 2.75 | 2.08 | | 3.73 | 4.92 | |

The best performance in terms of knowledge development for BLS was presented by the hospital area nurses, characterizing a mean of 11.90 correct answers in the pre-test and of 16.9 in the post-test, with a p-value<0.001. It is worth mentioning that, through the paired Student's *t*-test, statistical significance was also identified in the scores related to the development of cognitive knowledge of all the Nursing categories.

Table 2 shows the correct answers obtained considering the knowledge about BLS in adults using the AED and the total number of participants.

When comparing the mean of correct answers between the pre- and the post-test of all the Nursing professionals, using the paired Student's *t*-test, an increase in knowledge scores was noted. In the pre-test assessment, the mean number of correct answers by the professionals was 10.16 and, in the post-test, 13.62, with a p-value<0.001, being statistically significant for the development of cognitive ability regarding BLS in adults with the use of the AED, considering the articulation of active teaching and learning strategies.

**Table 2** – Correct answers obtained in the pre-test and post-test by all the Nursing professionals regarding knowledge about Basic Life Support in adults using the automated external defibrillator (n=113), Ribeirão Preto, SP, Brazil, 2019.

| Variable | Mean | Standard deviation | p |
|---|---|---|---|
| Pre-test | 10.16 | 3.28 | <0.001 |
| Post-test | 13.62 | 3.62 | |

## DISCUSSION

The importance of this research is related to the demonstration of the potentiality of the association of active pedagogical strategies, such as inverted classroom, video lesson and clinical simulation to develop knowledge about BLS in adults using the AED for Nursing.[11,14,15] Two professional categories were considered, nurses and nursing technicians, as well as two health care scenarios, the fixed pre-hospital scenario and the hospital scenario.

The fixed pre-hospital component comprises Basic Health Units, family health units, teams of community health agents, specialized outpatient clinics, diagnostic and therapeutic services, and non-hospital emergency care units.[16] In this study, it is represented by one UPA and two UBDS. The hospital component, on the other hand, addresses the general hospital units of types I and II and the reference hospital units types I, II and III, general and specialized backup beds, long-stay beds and semi-intensive and intensive therapy beds[16] in two general hospitals.

The Nursing activities portrayed in this research are performed, in their majority, by young and female nursing technicians.[17–19] It is noteworthy that Nursing is a profession in full rejuvenation. 40% of its contingent are in the age group between 36 and 50 years old (38%),[19] which is similar to the results identified in this study.

For many decades, it has been noticed that the health field is historically female, and that Nursing, by tradition and culture, has always contributed to this feminization of health. However, between 1970 and 1980, there was an increase in the male contingent with higher education. Despite this phenomenon, the Nursing workforce is still mainly composed by women.[19]

As for the assessment of the participants' knowledge development regarding the BLS of adult patients using the AED, through the articulation of active teaching strategies, the nurses working in the hospital area stood out. Nurses play an indispensable role in the context of CPR, since their work promotes organization, leadership and efficiency in this care.[20]

A number of research studies currently demonstrating the relationship between the nurses' knowledge and their performance in CPR shows that, despite the increased search for updates, courses and training, knowledge of this topic is still low, and training and routine assessment can be useful to increase nurses' cognitive ability, which occurs more frequently in the hospital environment.[21–22]

The articulation of active educational strategies to improve the teaching and learning process of CPR with BLS in adults adopted in this study indicated statistically significant results, which are also demonstrated in other research studies in Nursing.[20–23]

Inverted classrooms can be thought as learning outside the classroom environment, characterized by activities performed before and after class, made possible by the regular and systematic use of interactive technologies in the teaching and learning process.[11] In this study, the inverted classroom strategy was characterized by sending educational materials and video lessons on the proposed theme, with the intention of directing previous study and providing a virtual facilitating mechanism that would complement the participants' teaching and learning process.

The video lessons about BLS in adults using AED, associated with immediate CPR skills training on low-, medium- or high-fidelity manikins, is an effective tool that promotes learning in an interactive and motivating manner, favoring the retention of long-term cognitive knowledge.[24]

The adoption of diverse pedagogical strategies in CPR courses for knowledge development, mainly with an emphasis on clinical simulation − an experience characterized by an environment that mimics reality and is collaborative and centered on the learner − is an important pedagogical decision, given the potential to maximize the teaching and learning process through the use of various resources.[14,15,25–28]

These statements are corroborated by a survey carried out with Nursing students at a university in Iran that proposed to evaluate the effectiveness of the association of active teaching strategies for the learning of CPR, pointing to an increase in the scores of the participants' cognitive ability, with statistically significant results.[29]

In short, knowledge about CPR and BLS is essential for Nursing professionals and enabling it through active strategies, mainly through clinical simulation, favors its acquisition, possibly by favoring the development of critical thinking, stimulating clinical judgment, reflective discussion and active participation of those involved in the learning process – factors that positively impact on the acquisition and retention of cognitive ability/knowledge.[11,25–28,30]

The main limitations of this study were the following: first, the non-use of a control group to compare the effect of the intervention, added to the non-adoption of a randomized experimental design and, also, the absence of a measurement regarding the retention of the participants' knowledge in the long term. These limitations instigate the need for further research on the theme, by means of randomized clinical trials.

This study has implications for teaching, research and clinical practice in Nursing, primarily for obtaining scientific deepening regarding the best pedagogical practices to be adopted for development of knowledge regarding CPR in adult patients using the AED, evidencing an important theoretical framework for the improvement of this context, especially for evidence-based teaching and clinical practice in Nursing.

## CONCLUSION

This study assessed the knowledge of Nursing professionals regarding Basic Life Support with the use of the automated external defibrillator, considering the use of active teaching and learning strategies (such as inverted classroom, video lesson and clinical simulation) and the emphasis on the performance of nurses working in the hospital area regarding knowledge development on this theme.

In general, a statistically significant increase in knowledge was identified in all the Nursing categories, which indicates the effectiveness of this intervention, possibly justified by the articulation of the active strategies adopted, which enhance the development of critical thinking and stimulate clinical judgment, reflective discussion and active participation of the individuals in their learning process – factors that positively impact on the acquisition and retention of cognitive ability/knowledge.

It is recommended that this research be extended to Nursing students, considering the need to develop and improve knowledge about cardiopulmonary resuscitation while still at the university and also to develop experimental, randomized studies that test the effectiveness of articulating active teaching and learning strategies for cardiopulmonary resuscitation, addressed in this research, and long-term knowledge retention.

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## NOTES

## ORIGIN OF THE ARTICLE

Extracted from the thesis - Assessment of knowledge and skills of Nursing professionals working in emergency care units in BLS using the AED, presented to the *Programa de Pós-Graduação de Mestrado Profissional, Escola de Enfermagem de Ribeirão Preto, Universidade de São Paulo*, in 2019.

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Data analysis and interpretation: Nascimento KG, Silva AR, Nascimento JSG, Dalri MCB.
Discussion of the results: Silva AR, Nascimento JSG, Dalri MCB.
Writing and/or critical review of the content: Silva AR, Nascimento JSG, Dalri MCB.
Review and final approval of the final version: Silva AR, Nascimento JSG, Dalri MCB.

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## APPROVAL OF ETHICS COMMITTEE IN RESEARCH

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## CONFLICT OF INTEREST

There is no conflict of interest.

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