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Research Article

Teaching basic life support to children with autism spectrum disorder: A novel pictogram-based approach

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ABSTRACT

Background: Survival after cardiac arrest depends on timely bystander basic life support (BLS), yet children with autism spectrum disorder (ASD) are often excluded from BLS training strategies. This study assessed a pictogram-based, narrative approach using simulation to teach BLS to children with ASD.
Method: A quasiexperimental pretest/post-test design was conducted with a sample of eight children aged 8-12 years recruited from the Galician Autism Federation - ASPERGA Association. The intervention consisted of a 50-minute pictogram-based BLS simulation training, with participants assessed on their ability to perform the BLS sequence and cardiopulmonary resuscitation in a scenario-based cardiac arrest.
Results: Baseline assessments revealed inadequate proficiency in performing fundamental steps of the BLS sequence. Following targeted training, substantial improvements were noticeable, particularly in victim response ($p = .010$), airway opening ($p = .015$), and the look-listen-feel manoeuvre ($p = .014$). Nevertheless, challenges persisted in ventilation performance and overall cardiopulmonary resuscitation quality.
Conclusion: A pictogram-based simulation approach is a feasible strategy for teaching BLS to children with ASD. These children demonstrate the ability to learn and perform BLS with comparable proficiency to their peers without functional diversity.

Introduction

Sudden cardiac arrest (SCA) poses a significant global public health concern, particularly in out-of-hospital settings, where prompt intervention is paramount to enhance the current dismal prognosis. SCA is characterised by the cessation of cardiac activity, resulting in a loss of responsiveness and normal breathing due to the absence of blood circulation. In Europe, out-of-hospital cardiac arrest ranks as the third leading cause of mortality, with 30-day survival rates varying between 5% and 10% (Gräsner et al., 2016).

The chance of survival after SCA depends on the timely activation of the chain of survival (Figure 1), which includes four critical links: (a) early recognition of cardiac arrest and activation of emergency services, (b) early bystander cardiopulmonary resuscitation (CPR), (c) early defibrillation, and (d) early advanced life support and postresuscitation care. While the final step requires specialised healthcare professionals, the first three steps depend mainly on bystanders' attitudes and actions (Semeraro et al., 2021). Recent CPR recommendations place the greatest emphasis on the first two links, highlighting their priority, as they are pivotal in

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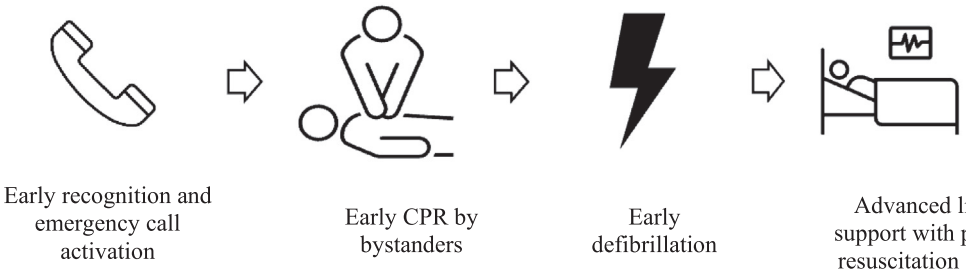

Figure 1. Steps in the survival chain.

determining the effectiveness and progression of subsequent links (Deakin, 2018).

