Knowledge and awareness of paediatric basic life support among parents in the Lady Ridgeway Hospital for Children, Colombo, Sri Lanka

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Sri Lanka Journal of Child Health, 2024; **53**(2): 128-134
DOI: https://doi.org/10.4038/sljch.v53i2.10786

Abstract

Background: Out-of-hospital cardiac arrest in children is uncommon but significant, with poor survival rates and high morbidity. Choking in children is common but less reported with high mortality. Early commencement of cardiopulmonary resuscitation (CPR) in cardiac arrest or following of choking algorithm in a case of choking is important for survival of the victim.

Objectives: To survey the knowledge, awareness and attitudes of parents in Sri Lanka regarding paediatric Basic Life Support (BLS) including early treatment of choking.

Method: This was a descriptive cross-sectional study and questionnaires were administered to parents of children managed at the Preliminary Care Unit (PCU) and wards 2 and 4 of Lady Ridgeway Hospital, Colombo from October 2022 to January 2023. Sample size was calculated according to the Lwanga and Lemeshow method. Total respondents were 350 out of total participants of 415. The questionnaire consisted of four sections for assessment of demography, knowledge and attitude. Total scores of each aspect were analysed with respect to different factors.

Results: Of the participants, 95% did not have BLS training and the largest proportion of them was educated only up to the General Certificate of Education (GCE) ordinary level. Knowledge of specific aspects of BLS or choking was demonstrated by only about 10% of the population. Nearly 50% of parents had identified substandard common practices as correct methods. There was no statistically significant correlation between total score of each aspect and previous observations, training or highest educational level. It was assessed with 95% confidence interval. However, seeing BLS had improved knowledge of basic health (p=0.013).

Conclusions: Seeing the procedure on television or other resources had not improved knowledge of BLS. Workshops were the preferred method to improve their knowledge on BLS including the choking algorithm and participants' educational level was not important in organizing such an event.

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(Received on 22 October 2023: Accepted after revision on 22 December 2023)
The authors declare that there are no conflicts of interest
Personal funding was used for the project.

(Key words: Paediatric basic life support, Cardiopulmonary resuscitation, Choking)

Introduction

Out-of-hospital cardiac arrest (OHCA) in children is rare but significant, with poor survival rates and high morbidity[1]. Asystole is the most common dysrhythmia[1]. Paediatric basic life support (BLS) is the initial resuscitation in a child with cardiac arrest or choking which should be initiated immediately, even outside the hospital, until advanced life support is initiated[2]. Some of the techniques are different depending on the size of the child, particularly between infants and older children[2]. As far as the causes of cardiac arrest are concerned, respiratory failure is the commonest cause in newborns, whereas sudden infant death syndrome, respiratory diseases, airway obstruction (including foreign-body aspiration), submersion, sepsis, and neurological disease are the leading causes in infants[3]. Beyond 1 year of age, injuries are the leading cause of death[3]. Overall, respiratory failure is the commonest cause of cardiac arrest in children[3]. Thus, effective breathing should be delivered by correct technique to achieve successful resuscitation[3].

The sequence of BLS in cardiac arrest is D: out of danger, R: check response, S: shout for help, A: check and open the airway, B: give 2 rescue breaths, C: chest compression and D: defibrillation[2]. In an out-of-hospital environment, the rescuer should not become a second victim; therefore, the child should be removed from continuing danger as quickly as possible[2,3]. Following that, the rescuer should check the response with stimulation by tapping. If the child does not respond, the airway should be assessed using the look, listen, and feel technique[2,3]. As soon as it is identified that the child is not responding, the rescuer should call for help either by shouting or dialing 1990 for an emergency ambulance (available in Sri Lanka)[2,3,4]. Then, 2 rescue breaths should be given immediately using the mouth-to-mouth breathing method, unless a specific mask is available[2,3]. A pulse check is not an essential element and may be a difficult task for a lay rescuer to perform. Once effective breathing is present, which is evident by chest expansion, chest compression should be started with a compression-to-breathing ratio of 15:2[2,3]. Ideally, a child's head should be positioned in neutral and sniffing positions for infants and older children, respectively[2,3]. This sequence should be followed in the case of an unresponsive child[2].

