

SAVING LIVES STARTS EARLY: NURSE-LED FIRST AID AND CARDIOPULMONARY RESUSCITATION TRAINING FOR HIGH SCHOOL STUDENTS AND FUTURE PROFESSIONALS



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Contribution to Emergency Nursing Practice

- Early bystander cardiopulmonary resuscitation is crucial for survival after cardiac arrest, yet public knowledge and confidence to perform it remain limited. Emergency nursing professionals play a key role in community cardiopulmonary resuscitation education.
- This study demonstrates that emergency nursing-led theoretical-practical workshops in schools and universities significantly improve cardiopulmonary resuscitation knowledge and self-efficacy across diverse age groups, providing evidence for the effectiveness of educational interventions outside health care settings. Cardiopulmonary resuscitation training led by nurses, involving students and future educators, fosters their role in shaping health-conscious generations of saving lives.
- Integrating emergency nursing-led cardiopulmonary resuscitation training into educational curricula enhances community preparedness, strengthens the chain of survival, and expands the preventive and educational role of emergency nurses beyond clinical environments.

Abstract

Introduction: Cardiopulmonary resuscitation refers to the emergency procedure performed in response to a sudden loss of consciousness with cessation of breathing and cardiac activity. It requires immediate interventions including airway management, ventilation, chest compressions, and defibrillation. According to the World Health Organization, with ischemic heart disease responsible for 13% of global mortality, widespread cardiopulmonary resuscitation training is critical, particularly outside health care settings. School and community nursing provide an effective platform to educate young people, reinforce the chain of survival, and promote health literacy in educational environments.

Objective: This study aimed to determine whether structured theoretical-practical workshops enhance cardiopulmonary resuscitation knowledge and self-efficacy among high school and university students compared with a control group and explore associations with sociodemographic variables.

Methods: A quasi-experimental design was used. Nursing-led workshops were delivered in high schools and universities, with pre- and postintervention assessments measuring cardiopulmonary resuscitation knowledge and self-perceived competence. The sample comprised 472 participants aged 12 to 74 years (mean = 21.27; SD = 12.54 years).

Results: Participants exhibited significant improvements in cardiopulmonary resuscitation knowledge and confidence after the intervention. Gains exceeded those observed in the control group and were consistent across sociodemographic subgroups.

Discussion: Nursing-led educational interventions in school and university settings substantially improve cardiopulmonary resuscitation knowledge and self-efficacy, enhancing preparedness for cardiac emergencies. Integrating such programs into

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educational curricula supports the chain of survival, strengthens community resilience, and aligns with public health priorities for early intervention and prevention.

Introduction

Cardiac arrest is defined as a sudden loss of consciousness accompanied by the absence of effective respiration and cardiac output.¹ Prompt reversal relies on the immediate initiation of a sequence of interventions, airway management, ventilation, chest compressions, and defibrillation, collectively referred to as cardiopulmonary resuscitation (CPR).² Although rudimentary resuscitation attempts date back centuries, chest compressions were formally incorporated into CPR techniques in the 1960s, forming the foundation of modern resuscitation practice.³ Alongside airway management and circulatory support, these interventions established the ABC paradigm, developed by Peter Safar, which still underpins global resuscitation training.^{3,4}

Worldwide, ischemic heart disease is the leading cause of death, accounting for 13% of total mortality, with deaths rising from 2.7 million in 2000 to 9.1 million in 2021.⁵ In Europe, myocardial infarction incidence is estimated at 40.6 per 100,000 individuals annually.⁴ Cardiac arrest is a major global health concern and remains the leading cause of prehospital and in-hospital deaths worldwide, with an estimated annual incidence of 95.9 per 100,000 adults and survival rates of less than 10%.⁶ Recent data from the American Heart Association indicate that, after an acute myocardial infarction, the short-term (3-month) risk of cardiac arrest is 0.29%, or 116 per 100,000 person-years.⁷ In Spain, approximately 1000 cardiac arrests occur daily, representing 30,000 sudden deaths per year, 80% of which occur at home, with bystander CPR initiated in only 40% of cases, often by family members.^{8,9} Despite evidence that early intervention within the chain of survival can double or triple survival rates,^{8,10} only 1 in 5 victims receives bystander CPR, with telephone-assisted guidance provided in roughly one-third of cases and defibrillators used in just 4% of cases.⁶ Survival is strongly time dependent, reaching 98% if CPR is initiated within 1 minute, decreasing to 25% after 5 minutes and 1% after 10.^{2,10}