In this context, effective management of the initial three links in the chain of survival hinges on the implementation of the basic life support (BLS) sequence. According to the European Resuscitation Council (ERC) Guidelines, BLS includes early recognition of cardiac arrest, activation of emergency medical services, chest compressions, rescue breaths, early defibrillation, and safety considerations (Smyth et al., 2025). 'CPR' refers specifically to chest compressions and ventilations and therefore represents a core component of BLS. It serves as a temporary substitute for spontaneous breathing and circulation, with the objective of restoring these functions and preventing damage to vital organs, particularly the brain. The potential for irreversible brain damage to occur within the initial three to five minutes of SCA underscores the paramount importance of immediate bystander intervention. Studies have demonstrated that bystander intervention (Ferrer Roca et al., 2021; Gräsner et al., 2020) can double or triple the chances of survival from SCA (Christensen et al., 2019; Sondergaard et al., 2019; Wissenberg et al., 2013). Despite the critical importance of early intervention, bystander-initiated CPR is performed in only an estimated 58% of SCA cases in Europe, according to the ERC (Semeraro et al., 2025). Alarmingly, the proportion of rescuers under 20 years of age remains particularly low, highlighting a significant gap in preparedness among younger individuals (Gräsner et al., 2020).

In this regard, it has been found that the most positive impact on increasing bystander CPR rates is by training schoolchildren (Semeraro et al., 2025; Wissenberg et al., 2013). Consequently, providing both theoretical and practical education at an early age in schools could foster long-term benefits for public safety. This approach is the most effective method of achieving long-term well-being for the entire population, not only ensuring that all children are exposed to BLS simulation but also developing them into potential peer trainers. This contributes to a multiplier effect within their families and school communities (Böttiger et al., 2017; Schroeder et al., 2023). The ERC currently leads an international statement called *Kids Save Lives* endorsed by the World Health Organization, which advocates teaching schoolchildren BLS skills to other schoolchildren. While this strategy has shown positive results for the general population of schoolchildren using different methodologies (such as traditional instructor-led sessions, hands-on manikin practice or virtual reality) (Semeraro et al., 2024), there is a gap in addressing the specific challenges faced by children with disabilities in receiving such training. Several studies have indicated favourable outcomes for individuals with physical, hearing, visual, and Down syndrome disabilities, as well as those with other specific developmental challenges, when adapted approaches are employed. The challenges faced by these people may include learning barriers due to limited adapted materials, difficulties with communication, or impaired processing of verbal instructions. However, it should be noted that many of them are able to learn CPR successfully (Berlanga-Macías et al., 2023; Schnaubelt et al., 2024).

The children's disability group includes individuals with autism spectrum disorder (ASD), a neurodevelopmental condition characterised by difficulties in social interactions, communication, and repetitive behaviours. The prevalence of ASD is increasing worldwide, affecting an estimated 1-5 in 100 children (Lord et al., 2018). People with neurodevelopmental disorders often experience social prejudices that limit their full participation in society and impartial access to opportunities in multiple areas of health or work. Addressing this discrimination requires promoting equal societal contribution, acceptance of human diversity, and an inclusive model based on equality (Martínez & Bote, 2019). In recent years, efforts have been made to challenge 'ableism', the set of beliefs that devalue disability and assume superiority of nondisabled individuals (Brown & Ramlackhan, 2022), and nursing staff could play a key role in this regard when they provide health education.

In the effort to raise global awareness of CPR, recent systematic reviews on BLS training for specific populations, including individuals with disabilities, indicate that adapted CPR education is feasible and can include people with disabilities as part of the pool of potential bystander responders. However, there is a paucity of in-depth studies on this topic, and further research is recommended into the optimal adaptation of the courses and their application with first responders exhibiting these characteristics. The overall quality of the evidence remains limited (Schnaubelt et al., 2024). In this context, bibliotherapy could be a valuable tool for teaching children with ASD and other neurodevelopmental disorders, since current standard guidelines often do not include specific strategies for these individuals (Deegan et al., 2025). Bibliotherapy uses reading and writing therapeutically to facilitate knowledge integration, potentially improving the management of certain conditions. Although its application in health education remains limited, existing research supports its effectiveness (Abraham et al., 2021). To further support learning, alternative communication methods like pictograms (visual representations that aid or replace written language) can make educational content more accessible and effective (Crowe et al., 2022).