Choking is the mechanical obstruction of the internal airways (pharynx, hypopharynx, trachea) by a foreign body causing respiratory failure and it is a type of asphyxia[5]. According to a study by Loenzoni G, *et al*[6], it is a major cause of death in children, and 60-80% deaths following choking are due to food. Anatomical and physiological characteristics specific to young children are thought to be the reason for increased choking among them while eating[5]. Choking can cause death within

minutes, and prompt intervention, using the BLS choking protocol, is required to save the victim's life[2,3,5].

The first crucial step in the BLS choking protocol is to identify whether the victim has an effective cough or is in cardiac arrest[2,3]. A conscious older child should be encouraged to cough if there is an effective cough[2,3]. If acute stridor develops or child does not have an effective cough, the foreign body should be dislodged immediately using back blows and chest thrusts[2,3]. Combining manoeuvres give better results than doing them individually[2,3,5]. However, if child becomes unresponsive with features of cardiac arrest, cardiopulmonary resuscitation (CPR) should be started immediately[2,3].

OHCA in infants or toddlers mainly occurs at home[7]. A family member is usually the first responder available at the time of the incident[7,8]. Asystole is the predominant arrhythmia, which indicates effective CPR[3]. In children, early, effective bystander CPR has been associated with the successful return of spontaneous circulation and neurologically intact survival[2,3,9,10,11]. BLS courses should be offered to target populations such as expectant parents, childcare providers, teachers, sports supervisors, and others who regularly care for children. To implement steps to improve knowledge and practices in BLS, it is essential to identify the current knowledge, practice, and attitude in BLS. Further, knowing the possible obstacles to improving knowledge and practice, and the factors associated with inadequate or adequate knowledge are also crucial.

Objectives

General objective: To identify the knowledge and attitude of BLS in parents of children who were brought to the Preliminary Care Unit (PCU) and wards 2 and 4 in Lady Ridgeway Hospital for Children (LRH), Colombo.

Specific objectives:

- To describe the knowledge of the paediatric BLS algorithm, the right technique of chest compression and ventilation breaths
- To describe the knowledge of paediatric BLS choking algorithm
- To compare associated factors with adequate and poor knowledge
- To identify parents' attitude toward the pre-hospital BLS
- To identify a convenient mode to improve knowledge of BLS.

Method

This descriptive, cross-sectional study was conducted at PCU and wards 2 and 4 of LRH between October 2022 and January 2023.

Inclusion and exclusion criteria: All parents or guardians that brought their children to PCU and wards 2 and 4 of LRH for any form of assessment, investigation, or treatment were enrolled. Parents or guardians unable to read, understand and write any of the three languages (Sinhala, Tamil, English) were excluded.

Sample size and method: This was 415, calculated using the Lwanga and Lemeshow method. Patient management was not affected by filling out the questionnaire, as it was performed only during spare time. A questionnaire was distributed among 10 parents before commencing the survey, and none of the participants indicated that the questions were incomprehensible. The questionnaire was developed in Sinhala, Tamil and English, the three languages used in Sri Lanka. A convenient sampling technique was used.

To cater to participants with a lower educational level, simple words were used, and the questions and answers were tailored to be short, straightforward, and to the point. Pictograms were also made available so as to reduce potential confusion among participants.

The questionnaire consisted of four sections. Section A focused on the demographic profiling of the participants. Those who had previously attended a BLS course were denoted as 'trained', while those who had no prior attendance were denoted as 'untrained'. Section B focused on awareness of BLS or choking, including the method by which they have observed it. Section C comprised questions assessing knowledge of basic health, BLS, and choking; only those who had seen BLS performed were included in the assessment of knowledge on BLS, and only those who had seen an initial treatment for choking were included in the assessment of knowledge on initial treatment for choking; however, all respondents were included in the analysis of data of knowledge on basic health. Section D focused on attitudes toward the need for training in BLS, and responses from all individuals were included in the analysis. In Section C, responses were based on Advanced Paediatric Life Support 2016[2]. There were single-correct-response questions and multiple-correct-response questions in both BLS and choking parts. A correct answer to each question was awarded a score of one. There was a question (Q11) on the correct sequence of the BLS algorithm following cardiac arrest. Three appropriate correct orders were developed, and any other order was considered incorrect, while incomplete or blank ones were taken as 'invalid'. Subsequently, knowledge on each part, i.e., knowledge on basic health, knowledge on BLS, and knowledge on the choking algorithm, was expressed as a total score for each part.