Several European countries have integrated CPR education into national curricula, serving as benchmarks for population preparedness.¹¹ Embedding life support skills in school programs aligns with United Nations Sustainable Development Goals on Quality Education and Health, while fostering safer communities.¹² However, in Spain,

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school health education primarily emphasizes exercise and nutrition, with first aid and CPR training remaining limited.¹² This gap adversely affects both technical competence and confidence to act in emergencies, contributing to suboptimal early intervention rates relative to the European average.^{5,9,13-15}

To address these deficiencies, our intervention is framed by the nursing diagnosis (North American Nursing Diagnosis Association 00435): ineffective health management related to insufficient knowledge.¹⁶ The proposed strategy involves equipping students with lifesaving skills through theoretical-practical workshops conducted in schools and universities. Evidence supports the superiority of simulation-based training over purely didactic methods, particularly in teaching high-quality chest compressions, minimizing interruptions while ensuring adequate rate and depth.^{11,17-19} The workshops incorporate topics inspired by the Nursing Interventions Classification such as teaching, cardiac arrest management, first aid, and external defibrillator management.^{16,18} Students' physical and cognitive capabilities render them appropriate targets for early-life basic life support (BLS) training.^{11,16,19}

Beyond technical competence, such interventions enhance self-efficacy, defined as the belief in one's capacity to perform actions to achieve specific goals.¹⁷ Higher self-efficacy correlates with increased willingness and promptness to act during cardiac arrest or choking incidents.^{5,14} Pediatric, community, and school nurses are ideally positioned to lead these initiatives, given their accessibility and health promotion role.^{20,21} Systematic reviews by Pérez et al²⁰ and Morro Goñi et al²¹ confirm that nurse-led school interventions, covering CPR and broader health education, are well received by students, educators, and families and yield measurable community health benefits. Training may also be extended to parents and teachers, further strengthening preparedness across the educational environment.²¹ Nationwide regulation ensuring consistent deployment of school and community nurses could facilitate sustainable implementation of such interventions, promoting lifelong health literacy and community resilience.^{20,21}

International evidence reinforces the efficacy and feasibility of structured, supervised, and practical CPR training.^{1,22-26} Clear supervision enhances skill acquisition even in high-stakes procedures,²¹ whereas

curricula extending beyond CPR to include emergency calls, automated external defibrillator (AED) use, recovery position, choking, and injury management optimize overall preparedness.²² Peer- and teacher-led models have demonstrated comparable outcomes to professional instruction, with high retention and positive learner attitudes when guided by trained health care professionals.^{1,24} Interventions exceeding 3 hours with both practical and theoretical components significantly improve skill retention and knowledge acquisition.^{25,26} Our study incorporates these principles, through structured, interactive, and scientifically supported workshops, thereby maximizing learning outcomes and developing self-efficacy in adolescents and young adults.

Although previous research supports the effectiveness of simulation-based and didactic education in enhancing knowledge transference and self-efficacy, there remains a gap in understanding how these approaches can be applied within the Spanish educational contexts for CPR and first aid training.^{1,22,26} Despite legal mandates, Spanish CPR education remains limited within schools.^{3,11} This study aimed to evaluate whether structured workshops delivered by nurses enhance technical and theoretical skills among high school and future professionals. Specific objectives include assessing pre- and postintervention knowledge, exploring the influence of sociodemographic variables such as age, gender, and educational level on learning outcomes; strengthening population BLS skills through sustained training; and evaluating students' perceived self-efficacy in first aid performance. Hence, the present study is based on the hypothesis that Spanish nursing-led health education can substantially improve students' knowledge, competence, and self-efficacy in CPR and first aid.

Methods

STUDY DESIGN

This evidence-based project was designed as a quasi-experimental educational intervention with 2 groups (quasi-experimental and control group) intended to evaluate knowledge, beliefs, and self-efficacy toward CPR and first aid among adolescents and future professionals. A nonequivalent control group design was used, with a pretest–post-test for the quasi-experimental group (intervention) and a post-test only for the control group.