Given that existing studies demonstrate the positive impact of adapted educational techniques on individuals with diverse developmental disabilities (Du et al., 2022; Rodríguez-Núñez et al., 2015), this pilot simulation, a nurse-led project challenges the notion that combining visual learning with narrative structures can facilitate the acquisition and application of BLS skills in children with ASD who do not present intellectual or language impairments.

The primary objective of our study was to evaluate the efficacy of utilising pictograms integrated into a narrative (bibliotherapy) for BLS learning and simulation in children with ASD who had no intellectual impairment or language deficiency. Secondary objectives were (a) to assess the impact of personalised training on the performance of the BLS sequence, (b) evaluate the quality of CPR

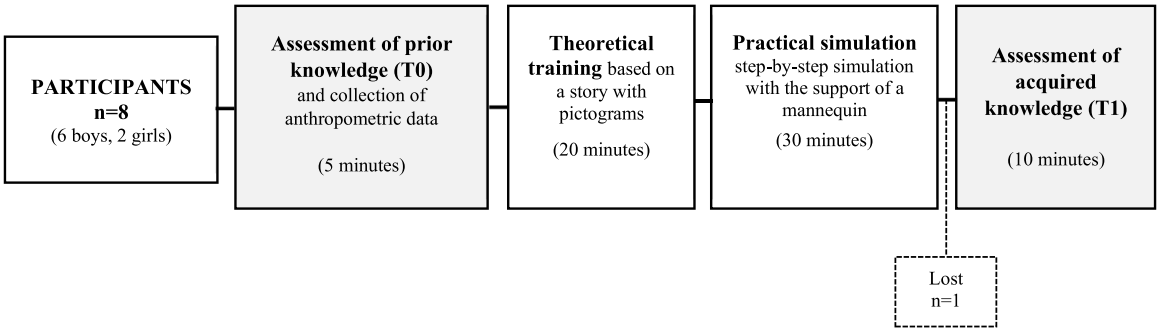

Figure 2. Flowchart of the study.

prior to and following simulation, and (c) compare the learning outcomes of children previously diagnosed with ASD with those of children of the same age range without disabilities.

Methods

Study design

An exploratory, quasiexperimental nurse-led simulation study with a pretest/post-test approach was carried out. Participants were divided into two groups of four to facilitate familiar and comfortable interactions, following the recommendations from the psychopedagogical team of the Galician Autism Federation - ASPERGA Association. Due to the nature of the intervention, participants and instructors were not blinded. To ensure clear and comprehensive reporting, the TREND checklist was used. This guideline is widely used to promote standardised and transparent reporting of nonrandomised intervention studies, particularly those with quasiexperimental designs (Des Jarlais et al., 2004).

Participants

A convenience sample of eight children with ASD, aged 8-12 years, from the cited association participated in this research. This age range has been identified as a favourable developmental period for the retention of BLS skills (Schroeder et al., 2023). These were recruited by approaching eligible members through the institution's directive. All invited participants agreed to take part. Given the exploratory nature of the study, children with associated intellectual disabilities or medical comorbidities that could exacerbate ASD symptoms were excluded.

The basic life support simulation project and its instruments

Our project followed a structured sequence comprising pretest (T0), intervention, and post-test (T1). The study process is shown in Figure 2.

At T0, participants individually completed a simulated scenario ("You come across a person who is lying on the ground and needs help; what would you do?") using an adult manikin simulating cardiac arrest (ResusciAnne®, Laerdal, Norway). Prior to the simulation, a brief prebriefing was conducted in which the scenario was explained and participants were informed that they should manage the situation independently, as if alone, with access to a telephone and a defibrillator that would be provided when appropriate.