Ethical issues: There were no confidentiality issues because personal data was not required in the questionnaire. Ethical clearance was obtained from the Ethics Review Committee (ERC) of the Faculty of Medicine, University of Colombo (Ref. EC-22-110) on 20th October 2022 before the commencement of the research.

Statistical analysis: The data were analysed using the Statistical Package for Social Sciences (SPSS) for Windows version 26. Means were assessed for demographic data, and some of them were presented as graphs. The means of qualitative data were compared using Chi-square test, whereas those of qualitative and quantitative data were compared using the independent-sample t-test. A p-value less than 0.05 was considered statistically significant.

Results

Questionnaires were distributed among 410 parents but only 350 responded during the given period. Of the participants 322 (92%) were females. Only 17 (5%) respondents had participated in any form of BLS training. Eleven participants mentioned that they underwent training between 2005 and 2014. Figure 1 shows the distribution of the study participants.

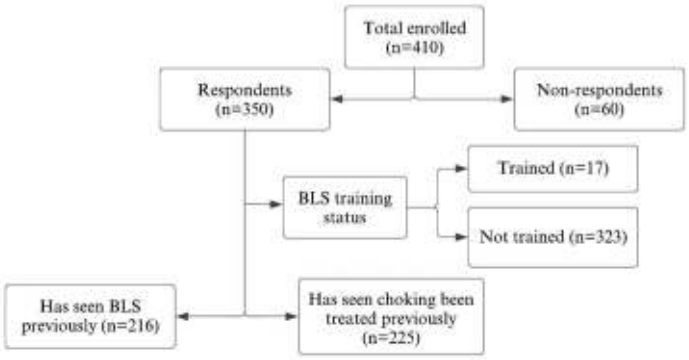

Figure 1: ***Distribution of participants of the study***

Figure 2 demonstrates the distribution of the highest educational level of participants. Most participants were educated only up to General Certificate of Education (GCE) ordinary level.

Table 1 shows the responses to the questions on basic health. More than 80% of participants responded correctly to the first two questions. Only 33% knew that the brain cannot survive more than 5 minutes without a blood supply.

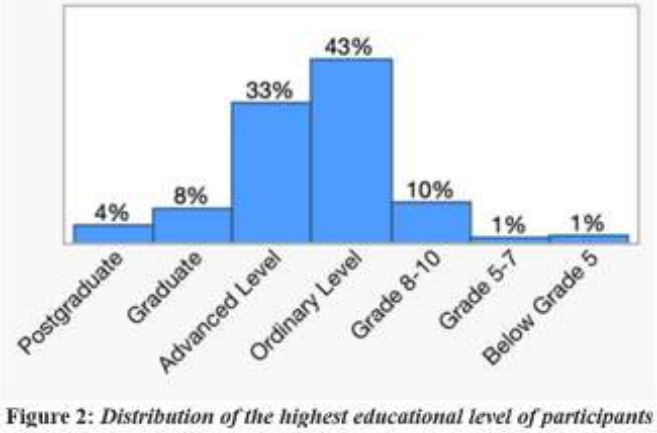

Figure 2: ***Distribution of the highest educational level of participants***

Table 1: ***Correct responses to the questions on basic health***

Question	Correct response	No. of correct responses	No. of total responses	% of correct response
Blood pump to body is done by the heart	Yes	288	330	87.3
Loss of consciousness happens due to poor blood supply to brain	Yes	266	321	82.9
How long can brain survive in functioning state without breathing or oxygen?	5 minutes	100	303	33

While 216 (61.7%) participants had seen initial treatment for cardiac arrest, 225 (64.3%) had seen initial treatment for choking (Table 2). Most of them have seen that on television, whereas about 5% have seen it at the roadside. However, nearly 25% of participants had observed initial treatment for choking at home.