PARTICIPANTS

The 472 participants were divided into 2 groups: an intervention group and a control group. The intervention group consisted of 154 students, of whom 133 were enrolled in grade 8 of junior high school (approximately 13–14 years old), 47 were in grade 12 of high school (approximately 17–18 years old), and 9 were undertaking a master's degree in education and inclusive society. The control group, composed of 318 individuals, did not receive the intervention but completed the same questionnaires. This group included high school pupils not exposed to the training, nursing undergraduates from all 4 years of study, and students undertaking a range of other university degrees in health sciences, education, social sciences, humanities, engineering, and natural sciences, as well as participants in lifelong learning programs. Inclusion criteria required completion of the questionnaire, either online or in print, and formal assignment to 1 of the study groups. Exclusion criteria were restricted to the absence of an informed consent.

Power analyses were conducted using G*Power program version 3.1.9.7. For pre–post comparisons within the intervention group, paired *t* tests with a large effect size ($d = 0.8$), alpha of 0.05, and a desired power of 0.99 indicated a minimum of 83 participants. The actual sample achieved a post hoc power of 1.0, indicating excellent statistical power. For comparisons between the intervention and control groups, independent *t* tests with the same effect size and alpha indicated a minimum of 42 participants per group. The actual samples also achieved a post hoc power of 1.0. These analyses confirm that the study sample was sufficient to provide high statistical power for both within-group and between-group comparisons.

PROJECT APPROVAL

Ethical approval for the study was obtained from the Bioethics Committee of the University of Burgos (IR 29/2023). Participation was voluntary and based on an informed consent. An informed consent was obtained from all participants before the study, ensuring voluntary participation, and additional consent was secured from parents or guardians, school authorities, and the relevant university bodies. To protect anonymity, each participant was identified by a numerical code, and responses were stored without personal identifiers.



FIGURE

Illustration of the theoretical and practical parts of the cardiopulmonary resuscitation intervention.

INTERVENTION

The educational intervention was conducted face-to-face between December 2024 and January 2025 in high schools and at the university. Each program had a total duration of approximately 3 hours, distributed across a single session. Participants in both intervention and control groups were recruited through a quota sampling strategy to ensure representation across educational levels. Data were collected in person from the intervention group and the nursing control group. Participants in the intervention group were recruited through collaboration among student counselors, teachers, university professors, and the research team. After coordinating with these professionals, researchers visited the high schools and the university to invite students to participate and administer the questionnaires. Grade 8 junior high school students completed the questionnaires on paper, given that the use of electronic devices is not permitted in classrooms except for the computer science subject, according to school policy. The remaining control group participants, comprising students from various university programs, were recruited via institutional email, which was distributed through the Vice-Rector's Office for Students. All participants, except for the grade 8 stu-

dents, completed the electronic questionnaire using a secure Microsoft Forms link, as recommended by the ethics committee to ensure data protection within the university's Office 365 environment. The quasi-experimental (intervention) group participated in the training, whereas the control group did not receive the intervention and completed only the post-test assessment. The intervention was conducted by a team comprising 7 registered nurses and 1 physician student (certified lifeguard) and was delivered in both high schools and a university setting. The educational sessions followed a structured format consisting of a theoretical introduction and a practical component.

The intervention commenced with a brief theoretical lecture of approximately 10 minutes, supported by a PowerPoint presentation (see [Supplementary Materials](#) for further details), which introduced key concepts of BLS including the definition of CPR, the mechanics and rationale of chest compressions, the use of AEDs, and the management of airway obstruction such as the Heimlich maneuver. The remainder of the session was devoted to practical skills training in simulation-based scenarios.

During the workshops, participants were divided into small groups and rotated through different stations to practice resuscitation skills. Scenarios included adult manikins,

with and without AED; a child manikin for pediatric resuscitation; choking simulations using a dedicated vest for adult airway obstruction; and infant manikins to practice the specific adaptations required for pediatric BLS. Training equipment included adult, child, and infant manikins; a training AED; and choking simulation vests. Sessions were conducted in high school classrooms (12th grade), auditoriums (8th grade), and university simulation facilities (university students). This practice is presented in the [Figure](#).

INSTRUMENT

Data were obtained using a questionnaire comprising 2 sections. The first gathered demographic data including age, gender, previous training in CPR, and whether close relatives were trained in resuscitation. The second section consisted of 2 assessment scales.