Trained nurse evaluators utilised a standardised checklist (Table 1) to record the participants' successful completion of each step within the BLS sequence, also assessing whether the steps were executed accurately or exhibited errors. In addition, quality of CPR performance (including CPR quality, chest compression quality, percentage of chest compressions with correct depth, rate, recoil and hand position, as well as quality of mouth-to-mouth ventilations) was recorded using the QCPR app (Laerdal Medical). This software is an integrated real-time feedback system designed for use with the ResusciAnne manikins and configured according to the ERC guidelines current at the time of the study (Olasveengen et al., 2021).

Following the pretest, a structured 50-minute training session was conducted, led by a specialised CPR instructor. The session consisted of 20 minutes of theoretical instruction, followed by a 30-minute practical demonstration through simulation. Theoretical training was based on storytelling (bibliotherapy) enhanced with pictograms to support comprehension. The primary tool utilised was an original story, titled '*The Day I Saved a Life*', developed specifically for the purposes of this intervention. This story presents a scenario involving a traffic accident that necessitates the application of BLS. The narrative centres around a victim who was unconscious and not breathing.

The practical component consisted of simulated cardiac arrest scenarios involving four manikins, allowing participants to train the BLS sequence and quality chest compression and mouth-to-mouth ventilations. The trainer-to-participant ratio was 1:1 due to the special characteristics of the sample.

Post-training (referred to as '*T*1'), participants were individually evaluated using the same simulated scenario as *T*0 to assess improvements in their responses and skills in performing the BLS sequence. After that, a postbriefing was conducted, consisting of a structured review of the participant's performance, highlighting correctly executed actions and those requiring improvement according to the ERC guidelines (Olasveengen et al., 2021), with constructive feedback provided.

The intervention was led by registered nurses with formal training in BLS and certified CPR instruction, as well as experience in simulation-based health education. These nurses were present throughout data collection to ensure accurate assessment and measurement of outcomes. All instructors and evaluators followed standardised ERC-based BLS guidelines (Olasveengen et al., 2021) to ensure consistency in training and assessment. The multidisciplinary research team also included a paediatrician with simulation expertise, a psychopedagogist specialising in ASD, a licensed psychologist, and occupational therapists from the collaborating association to ensure appropriate educational adaptation. Data collection was carried out over two consecutive days, as the children from the association usually work in groups of four people. This approach, following the recommendation of the participant ASD association, ensured that the children remained connected to their routine, facilities, and classroom group.

The story and pictograms were developed collaboratively by this working group, including parent representatives of the association who piloted the materials. An illustrator designed the pictograms specifically for this project, as equivalent materials were

Table 1
Checklist to Record the Participants' Adherence to Basic Life Support (BLS) Sequence.

Code: __	Boy ☐/Girl ☐	Weight (kg):	Height (m):	
BLS Sequence				
Order of the sequence: Indicate the order in which the steps are performed from 1 to 6, regardless of whether they are done correctly or incorrectly	Safety	Response		
If a step is not performed, use Ø	Breathing	Alert emergency services		
	Chest compressions	Ventilations		
Check the safety of the environment	Yes	No		
Check for a response verbally and by shaking the victim	Done well	With errors		Not done
Open the airway (head-tilt, chin-lift)	Done well	With errors		Not done
Check for breathing (look, listen, feel)	Done well	With errors		Not done
Assess breathing for 10 seconds (approx.)	Done well	With errors		Not done
Alert emergency services (112/061)	☐ 112/☐ 061/☐ Done but says a different number/☐ Done but cannot remember the number/☐ Not done			

Start chest compressions	Yes	No
CPR Quality (QCPR app, Laerdal Medical)*	Ending time:	
CC score (%)	Ventilation score (%)	
Number of CC	CC with correct recoil (%)	
Average depth (mm)	CC with correct hand position (%)	
Average frequency (CC/min)	**CPR quality (%)**	

Note. CC = chest compressions; QCPR = quality of cardiopulmonary resuscitation.
* All CPR quality variables (ventilation, recoil, and percentage scores) were automatically recorded by the QCPR real-time feedback system (Laerdal Medical).

not identified in the open-access pictogram repositories commonly used by the participating entity.