Table 2: ***Methods of seeing basic life support (BLS) or the choking algorithm***

Method of observation	Those who have seen BLS *(n=216)* *n (%)*	Those who have seen choking been treated *(n=225)* *n (%)*
On television	147 (68.1)	117 (52.0)
In hospital	64 (29.6)	42 (18.7)
In films	53 (24.5)	45 (20.0)
At roadside	13 (06.0)	09 (04.0)
At home	20 (09.3)	56 (24.9)
Youtube videos	61 (28.2)	69 (30.7)

Table 3 demonstrates the distributive data of correct answers to the questions on BLS. It revealed that only 2.8% had an idea about the correct order of steps to follow in a cardiac arrest; 16–57% knew how to identify cardiac arrest early; 16–36% of participants knew the correct way to wake up an unconscious child, while 80% identified the application of water, which is a substandard common practice in Sri Lanka, as another way to do it. Only 50% knew the correct site of chest compression, while 40% knew the correct depth. However, most individuals did not know the correct rate of chest compression; the majority believed it to be 50 beats per minute, while only 10% knew the correct rate. Majority knew how to confirm the child was not breathing. Only 11% knew the correct ratio of chest compression to breathing, while 44% believed it was 3:1. Most of that sample (78.2%) incorrectly responded to the question "Chest compression to mouth-to mouth breathing ratio should be:" as 3:1.

Table 3: ***Correct responses to the questions on basic life support***

Question	Correct response	No. of correct responses *(n=216)*	% of correct responses
Steps in correct order that should be followed if you encounter an unresponsive child	Correct order: BCFDEA, BCDEAF, BCDFEA	06	02.8
How to identify cardiac-arrest ('heart not working' state) in a child at the earliest stage?	A. absent pulse B. absent movements C. absent breathing D. not talking	124 58 110 35	57.4 26.9 50.9 16.2
How to wake-up an unconscious child?	A. by tapping and gently shaking the shoulders B. by talking aloud repeatedly	78 35	36.1 16.2
On chest, where is the place you should compress (according to figure 1 given in questionnaire)?	B. lower half of sternum	109	50.5
How deep the chest compression should be done?	A. 1/3 of height of chest	87	40.3
What should be the rate of chest compression (beats per minute)?	A. 100	22	10.2
How to confirm that child is not breathing?	A. By looking at moving up and down of chest B. By feeling fat your cheek of air flow out of nose and mouth C. By listening of child's breath sounds	142 105 65	65.7 48.6 30.1
Chest compression to mouth-to mouth breathing ratio should be:	A. 15:2	24	11.1

Table 4 demonstrates the descriptive data of the correct responses to the questions on the choking algorithm; 16–59% knew the correct immediate treatment for choking, while 49% identified turning the child upside down and shaking as the correct method, which is not recommended. 88% knew the correct site of back blows, and nearly 48% knew the correct site of chest thrusts.

Table 4: ***Correct responses to the questions on initial management of choking***

Question	Correct response	No. of correct responses *(n=225)*	% of correct responses
What will you do immediately, if you see a child is choking after putting something into his/her mouth?	D. Giving back-blows and chest thrusts E. Giving abdominal thrust for older children	133 36	59.1 16.0
To where should back-blows be given in choking (according to figure 2 given in questionnaire?)	B. Lower half of sternum	198	88.0
To where should chest thrusts be given in choking (according to figure 3 given in questionnaire?)	B. Lower half of sternum	107	47.6

As demonstrated in Table 5, 45% of participants preferred workshops to learn BLS; 84% are willing to participate in such a workshop, while the majority of those who are not willing to do so mentioned time constraints as a barrier. Approximately 93% of people believed that BLS was important to save lives.