The knowledge and attitudes toward CPR questionnaire (KACPRQ) was developed by the research team to assess participants' understanding and beliefs related to CPR. The questionnaire consisted of 19 items; the first 14 items assessed knowledge of CPR using true/false/don't know response options, and the remaining 5 items, rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), measured attitudes and perceptions regarding CPR training and personal competence in performing CPR. The KACPRQ was researcher developed based on established guidelines and recognized publications.^{1,2,8,15,27-31} The development process of the questionnaire included expert review to ensure face and content validity, followed by construct validation procedures, including factor analysis. The scale demonstrated acceptable internal consistency, with a Cronbach's alpha of 0.78, indicating good reliability for research use. A validation study, including psychometric analysis, is currently in progress and will be submitted for publication in the next phase of the project.

The self-efficacy scale was a validated instrument designed to measure individuals' self-perceived confidence in their CPR skills.¹⁵ It comprises 2 subscales, BLS, and advanced life support, the latter focusing on techniques for health care professionals. Each item was rated on a 7-point Likert-type scale ranging from 0 (no confidence) to 6 (total confidence). For this study, only the BLS subscale (SEBLS) was used, consisting of 13 validated items. The original SEBLS demonstrated excellent reliability (Cronbach's alpha = 0.95), which was confirmed in the present study with a Cronbach's alpha of 0.95, indicating high internal consistency.

DATA ANALYSIS

Before analysis, the assumptions of normality and homogeneity of means were examined and considered satisfied for the tests, largely owing to the large sample size. Group comparisons were conducted using Student *t* test and analysis of variance test, whereas Pearson correlation coefficients were used to explore associations between continuous variables such as age and questionnaire scores. Statistical significance was set at $P < .05$, with $P < .001$ considered highly significant.³² Effect sizes were calculated using Cohen's *d*, interpreted as small (0.20), medium (0.50), and large (0.80). For analysis of variance, effect size was assessed with partial eta squared, with thresholds of 0.01, 0.06, and 0.14 indicating small, medium, and large effects, respectively. Correlations were interpreted as small, medium, or strong for *r* values of 0.1, 0.3, and 0.5, respectively.

Results

The study population included a total of 472 participants, with 331 women (70.1%), 139 men (29.5%), and 2 nonbinary individuals (0.4%). Ages ranged from 12 to 74 years, with a mean of 21.27 years ($SD = 12.54$). Additional characteristics of the sample participants are presented in [Table 1](#).

The effectiveness of the intervention was assessed by comparing post-test outcomes between the intervention and control groups. The KACPRQ showed a significant difference, with the intervention group ($n = 154$; mean = 28.25; $SD = 5.94$) scoring higher than the control group ($n = 318$; mean = 26.30; $SD = 5.22$; $t[470] = 3.49$; $P = .001$; $d = 0.35$; 95% CI, 0.16-0.55). This small to medium effect size reflects higher levels of CPR knowledge and more positive beliefs toward resuscitation among participants in the intervention group than those in the control group. Notably, before the intervention, the intervention group achieved a lower mean score than the control group (mean = 25.03; $SD = 6.46$; $n = 287$). This difference is explained by the greater proportion of health science students in the control group. This composition enabled us to examine whether the intervention allowed participants to reach knowledge levels comparable with those of the professional population, particularly health care professionals who routinely perform BLS.

The SEBLS showed a significant difference, with the intervention group ($n = 152$; mean = 54.93; $SD = 13.53$) scoring higher than the control group ($n = 318$; mean = 43.45; $SD = 16.06$; $t[468] = 7.62$; $P =$

