



Effectiveness of theoretical-practical training in basic life support for school canteen monitors from Primary Care

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Date of online publication:
17-january-2024

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Abstract

Introduction: cardiovascular diseases constitute a public health problem worldwide, among which cardiopulmonary arrest (CPA) stands out. School canteens are spaces where there is a possibility of witnessing CPA.

Materials and methods: quasi-experimental interventional and analytical study. Participants received training through an interactive virtual platform and a face-to-face clinical simulation session on the Heimlich manoeuvre, basic cardiopulmonary resuscitation (CPR) and the use of the semiautomatic external defibrillator (SAED). We carried out a descriptive analysis of the study population and a comparative statistical analysis of the results obtained in the tests conducted before and after the virtual training. We created variable corresponding to the subtraction of the pre-training score from the post-training score. Clinical simulation was analysed by direct observation. Statistical significance was defined as $p < 0.05$. The statistical analysis was carried out with SPSS version 19.0. The study adhered to the principles of the Declaration of Helsinki and the guidelines on good clinical practice.

Results: the entire sample consisted of women with a median age of 48.50 years. The median score in the pre-test was 6.7/10, and the score in the post-test was uniformly 10/10. The median difference between the pre- and post-training tests was of 3.3 points ($p 0.01$) and the simulation evinced that the learning was optimal.

Conclusions: training in CPR is a strategy that has social impact in terms of the improvement in the response to a CPA events, achieving a reduction in the associated morbidity and mortality.

Key words:

- Cardiopulmonary resuscitation
- Cardiorespiratory arrest
- Primary health care

Efectividad de la formación teórico-práctica en soporte vital básico a monitoras de comedores escolares desde Atención Primaria

Resumen

Introducción: las enfermedades cardiovasculares constituyen un problema de salud pública a nivel mundial y dentro de ellas destaca la parada cardiorrespiratoria (PCR). Los comedores escolares son espacios con potencial riesgo de presenciar una PCR.

Materiales y métodos: estudio analítico cuasiexperimental de intervención. Las participantes recibieron formación mediante una plataforma virtual interactiva y una sesión de simulación clínica presencial sobre maniobra de Heimlich, reanimación cardiopulmonar (RCP) básica y uso del desfibrilador externo semiautomático (DESA). Se realizó un análisis descriptivo de la población a estudio y un análisis estadístico comparativo entre el resultado obtenido en un test previo y otro posterior a la formación virtual. Se creó una variable restando la puntuación obtenida antes de la formación a la obtenida después de la misma. Se analizó mediante observación directa la simulación clínica. Se definió la significación estadística con una $p < 0,05$. Análisis estadístico con SPSS versión 19.0. Se siguieron los principios de la Declaración de Helsinki y las directrices sobre buenas prácticas clínicas.

Resultados: la totalidad de la muestra eran mujeres con edad mediana de 48,50 años. La nota mediana del test previo fue de 6,7/10 y el test posterior tuvo un resultado constante de 10/10. La diferencia entre el test posterior y el previo tuvo una mediana de 3,3 ($p 0,01$) y se constató en la simulación que el aprendizaje fue óptimo.

Palabras clave:

- Atención primaria de salud
- Parada cardiorrespiratoria
- Reanimación cardiopulmonar

How to cite this article: Salom Osta GA, Campos Uribe N. Efectividad de la formación teórico-práctica en soporte vital básico a monitoras de comedores escolares desde Atención Primaria. Rev Pediatr Aten Primaria. 2024;26:15-20. <https://doi.org/10.60147/a767b139>

INTRODUCTION

Cardiovascular diseases are a global public health problem, and cardiopulmonary arrest (CPA) is among the most important. It is a critical condition associated with a mortality of approximately 80% in Spain¹ that in up to 85% of cases occurs in out-of-hospital settings where health care or adequately trained staff are not available.