Data analysis

Data were categorised into three groups: participant characteristics, performance of the BLS sequence in pretest and post-test, and CPR quality metrics (compression depth or compression rate, among others). Normality assumptions were assessed using the Shapiro–Wilk test due to the sample size and to determine whether parametric or nonparametric analyses were appropriate. Quantitative variables were summarised as mean and standard deviation or median and interquartile range, while categorical variables were presented as absolute and relative frequencies.

The McNemar test was used to compare performance on the BLS sequence between pretest and post-test for dichotomous variables, as it is appropriate for paired within-subject comparisons of binary outcomes. The Wilcoxon signed-rank test evaluated changes in the same BLS sequence between pretest and post-test for ordinal variables as well as in CPR quality metrics that did not meet normality assumptions. All analyses were performed using IBM SPSS Statistics version 25.0. p Values $<.05$ were considered significant.

Ethical issues

The research was presented and subsequently approved by the Bioethics Committee of the University of Santiago de Compostela. Following the national regulations, written informed consent was obtained from the parents of the participants, along with written assent from children over the age of 12 years. Participant anonymity was ensured by assigning a unique study code to each participant, and no personally identifiable information was included in the dataset used for analysis. All data were processed anonymously and informed consent will be stored securely in accordance with institutional policies and current data protection regulations. Access to the data was restricted to authorised members of the research team.

Results

The sample consisted of a total of eight children with ASD, six boys and two girls, aged 8-12 years (mean age 11.75 ± 0.89 years, weight 51.32 ± 16.49 kg and height 1.53 ± 0.08 m). During the post-test, CPR quality data from one of the participants were excluded due to incomplete chest compression metrics recorded by QCPR application (data loss caused by a technical recording failure). Consequently, data from only seven participants were included in the CPR quality analysis.

Basic life support sequence

Results presented in Table 2 indicate a significant improvement in four of the assessed steps. Concretely, only three participants (37.5%) attempted to assess the victim's response in pretraining ($T0$), and all did so incorrectly by omitting certain steps. However, post-training ($T1$), none of the participants forgot this step; 87.5% executed it correctly, whereas one participant (12.5%) performed it incorrectly, that is, skipped the step of checking verbal response ($Z = -2.585$; $p = .010$).

Regarding airway management ($Z = -2.428$; $p = .015$), only two participants had prior familiarity with the technique before training, and both failed to correctly open the airway, omitting the required head tilt. However, in the second evaluation ($T1$), seven participants (87.5%) successfully performed the technique, with only one executing it incorrectly. For the look-listen-feel manoeuvre used to assess breathing ($Z = -2.460$; $p = .014$), only three participants were familiar with it at $T0$, and only one participant was able to perform the technique correctly prior to the training. In contrast, at $T1$, all participants executed the look-listen-feel manoeuvre successfully. The described pre- (T0) and post-test (T1) results are illustrated in Figure 3.

Cardiopulmonary resuscitation quality

The quality of CPR, both in the pre- and post-test, is detailed in Table 3. Regarding chest compressions, median values increased across almost all variables, indicating an improvement in participants' performance in the post-test. Specifically, the median com-

Table 2
BLS Sequence Execution Results: Pre- and Post-Test.