TABLE 1

Sociodemographic characteristics of the study population

Variable	Quasi-experimental group		Control group	Total
	Pretest	Post-test	Post-test	
Gender				
Woman	79 (59.4%)	88 (57%)	243 (76.9%)	410 (67.8%)
Man	53 (39.8%)	65 (42.2%)	74 (23%)	192 (31.7%)
Other gender	1 (0.8%)	1 (0.6%)	1 (0.3%)	3 (0.5%)
Course				
Eighth grade	77 (57.9%)	133 (86.4%)	0	210 (73.2%)
12th grade	47 (35.3)	16 (10.4%)	0	63 (22%)
Master's degree in teaching	9 (6.8%)	5 (3.2%)	0	14 (4.9%)
10th grade	0	0	3 (1%)	3 (1%)
First degree in nursing	0	0	71 (23.7%)	71 (23.8%)
Second degree in nursing	0	0	49 (16.6%)	49 (16.4%)
Third degree in nursing	0	0	31 (10.5%)	31 (10.4%)
Fourth grade in nursing	0	0	11 (3.7%)	11 (3.7%)
Health science degree, master, and PhD	0	0	24 (8.1%)	24 (8.1%)
Educator degree, master, and PhD	0	0	9 (3%)	9 (3%)
Humanities degree, master, and PhD	0	0	15 (5.1%)	15 (5%)
Social science degree, master, and PhD	0	0	24 (8.1%)	24 (8.1%)
Engineering degree, master, and PhD	0	0	15 (5.1%)	15 (5%)
Science degree, master, and PhD	0	0	9 (3%)	9 (3%)
Other degree, master, and PhD	0	0	36 (11.3%)	36 (5.9%)
Experience university	0	0	21 (7.1%)	21 (7%)
Previous training in CPR				
Yes	64 (48.1%)	72 (46.7%)	217 (72.6%)	353 (58.3%)
No	69 (51.9%)	82 (53.2%)	81 (27.4%)	232 (38.35%)
Nonanswer	0	0	20 (6.3%)	20 (3.3%)
Family who performs BLS				
Yes	51 (38.3%)	53 (34.4%)	153 (50%)	257 (42.4%)
No	82 (61.7%)	101 (65.6%)	165 (52%)	348 (57.5%)
Total	133 (100%)	154 (100%)	318 (100%)	605 (100%)
Profession of a relative who performs BLS				
Nurse	25 (48.1%)	24 (44.4%)	67 (43.4%)	116 (44.78%)
Physician	7 (13.5%)	11 (20.4%)	28 (43.4%)	46 (28.9%)
Nurse assistant	6 (11.5%)	7 (13%)	17 (8.6%)	30 (11.58%)
Other health care professional	5 (9.6%)	6 (11.1%)	13 (8.6%)	24 (9.26%)
More than 1 relative	9 (17.3%)	6 (11.14%)	28 (18.4%)	43 (16.6%)
Total	52 (100%)	54 (100%)	153 (100%)	259 (100%)

BLS, basic life support; CPR, cardiopulmonary resuscitation.

.001; $d = .77$; 95% CI, 0.55-0.95). This large effect size indicates that participants in the intervention group reported substantially higher levels of self-efficacy for

performing BLS than those in the control group. Before the intervention, the intervention group had also achieved a slightly higher mean score than the control

TABLE 2

Differences in KACPRQ and SEBLS scores by gender, previous CPR training, and having a family member trained in BLS

Variable	t	df	P value	Cohen's d	
				d	95% CI
Gender, mean (SD), KACPRQ	2.54	599	.01*	.22	0.04-0.39
Woman 26.11 (5.60); n = 409					
Man 24.81 (6.37); n = 192					
Gender, mean (SD), SEBLS	-.72	596	.47	.06	-0.23 to 0.11
Woman 44.95 (16.20); n = 408					
Man 45.99 (16.85); n = 190					
Previous training in CPR, mean (SD), KACPRQ	6.55	603	.001†	.54	0.38-0.71
Yes 26.98 (5.62); n = 353					
No 23.90 (5.76); n = 252					
Previous training in CPR, mean (SD), SEBLS	3.51	600	.001†	.29	0.13-0.45
Yes 47.18 (15.27); n = 351					
No 42.47 (17.49); n = 131					
Family who performs BLS, mean (SD), KACPRQ	1.67	603	.10	.14	-0.02 to 0.30
Yes 26.16 (5.9); n = 257					
No 25.36 (5.84); n = 348					
Family who performs BLS, mean (SD), SEBLS	.73	600	.46	.06	-0.10 to 0.22
Yes 45.79 (15.73); n = 255					
No 44.80 (16.87); n = 347					

BLS, basic life support; CPR, cardiopulmonary resuscitation; df, degrees of freedom; KACPRQ, knowledge and attitudes toward CPR questionnaire; SEBLS, basic life support subscale.