Table 5: ***Parents' attitude towards basic life support***

Question	Correct response	No. of correct responses *(n=350)*	% of correct responses
Most preferred mode of learning Basic Life Support	Television programmes	82	23.4
	Training workshops at a convenient place	158	45.1
	"Youtube" videos	97	27.7
	Leaflets	44	12.6
Will you attend if you get a chance to learn Basic Life Support in a workshop?	Yes	295	84.3
	No	20	05.7
If not, reason?	I already know	01	0.3
	No time	14	04.0
	I have no capability to practise it	01	0.3
	Financial difficulties	05	01.4
Do you think "Basic Life Support" is important to save lives?	Yes	325	92.9
	No	06	01.7
	Not responded	19	05.4

Total scores (TS) of basic health, BLS, and the choking algorithm were calculated and compared to different variables to assess their correlation with the 95% confidence interval as demonstrated in Table 6. The TS of basic health had to vary between 0 and 3 among participants (n=350). It was compared with training status, observation status of BLS or choking treatment, and the highest educational level. A mean score of 1.95 was obtained in the group of those who had seen BLS (p=0.013). However, none of the other variables showed a statistically significant correlation (p>0.05). TS on BLS had to be between 0 and 14 among those who had observed BLS earlier (n=216). However, there was no statistically significant correlation between TS-BLS and BLS training status or the highest educational level. TS on the choking algorithm had to be between 0 and 4 among those who had observed initial treatment of choking (n=225). Correlation assessment revealed that there was also no statistically significant correlation between TS on choking and BLS training status or highest educational level.

Table 6: ***Comparison of total score of basic health, basic life support, and choking algorithm in participants between different variables***

Characteristic	Total score of basic health			Total score of basic life support			Total score of choking algorithm		
	n=350	Mean (SD)	P	n=216	Mean (SD)	p	n=225	Mean (SD)	p
BLS training status									
Trained	17	1.71 (0.71)	0.818	15	4.86 (2.09)	0.397	12	4.66 (1.82)	0.114
Not trained	323	1.89 (0.93)		194	4.69 (1.91)		203	3.97 (2.01)	
Seeing BLS									
Has seen.	216	1.95 (0.75)	**0.013***						
Has not seen	129	1.74 (0.85)							
Seeing choking being treated									
Has seen	225	1.88 (0.79)	0.369						
Has not seen	123	1.85 (0.81)							
Highest education level									
Postgraduate	13	2.23 (0.59)		09	8.66 (1.41)		11	3.81 (1.83)	
Graduate	27	2.15 (0.66)		24	7.50 (2.06)		17	3.29 (2.22)	
Advanced level	114	2.04 (0.68)	1.966	71	7.40 (1.84)	0.252	82	4.00 (2.07)	0.499
Ordinary level	150	1.78 (0.82)		93	7.04 (1.91)		92	4.10 (1.98)	
Grades 8-10	33	1.64 (0.82)		13	7.00 (1.29)		14	3.86 (2.09)	
Grades 5-7	04	0.75 (0.50)		01	9.00 (,)		01	4.00 (.)	
Below grade 5	05	1.2 (1.09)		03	6,66 (2.30)		03	5.00 (0.81)	

**p<0.05 is considered as statistically significant*

Discussion

This research was intended to identify knowledge and awareness of paediatric BLS and choking algorithms and attitudes toward them. This was assessed among parents of children who presented to the PCU and were admitted to Wards 2 and 4. It was assumed that this sample represents parents in the whole country because this is the leading children's hospital in Sri Lanka, where children are referred to this centre from all over the country for different reasons due to the availability of sub-specialties. There was no previous research evidence on knowledge of BLS in parents in Sri Lanka, and it is important to identify gaps in knowledge of BLS (including the choking algorithm) and factors that might help to improve BLS knowledge in parents. Overall, the research results revealed that parents had inadequate knowledge of BLS, choking, or basic health, irrespective of their educational level. However, they had optimistic attitudes toward the need for BLS training in the future.

Most parents could answer some correct facts on basic health (physiology), even though they could not differentiate correct responses, which are numerical (i.e., duration in minutes), from incorrect responses. This answering pattern was observed in the assessment of knowledge on BLS and the choking algorithm as well. Awareness of the important facts, such as, brain survival without oxygen is very short-lasting, was lacking among parents. Common but substantial practices were also included in the responses to check their true knowledge. Parents responded to them as correct ones, such as applying water to wake up an unconscious child or putting

the child upside down in choking. Nearly 10% of parents had precise knowledge such as chest compression rate, compression to ventilation ratio, and giving abdominal thrust in choking, which could not be guessed without proper background knowledge. According to the assessment of possible factors that might affect the knowledge of basic health, BLS, or the choking algorithm, only the knowledge of basic health would have been greater if they had seen BLS previously. Otherwise, previous training, observation of the BLS or choking algorithm, and their highest educational level did not correlate with their knowledge of the above three aspects. If proper training had been followed, their knowledge of those aspects should have been improved by their training. Thus, it is rational to argue about the quality of those training programmes. Most participants had seen them on television, and therefore, it can be concluded that this source of education had not been effective for the people.