Cardiopulmonary arrest is defined as the abrupt, unexpected and potentially reversible cessation of spontaneous circulation and ventilation. In children and young adults, it usually results from causes other than cardiovascular disease, such as respiratory disease, accidental injury or choking.¹

In the population under 18 years, foreign body airway obstruction (FBAO) is the third leading cause of accidental death in Spain, as it can lead to asphyxia and, if not resolved quickly, progress to CPA and death.² Most of these episodes are witnessed by an adult, so knowledge on how to adequately manage these events can be crucial to reduce progression to CPA, morbidity and mortality. In this context, school canteens are shared spaces of socialization³ where large numbers of children and adolescents are exposed to situations that involve a risk of choking that could lead to FBAO and subsequently result in CPA.

There is evidence that survival from the time of CPA is inversely proportional to the time elapsed to initiation of cardiopulmonary resuscitation (CPR). Early initiation of CRP manoeuvres can even triple survival, reducing the associated morbidity and mortality, which must be considered in the context that it takes an average of 8 minutes for emergency medical services to arrive from the moment they are called.¹

Therefore, CPR training offers an opportunity to acquire knowledge on a topic of general interest that can be lifesaving and is included in current public health policy, that promotes health in the population and that not only addresses the physical and emotional health of individuals, but fosters

a sense of responsibility toward the care of oneself and of others.^{3,4}

Given the high mortality associated with CPA and the importance that individuals outside the health professions know how to respond to these situations, we developed an intervention to deliver BLS training to nursery and school canteen staff in the basic health zone of Tarragona-1, with the aim of improving their ability to respond in the event of witnessing a choking or CPA episode in the workplace and thereby improving outcomes in individuals victim of out-of-hospital CPA.^{5,6}

Hypothesis: theoretical and practical training on BLS and CPR manoeuvres through an interactive virtual platform and in-person clinical simulation is effective by improving the knowledge and skills of nursery and school canteen staff for responding to choking and CPA events.

Primary objective: to assess the effectiveness of training in BLS and CPR through a virtual platform and clinical simulation in an intervention aimed at the staff of a nursery and a school canteen.

Secondary objectives:

- To assess through direct observation of clinical simulations whether training through a virtual platform improves the ability to respond to choking or CPA events.
- To assess the potential association between age and the effectiveness of the delivered theoretical-practical training.
- To assess the association between previous training on BLS and the baseline results obtained in the pre-intervention test.

MATERIAL AND METHODS

Study design: quasi-experimental interventional and analytical study conducted between February and March 2022 in school canteen staff in the basic health zone of Tarragona-1 and the staff of the Bonavista nursery.

Study population: school canteen staff in the basic health zone of Tarragona-1, which includes the neighbourhood of Bonavista and the town of La Canonja, and staff of the Bonavista nursery. The inclusion criteria were age greater than 18 years and having signed the informed consent form. The exclusion criteria were refusal to participate and employment in the school canteen that did not involve actual monitoring of the children. Participants were recruited systematically applying the aforementioned criteria, and all were assigned to the intervention group, adding up to a total of 36 participants.

Intervention: the intervention consisted in the delivery of training through an interactive virtual platform, which entailed between 4 and 5 hours of independent work on the part of the participants within a 1-month period, after which an in-person 120-minute clinical simulation session was held in each participating centre. The contents of the training included the Heimlich manoeuvre, basic CPR manoeuvres and the use of the AED.

Outcome definition and measurement: the primary outcome was the difference in the scores obtained in the pre- versus post-intervention tests, which comprised 5 versus 10 items, respectively, and were scored on a 10-point scale, to assess the impact of the training. The secondary outcomes involved the assessment through direct observation of the application of the skills acquired in the virtual BLS training, including the correct implementation of the paediatric CPR algorithm (checking the scene for safety, checking for responsiveness, checking airway patency, checking breathing, calling for help and for an AED, delivery of rescue breaths, early initiation of effective chest compressions, adequate 30:2 compression-to-ventilation ratio and use of the AED) and the detection and correct implementation of the FBAO algorithm. Other secondary variables under study were sex, age group and previous training in BLS.