* $P < .05$.† $P < .001$.

group (mean = 47.21; SD = 16.56; $n = 284$), although this difference corresponded to only a small effect size. As with the other scale, health sciences students in the control group obtained the highest scores on this measure.

Implementation of the intervention in the quasi-experimental group, as evidenced by the comparison of pre- and post-test results, demonstrated a clear positive effect, with notable improvements in knowledge, beliefs, and self-efficacy in performing BLS. The KACPRQ showed a significant difference, with the post-test group ($n = 154$; mean = 28.25; SD = 5.94) scoring higher than the pretest group ($n = 133$; mean = 21.31; SD = 4.84; $t[285] = 10.75$; $P = .001$; $d = 1.28$; 95% CI, 1.53-1.02). This large effect size indicates that participants in the post-test group demonstrated substantially greater CPR knowledge and more positive beliefs toward resuscitation than the pretest group, reflecting a marked improvement attributable to the intervention. The SEBLS showed a significant difference, with the post-test group ($n = 152$; mean = 54.93; SD = 13.53) scoring higher than the pretest group ($n = 132$; mean = 38.31; SD = 15.24; $t[282] = 9.66$;

$P = .001$; $d = 1.15$; 95% CI, 1.41-0.91). This large effect size indicates that participants in the post-test group demonstrated substantially greater levels of self-efficacy for performing BLS than the pretest group, reflecting a marked improvement also attributable to the intervention.

The relationship between the scale scores and the sociodemographic characteristics of the sample is presented in Tables 2, 3, and 4. Significant gender differences are presented in Table 2, with women demonstrating higher levels of knowledge and more positive beliefs (KACPRQ) than men, with a small to medium effect size. Medium and small effect sizes were also observed among participants with previous training, who exhibited greater knowledge, more positive beliefs (KACPRQ), and higher self-efficacy (SEBLS) for performing BLS than those without training. No significant differences were observed based on whether participants had a family member trained in BLS. Significant differences by course of study are presented in Table 3. Third- and fourth-year nursing students demonstrated greater knowledge, more positive beliefs (KACPRQ), and higher self-efficacy (SEBLS) for performing BLS than the remaining participants. Among the

TABLE 3
Differences in KACPRQ and SEBLS scores by study courses and family members' BLS-related profession

Variable												F	df	P value	η_p^2
Study course, mean (SD), KACPRQ															
Eighth and 10th G ^a	12th G ^b	First ND ^c	Second ND ^d	Third ND ^e	Fourth ND ^f	Education ^g	Health ^h	Social Science ⁱ	Engineering ^j	Science ^k	Other course ^l	6.64	11, 604	.001*	.11
24.71 (6.51) ^{e,f} n = 213	25.38 (6.14) ^{e,f} n = 63	25.31 (5.37) ^{e,f} n = 71	25.55 (4.28) ^{e,f} n = 49	31.52 (3.95) ^{a,b,c,d,g,i,j,k} n = 31	32.82 (2.40) ^{a,b,c,d,g,i,j,k} n = 11	26.13 (6.38) ^{e,f} n = 23	28.17 (4.92) n = 24	23.41 (4.71) ^{e,f} n = 39	25.2 (4.07) ^{e,f} n = 15	23.56 (4.48) ^{e,f} n = 9	26.65 (4.44) ^e n = 57				
Study course, mean (SD), SEBLS															
Eighth and 10th G ^a	12th G ^b	First ND ^c	Second ND ^d	Third ND ^e	Fourth ND ^f	Education ^g	Health ^h	Social Science ⁱ	Engineering ^j	Science ^k	Other course ^l	8.78	11, 601	.001*	.14
49.15 (16.33) ^{b,i} n = 210	41.86 (15.61) ^{e,f} n = 63	39.80 (15.99) ^{e,f} n = 71	41.04 (14.09) ^{e,f} n = 49	58.48 (11.70) ^{b,c,d,g,i,j,l} n = 31	63.09 (10.27) ^{b,c,d,g,i,j,l} n = 11	43.96 (19.15) n = 23	49.58 (14.34) ⁱ n = 24	34.44 (15.34) ^{a,e,f,h} n = 39	35.27 (12.12) ^{a,e,f} n = 15	40.78 (12.58) n = 9	43.53 (13.51) ^{e,f} n = 57				
Relative's profession performing BLS, mean (SD), KACPRQ															
Nurse ^a 25.87 (5.82) n = 116	Physician ^b 26.52 (5.27) n = 46		Nurse assistant ^c 25.53 (6.73) n = 30		Other health care professional ^d 26.33 (7.08) n = 24		More than 1 relative ^e 26.81 (5.52) n = 43					.33	4, 258	.86	.01
Family member's BLS-related profession, mean (SD), SEBLS															
Nurse ^a 44.3 (16.21) n = 116	Physician ^b 45.8 (14.66) n = 44		Nurse assistant ^c 45.73 (16.16) n = 30		Other health care professional ^d 46.5 (15.24) n = 24		More than 1 relative ^e 48.67 (15.83) n = 43					.62	4, 256	.65	.01