		Pretest (n = 8)	Post-Test (n = 8)	Test
Safety	Done well	1 (12.5)	6 (75.0)	0.063*
	Not done	7 (87.5)	2 (25.0)	
Victim's response	Done well	–	7 (87.5)	0.010†
	With errors	3 (37.5)	1 (12.5)	
	Not done	5 (62.5)	–	
Airway	Done well	–	6 (75.0)	0.015†
Open the airway	With errors	2 (25.0)	1 (12.5)	
	Not done	6 (75.0)	1 (12.5)	
Breathing	Done well	1 (12.5)	8 (100.0)	0.014†
Look-listen-feel for breathing	With errors	2 (25.0)	–	
	Not done	5 (62.5)	–	
Look-listen-feel during 10 seconds	Done well	–	2 (25.0)	0.023†
	With errors	1 (12.5)	5 (62.5)	
	Not done	7 (87.5)	1 (12.5)	
Alert emergency services‡	112 or 061§	3 (37.5)	8 (100.0)	0.063*
	Says another number	4 (50.0)	–	
	Not done	1 (12.5)	–	
Start chest compressions	Done well	4 (50.0)	8 (100.0)	0.125*
	Not done	4 (50.0)	–	
All steps	Done well	1 (12.5)	6 (75.0)	0.063*
	Not done	7 (87.5)	2 (25.0)	
Correct order	Done well	0 (0.0)	5 (62.5)	0.063*
	Not done	8 (100.0)	3 (37.5)	

Categorical variables are expressed as absolute frequencies (relative frequencies).
Note. BLS = basic life support.
* Significance associated with McNemar's Test.
† Significance associated with the Wilcoxon signed-rank test.
‡ This variable has been recoded into a dichotomous variable, including the last two options as errors.
§ Spain emergency number.

Table 3
Quality of Cardiopulmonary Resuscitation of Pre- and Post-Test.

	Pretest (n = 7)	Post-Test (n = 7)	Wilcoxon Test
Frequency in CC·min^{-1}	114 (94-139)	128 (109-153)	0.236
Depth in mm	25 (22-30)	28 (31-36)	0.611
CC with complete recoil (%)	89.0 (72.0-100)	97.0 (95.0-100)	0.248
CC with correct hands position (%)	93.0 (57.5-100.0)	100.0 (99.3-100.0)	0.180
Quality of CC (%)	2.0 (0.0-4.0)	6.0 (3.0-35.0)	0.397
Quality of mouth-to-mouth ventilations (%)	0 (0-0)	0 (0-71.0)	0.180
Overall quality of CPR (%)	1.0 (0.0-3.0)	5.0 (1.0-27.0)	0.310

Quantitative variables are shown as median (interquartile range).
Note. CC = chest compressions; CPR = cardiopulmonary resuscitation; mm = millimetre.

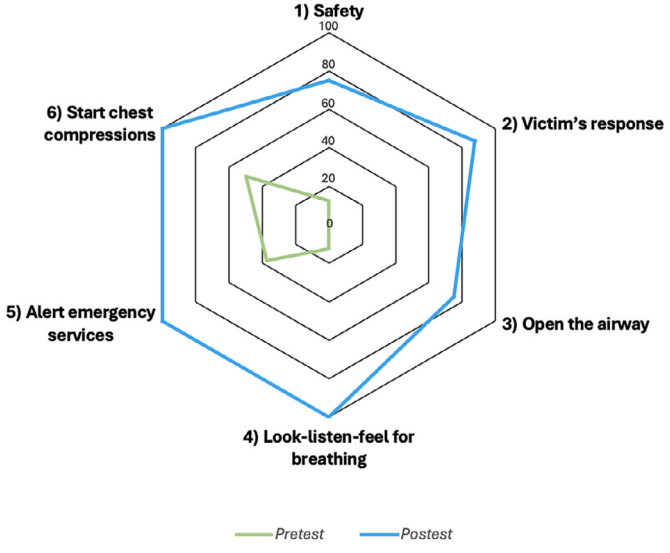

Figure 3. Percentage of participants who correctly executed BLS actions: pre- and post-test performance. *Note*. BLS, basic life support.

pression depth increased from 25 mm in the pretest to 28 mm in the post-test. Additionally, the percentage of chest compressions with correct hand position rose from 93% to 100%, and the percentage of chest compressions with full recoil improved from 89% to 97%. However, ventilation parameters remained deficient, with no improvement in the quality of ventilations between the pre- and post-test (0% in both tests).