Research to identify knowledge and awareness among parents regarding BLS in Sri Lanka is scanty. However, several studies have been conducted to assess knowledge and practices in first aid for injuries or emergencies in children[12,13,14,15]. Some studies have identified knowledge of basic and advanced life support among healthcare workers and medical and nursing students[16,17,18,19]. Edirisinghe NK, *et al*[19] studied the knowledge of emergencies such as choking, burns, and acute poisoning and their first aid practices among mothers of children admitted to paediatric wards in District General Hospital Kalutara; only 11% had adequate knowledge of first aid for choking. Balasuriya A, *et al*[15] studied the prevalence of home accidents among children aged 1-4 years, and its relationship with the knowledge, attitude, and first aid practices of mothers in the Bulathsinghala MOH area; this study showed that 64% had adequate knowledge of first aid for choking[15]. Alahakoon P, *et al*[12] studied the knowledge and attitude toward first aid among advanced-level students in Gampaha District; they found that educational qualifications related to biology have improved the knowledge of first aid but that previous training status had not affected the knowledge of first aid. Ralapanawa D, *et al*[17] demonstrated that overall knowledge and attitudes toward advanced life support, in nearly 10% of final-year medical students and medical officers in Peradeniya Teaching Hospital was inadequate. Thoradeniya V, *et al*[16] studied knowledge of BLS among nursing students and found that only 50% had good knowledge and attitude towards BLS. Alukumbura D, *et al*[18] showed that knowledge and attitude on BLS among traffic police officers in Nugegoda was inadequate. However, none of the studies had evaluated the knowledge, including techniques on paediatric BLS and choking, among parents.

A study on knowledge, attitude, and perception of infant BLS, conducted in Singapore by Chia P, *et al*[1] revealed that those who had participated in the BLS course had better knowledge and that those who had higher educational qualifications demonstrated better knowledge. Uehara R, *et al*[20] studied the associations of poor knowledge of cardio-pulmonary resuscitation among parents in Japan; age of mother at delivery, awareness of medical facilities for emergency services at night or during the weekend, current occupational status of mother and current economic status, were independently associated with CPR awareness**.** A study in India by Pathak A, *et al*[8] revealed different modes of transport in an emergency and different first aid practices in India; only 1% of the injured used ambulance services, while motorbikes were the most preferred mode of transport; it revealed potentially harmful practices used as first aid in India. A study by Pai M, *et al*[21] revealed that knowledge of BLS improved more by 'hands-on training' compared to educational videos, among 458 school adolescents in India.

People identify BLS as a life-saving procedure and are willing to participate in a workshop. Even though they have seen either BLS or choking management on television, they still prefer to participate in a workshop as they identify it as a skill that needs to be practised.

Previous research to identify knowledge of first aid among parents or students performed in Sri Lanka had not identified knowledge and practices related to BLS. Therefore, with this research, we have statistics on parents' knowledge of that aspect. Not only that but this data could also be utilized to organize workshops to enhance parents' knowledge of BLS, including the choking algorithm. Parents are the first responders in an emergency for their children. Widespread standard BLS workshops should be implemented for parents, irrespective of their educational level, to enhance their knowledge.

Conclusions

Seeing the procedure on television or other resources had not improved knowledge of BLS. Workshops were the preferred method to improve their knowledge on BLS including the choking algorithm and participants' educational level was not important in organizing such an event.

Acknowledgements

The author thanks the parents in LRH who took part in the research. Special mention is needed for the supervisor, Dr. Viraj Jayasinghe, Consultant Paediatrician in PCU, LRH for his kind support and coordination for the success of this research. Further, the author thanks all consultants and staff in PCU and wards 2 and 4.

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