BLS, basic life support; *df*, degrees of freedom; G, grade level in high school; KACPRQ, knowledge and attitudes toward CPR questionnaire; ND, nursing degree; η_p^2 , partial eta squared; SEBLS, basic life support subscale.

* $P < .05$.

^{a-1} Based on the Bonferroni post hoc tests ($p < 0.001$), each group is labeled with a superscript letter. When a group's letter appears alongside 1 or more additional superscript letters, it indicates that the group shows a significant difference from the other group or groups represented by those letters.

TABLE 4
Correlations among standardized scale scores, CPR training hours, and age in the sample

Variable	KACPRQ	SEBLS	CPR training hours	Age
KACPRQ	1			
SEBLS	.60*	1		
Previous CPR training hours	.15	.15 [†]	1	
Age	.05	-.04	.12	1

CPR, cardiopulmonary resuscitation; KACPRQ, knowledge and attitudes toward CPR questionnaire; SEBLS, basic life support subscale.

* $P < .001$.

[†] $P < .05$.

remaining participants, the intervention group and health science students exhibited the next highest levels of knowledge, beliefs, and self-efficacy for performing BLS. Differences by course of study had medium to large effect sizes. No significant differences were found based on a family member's BLS-related profession. The correlations between knowledge of and beliefs about CPR (KACPRQ) and CPR self-efficacy (SEBLS) are presented in Table 4. The results demonstrate strong associations, indicating that greater knowledge and more positive beliefs about CPR are linked to higher self-efficacy in performing BLS. With respect to training hours, a positive but small correlation was observed, suggesting that increased training is associated with a slightly higher perception of self-efficacy in BLS. No significant correlations were identified among the remaining constructs.

Discussion

This study was based on the hypothesis that nurse-led health education in Spain can substantially improve students' knowledge, competence, and self-efficacy in CPR and first aid. The findings confirm this assumption and the study's aim: the intervention significantly enhanced knowledge, beliefs, and perceived self-efficacy in the intervention group. Consistent with previous studies, students in health-related fields, particularly third- and fourth-year nursing students, achieved the highest scores.^{11,16,17,32,33} This supports the argument that sustained, well-designed, theory-practice interventions and high-quality training delivered by experienced professionals and supported by

simulation are particularly effective in reducing gaps caused by heterogeneous previous experiences.^{11,19,34} Importantly, women in the intervention group achieved higher knowledge scores than men, a pattern also observed in the study of Protano et al.⁵ This may reflect gender-related differences in motivation, which merit further exploration. Previous training was also associated with significantly higher scores in CPR knowledge, beliefs, and self-efficacy competence, in line with previous evidence emphasizing the importance of continuous education for CPR competence.^{11,16,17,19}

With respect to self-efficacy, the intervention not only improved theoretical knowledge but also enhanced participants' confidence in applying CPR in real emergencies. This finding is highly relevant, given that self-efficacy is a critical determinant of the willingness and ability to act promptly in life-threatening situations. Previous research has underscored the role of self-efficacy in facilitating effective resuscitation.^{5,11-13} Therefore, strengthening this component through targeted education represents an essential outcome of CPR training programs.³⁴ Similarly, the significant improvement observed in the beliefs items highlights that educational interventions can positively modify attitudes toward the importance and effectiveness of CPR, reinforcing participants' readiness to intervene when required.²⁵

Gender differences were not observed in the self-efficacy scale. The literature on gender and self-efficacy has reported mixed findings. For example, Protano et al.⁵ observed that although women often demonstrate higher knowledge, men tend to report greater self-efficacy. Furthermore, as Panchal et al.¹⁸ have argued, attitudes, norms, and self-efficacy are modifiable constructs, and educational approaches such as the 1 implemented here may reduce gender-related differences in CPR readiness.