Discussion and conclusion

Discussion

A recent scoping review by Berlanga-Macías et al. (2023) identified a knowledge gap regarding how children with disabilities perform BLS manoeuvres, underscoring the necessity for further research involving typically developing populations in research projects. To the best of our knowledge, no previous simulation-based studies have specifically examined the learning effect of pictograms integrated into a narrative on BLS sequence performance and CPR quality in children with ASD. Our pilot findings help address the knowledge gap on how children with ASD can achieve outcomes comparable to their neurotypical peers when provided with personalised training, aligning with the World Health Organi-

zation's Global Report on Health Equity for People with Disabilities (2023) (WHO, 2023).

Our study demonstrated substantial improvements in BLS sequence performance when comparing pre- and post-test results. During the pretest, no participant checked the victim's response – including verbal and gentle tactile stimulation – or performed the head-tilt chin-lift manoeuvre to open the airway and assess breathing. Notably, only one child was familiar with the 'look, listen, and feel' manoeuvre, suggesting a limited ability to recognise SCA in a real-life scenario among most participants. Additionally, only a few participants promptly alerted emergency services.

Post-test results demonstrated substantial improvements, with nearly two thirds of the children successfully completing all the requisite steps in the BLS sequence. Notably, all participants demonstrated proficiency in assessing breathing, alerting emergency services, and initiating chest compressions. This significant progress underscores the efficacy of the pictogram-based training approach and provides a foundation for the broader implementation of the tested pedagogical methods.

In terms of CPR quality, evidence suggests that children over the age of ten can reproduce the correct hand position and chest compression rate when trained. However, regardless of age, a minimum body weight of 40-50 kg seems to be required to achieve adequate depth of compressions (Schroeder et al., 2023). In this sense, our findings showed that all participants demonstrated correct hand placement with a median compression rate exceeding the recommended range (median: 128 compressions/minute). Nevertheless, despite an average weight of approximately 50 kg, the mean compression depth reached after training was only 28 mm, below the 50-60 mm recommended compression depth (Smyth et al., 2025). While post-test values showed improvements across nearly all variables, the differences did not reach statistical significance considering the number of participants.

Ventilations are recognised as a difficult manoeuvre (Schroeder et al., 2023), even for healthcare staff (García-Martínez et al., 2024). Previous studies have reported that children over the age of ten years are capable of achieving the correct rate and sequencing of mouth-to-mouth ventilation (Berthelot et al., 2013; Sherif et al., 2005). However, according to Sherif et al. (2005), the students' relatively small lung capacity often prevents them from delivering adequate volumes of air. In our study, ventilations proved challenging for ASD children, who achieved suboptimal rates despite an average age of 11.7 years. Current recommendations acknowledge that some neurotypical children may struggle to achieve sufficient ventilation volumes (Schroeder et al., 2023). Given that our sample consisted of children with special needs, we hypothesise that mastering this skill may require additional learning time, potentially with specific training methods, which requires further investigation.

Our findings are encouraging and align with previous research involving neurotypical children. A longitudinal study conducted in Spain (Abelairas-Gómez et al., 2021) compared BLS refresher training delivered every four months with a single annual session across three groups of schoolchildren. In that investigation, the control arm received training conditions comparable to those of our participants, without retraining, and performance was evaluated one week and two years after the intervention. Therefore, the one-week outcomes from the control arm provide the closest comparison to our results. Key CPR metrics, including compression rate, depth, percentage of compressions with complete recoil, and correct hand position, were similar to those observed in our sample. Similarly, Martínez-Isasi et al. (2022) examined the BLS learning capacity among children aged 8, 10, and 12 years. The evaluation of the skills one week after a 100-minute theoretical and practical training showed consistent results with those observed in our study across all assessed skills. Overall, the average chest compression depth and the overall quality of CPR were suboptimal in all cases. This indicates that, irrespective of age, a single, one-time training session may not be sufficient to attain adequate outcomes utilising standardised parameters. Periodic refresher sessions may support long-term skill retention and could be similarly beneficial for children with ASD, in-line with findings reported in neurotypical schoolchildren (Abelairas-Gómez et al., 2021).