Data analysis: we performed a descriptive analysis of the study population, calculating the median and interquartile range for quantitative variables and absolute and relative frequencies for categorical

variables. To assess the primary outcome, we compared the results obtained in the tests conducted before and after the virtual training. Since these data were paired and did not follow a normal distribution, we used the Wilcoxon test. Since the study involved different methodologies, the assessment of clinical simulations was performed through direct observation. As a secondary outcome, we analysed the association between previous training in BLS and the score in the pre-training test by comparing the medians, assessing the statistical significance using the nonparametric Mann-Whitney U test. To assess the impact of sociodemographic variables and the improvement between the pre- and post-training tests, we created an additional variable obtained from subtracting the score in the pre-training test from that obtained in post-training test. This difference was analysed as a quantitative variable and compared by age group, with the categories defined as less than 40 years, 40 to 52 years and more than 52 years, after which we assessed the statistical significance of the results with the nonparametric Kruskal-Wallis test. Lastly, we analysed the association between previous training and age group. We defined statistical significance as $p < 0.05$, and the analyses were carried out with the software package SPSS version 19.0.

Ethical considerations: the study conformed to the principles of the Declaration of Helsinki⁷ and good clinical practice guidelines. It was conducted in the framework of the *Smartwatch* project (*"effectiveness of an automatically-activated network of volunteers in the reduction of the time elapsed to initiation of CPR manoeuvres"*), funded by the Strategic Plan for Health Research and Innovation (PERIS) (file SLT002/16/00162) and approved by the Clinical Research Ethics Committee of the Instituto de Investigación de Atención Primaria IDI-AP Jordi Gol (file 4R17/051). We safeguarded the confidentiality of the data as established by Organic Law 15/1999, of 13 December on the protection of personal data. Participants provided signed informed consent at the beginning of the intervention.

RESULTS

The final sample included 32 participants, which constituted an initial loss of 11.1% of the study population.

The statistical analysis of sociodemographic variables showed that the entire sample was comprised of women, with a median age of 48.50 years and an interquartile range of 37.3 to 53.8 years. Of the total sample, 53.1% had received BLS training before participating in the project.

The median score in the pre-training test was 6.7 out of 10 (interquartile range, 4.6-8.5) compared to a uniform score of 10 out of 10 in the post-training test in the entire sample.

To establish the primary outcome of the study, we assessed the difference between the pre- and post-training test scores, finding a median difference of 3.3 points (interquartile range, 1.5-5.4), which was statistically significant with a *p* value of 0.01.

As a secondary objective, we compared pre-training scores based on whether the participant had received any previous training on BLS, finding a median score of 6.6 in staff with previous training (interquartile range, 4-7.4) compared to 6.9 in staff with no previous training (interquartile range, 5.1-8.6), a difference that was not statistically significant, with a *p* value of 0.11.

Another secondary objective was to analyse the difference in the pre- and post-training scores by age group. In this analysis, the improvement in the scores was greatest in the staff aged less than 40 years, with a median of 4.4 (interquartile range, 2.6-5.6) and smallest in the staff aged more than 52 years, with a median of 2.9 (interquartile range, 1.6-5.8). This finding could have to do with the fact that the youngest staff was also the group that scored lowest in the pre-training test, given that the score in the post-training test was uniform across age groups. This finding was not statistically significant, with a *p* value of 0.32.

We also analysed the frequency previous training by age group. We observed that, of the participants

that had received previous training, 8 were aged less than 40 years (47.1%), 4 were aged 40 to 52 years (23.5%) and 5 were aged more than 52 years (29.4%). Of the participants that had not received previous training, 4 were aged less than 40 years (26.6%), 6 were aged 40 to 52 years (40%) and 5 were aged more than 52 years (33.3%).

As an interesting aside, only one participant had ever witnessed a CPA, and she had a score of 4 out of 10 in the pre-training test.

Lastly, we assessed what had been learned through the virtual training and the ability to respond to FBAO and CPA. We found that learning was optimal, as all participants were able to meet the established objectives, with significant engagement and participation during the practical session.