Nonsignificant association with self-efficacy was observed by age. This suggests that adolescents and future school health educators alike can benefit from CPR training, consistent with earlier studies demonstrating that individuals from adolescence onward possess the physical and cognitive capacity to acquire and apply CPR skills effectively.^{11,16,19,34}

No significant differences were found in relation to having health care-trained relatives, although participants with nurse relatives tended to perform slightly better in the intervention group. The study also identified a positive medium correlation among knowledge, beliefs, and self-efficacy within the sample and the intervention and control groups. This reinforces the hypothesis that educational interventions can simultaneously improve knowledge, strengthen confidence, and positively influence beliefs about CPR,

thereby producing a comprehensive impact on readiness to act. International evidence reinforces the efficacy and feasibility of these approaches, emphasizing structured, precise instruction and active participation.^{1,22-26} Supervised practice has been shown to enhance skill acquisition even in high-stakes procedures,²³ whereas curricula that extend beyond CPR to include emergency calls, AED use, recovery position, choking, and injury management optimize overall preparedness.²² Peer- and teacher-led models have achieved outcomes comparable with professional instruction, particularly when supported by health care professionals, with high retention and positive learner attitudes.^{1,24} Furthermore, long-term structured programs, particularly those exceeding 3 hours and integrating both practical and theoretical components as in the present intervention, have been shown to significantly enhance knowledge retention and skill acquisition.^{25,26} The strength of the study aligns with these principles, given that the structured, interactive workshops were designed to maximize learning outcomes and foster self-efficacy among adolescents and future school health educator.

Limitations

This study has limitations, including a lack of random sampling and a heterogeneous student population, which complicates comparison between groups. Future research should involve more diverse populations, including children, older adults, and individuals with disabilities, to enhance generalizability and explore the broader applicability of nurse-led interventions.

Implications for Emergency Nurses

The findings of this study, grounded in nurse-led, simulation-based educational interventions, carry significant implications for emergency nursing practice. This intervention improves participants' CPR knowledge, confidence, and self-efficacy, underscoring the pivotal role of emergency nurses as educators, facilitators of health literacy, and leaders in community preparedness. For emergency nurses, the results highlight the value of extending professional practice to encompass preventive and educational domains, particularly within schools and universities. By implementing CPR training programs, emergency nurses can reinforce the chain of survival at the community level, ensuring that a greater proportion of the population is capable of responding to cardiac emergencies before profes-

sional assistance arrives. Integrating nurse-led CPR education into educational curricula supports early intervention, enhances public health competence, and fosters a culture of readiness that may help reduce mortality from sudden cardiac arrest. Collectively, these findings reaffirm emergency nursing's strategic role in advancing prevention, preparedness, and empowerment across communities.

Conclusion

This study demonstrates that a well-structured, simulation-based intervention, led by nurses, is effective in improving knowledge, beliefs, and self-efficacy toward CPR and first aid. These improvements were influenced by demographic factors such as gender and previous training. Nurse-led interventions offer distinct advantages in community and school contexts, where nurses' clinical expertise, teaching skills, and professional credibility make them ideally positioned to deliver high-quality health education. As many future professionals reach adulthood without previous CPR training, our findings highlight the strategic role of nurses in advancing continuous population-wide education in CPR and first aid.

Data, Code, and Research Materials Availability

The data reported in this manuscript can be accessed through contacting the corresponding authors and are deposited in a digital repository (Zenodo) that can be accessed from the following link: <https://doi.org/10.5281/zenodo.17072696>.

All procedures were performed according to the ethical standards of the Declaration of Helsinki and the National Research Committee. This study was approved by the Bioethics Commission of the University of Burgos (ID: IR29/2023). An informed consent was obtained from all participants before the research, guaranteeing their voluntary participation. In addition, consent was secured from the parent/guardian, the school management, and the relevant university authorities.

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Author Disclosures

Conflicts of interest: none to report.

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Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jen.2020.11.018>.

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