Training BLS using didactic materials tailored to the psychoevolutionary development of children is a recommended educational strategy by experts, but it still requires thorough evaluation to become evidence-based (Plant & Taylor, 2013; Varela-Casal et al., 2021). However, when considering strategies for children with special needs, the available data is virtually nonexistent (Berlanga-Macías et al., 2023). In this sense, our results suggest that a brief theoretical training (20 minutes) supported by bibliotherapy and pictograms, followed by a 30-minute additional practice, could be a viable approach for BLS training in children with ASD.

Future research with larger sample sizes could help confirm these findings while also exploring strategies to improve ventilation performance. One potential solution proposed could be to separate the theoretical and practical training into two different days, considering the special characteristics of children with ASD. Future studies should also assess whether skills are retained over time and, if not, evaluate whether periodic refresher sessions could support long-term skill retention.

Regarding people with disabilities, recent evidence from a scoping review highlights the limited availability of BLS training programmes for this population (Berlanga-Macías et al., 2023). In addition, there is no consensus on the optimal design, characteristics and materials of such programmes. However, studies examining the effectiveness of adapted BLS training for individuals with different disabilities, such as intellectual disability (Kearney et al., 2019), visual impairments (Martínez-Isasi et al., 2021), and Down syndrome (Rodríguez-Núñez et al., 2015), have reported promising results. Some studies, as well as our research, indicate that the quality of CPR performance among these groups is comparable to that of their nondisabled peers (Kearney et al., 2019; Martínez-Isasi et al., 2021). Nevertheless, other studies emphasise that additional training sessions may be required (Rodríguez-Núñez et al., 2015).

We consider that inclusion of people with disabilities in BLS training programmes could contribute to an increase in bystander-initiated CPR rates and ultimately contribute to improved outcomes (Berlanga-Macías et al., 2023). Ableism perpetuates the misconception that individuals with disabilities are less capable, leading to their exclusion from research or the assumption that their needs are secondary (Lundberg & Chen, 2024). In this sense, it would be unsuitable to conduct health education for children with ASD without visual supports like pictograms, just as it would be inappropriate to use images for educating a visually impaired person (Choi et al., 2023). Tailoring educational strategies to the specific needs of people with disabilities not only enhances learning outcomes but also promotes inclusivity, recognising and respecting their specific capabilities and challenges (Turnbull et al., 2023; WHO, 2023).

Strengths and limitations

To the best of our knowledge, this is the first study to investigate BLS training in children with ASD, addressing the lack of research in understudied neurodivergent populations through an innovative learning strategy using simulation. Nevertheless, our research has limitations that should be considered. The small sample size reduced statistical power and may not fully represent the broader population of children with ASD; however, the number of participants was comparable to that in other studies involving indi-

viduals with disabilities (Berlanga-Macías et al., 2023). This may be due to difficulties in accessing the sample and the specific characteristics of the group and organisations involved, which have limited schedules. Additionally, the simulated setting may not fully reflect the stress and pressure of a real-life cardiac arrest.

Conclusion

This innovative learning strategy using simulation supported by a pictogram-based story can be an effective tool for teaching BLS to children with ASD. Following the nurse-led training, participants showed improvements in key steps of the BLS sequence, including victim response, airway opening, and the look, listen, and feel manoeuvre, while chest compressions and ventilations were performed at levels comparable to neurotypically developing peers. These findings support the feasibility of inclusive, tailored BLS education, though further research with larger samples is needed to confirm long-term retention and efficacy.

Ethical approval

The study was approved by the Bioethics Committee of the University of Santiago de Compostela.

Financial disclosure

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Declaration of competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

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