DISCUSSION

The study assessed the effectiveness and usefulness of training in BLS for the management of choking and CPA. The results evinced improvement after completion of the virtual training and adequate performance during simulation, which was consistent with the findings of a similar study conducted in schools in the region of Castilla-La Mancha.⁸

It stands to reason that BLS training in the community is essential to improve the capacity to respond to FBAO or CPA and thus reduce the morbidity and mortality associated with these events. Given that 80% of CPA events occur out of hospital and in the presence of individuals who are not health care workers,¹ it is important to promote the implementation and dissemination of health promotion activities that increase knowledge and improve performance of how to respond to an emergency due to choking or CPA in the general population, which would have a significant social impact.⁸

On account of the restrictions established due to the COVID-19 pandemic, we planned the delivery of the theoretical contents through a virtual platform, which allowed participants to acquire

knowledge at the time and pace allowed by their schedules, in addition to offering the advantage of being able to retake the course as many times as they wished and to share what they learned with people around them. A past systematic review demonstrated that virtual training is as effective as in-person training,⁹ so a factor that could have appeared as a limitation at the outset turned out to be a strength.

However, a limitation that we must highlight is the difficulty in assessing the capacity to respond to choking or CPA using a simulated scenario, as the ideal way to evaluate it would be in a real-life situation, which for obvious reasons is not possible.

Although large part of the population reports having notions of first aid, the existing knowledge is insufficient when it comes to CPR. Training on this subject is relevant, as would address a public health problem and a known need in the community, as individuals in the general population tend to be open to participating in BLS-related activities.

Our analysis evinced an inverse association between having previous training in CPR and the score in the pre-training test, so, although we did not determine the quality of previous training or the time elapsed since it was received, it is reasonable to conclude that simply receiving training in BLS does not guarantee the maintenance of the acquired skills. It is important that training in BLS be ongoing and offered at regular intervals to ensure the persistence of the acquired knowledge and skills, so we recommend the implementation of educational interventions in the community in order to improve the response of the general population to life-threatening emergencies.⁸ Periodical reinforcement of this knowledge makes the response to these emergencies more effective.⁶

To assess the engagement of the participants during the clinical simulation, we initially considered the possibility of using a checklist, but during the development of the practical session, we deemed that it would be more beneficial for their learning

and participation to not carry out a quantitative evaluation. Instead, we considered the heterogeneity of the group and adapted the evaluation strategy to the observed reality, assessing knowledge acquisition, interest and engagement in the staff after completing the virtual training through direct observation.

Some of the reasons highlighted by the canteen staff to not initiate CPR manoeuvres were lack of knowledge and fear of making the situation worse or harming the victim. After the simulation, participants exhibited great satisfaction as a perceived need had been met. In addition, they expressed the importance of receiving training in first aid and be able to practice what has been learned in the virtual training through simulated cases, which increased their confidence in responding to real-life FBAO or CPA events.

Lastly, we may conclude that training in CPR and FBAO management techniques is a strategy with a positive social impact.⁴ Furthermore, there is evidence that training in first aid of the general population, including education delivered through short remote courses⁹ and specifically in the school setting, is associated with an improved response to CPA in the community, thereby reducing the associated morbidity and mortality of these events.^{2,3,6,10,11} For this reason, it is important that the primary care system serves as a platform to promote the involvement of the population in accident-prevention activities through community health initiatives as a form of health education.

Given the effectiveness of the project, we propose, as a future strategy, the delivery of theoretical training underscoring the implementation of clinical simulation in the BLS education of other professional collectives with the ultimate goal of improving the response of the general population to choking of CPA, as most trainings on the subject are aimed at health care professionals, while the incidence of CPA is much higher in community compared to health care settings.^{5,6}

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare in relation to the preparation and publication of this article.

AUTHORSHIP

Author contributions: writing of manuscript and clinical simulation (NCU, GASO), translation and revision of the manuscript (GASO).

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