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BUILDING AWARENESS OF THE FIRST AID AMONG THE PRIMARY SCHOOL CHILDREN IN POLAND − THE EFFECTS OF A TRAINING IN PRACTICAL CHEST COMPRESSIONS

Abstract

Aim: Building awareness and safety culture in the field of first aid among Polish schoolchildren through additional, non-obligatory classes in medical rescue. Establish baseline knowledge and motor skills for CPR.

Materials and methods: The study included 97 pupils from primary schools in Lubelskie Voivodeship. The study group were pupils from grades 6 through 8 (aged 12-14). The training station was connected to a computer with the SkillReporter QCPR (Laerdal) software, which allowed controlling and archiving test results. Subsequently, each pupil provided CPR within the specific timeframe of 2 minutes (i.e. for the maximum of 120 seconds).

Results: The study included 97 pupils: 60 boys (61.9%) and 37 girls (38.1%). Age profile of the pupils: 12 years old (n=31), 13 years old (n=34) and 14 years old (n=32). 94 pupils completed the planned task fully (a 2-minute cycle of chest compressions on a training model). Three pupils ended the task after 102, 105 and 114 seconds out of the planned 120. Children who have a lower BMI much more frequently carried out CPR incorrectly as they compressed the chest too shallowly compared to children with higher BMI (rho = 0.216, p = 0.033).

Conclusions: Children with a lower BMI value were characterized by significantly more frequent errors in CPR in terms of too shallow pressure performance than children with higher BMI values. There was no statistically significant influence of age group and gender on the quality of CPR performance.

KEYWORDS: *cardiopulmonary resuscitation, school youth, chest compression, BMI value, security awareness*

INTRODUCTION

Practical classes in first aid held for young people attending schools, including cardiopulmonary resuscitation, are a very popular form of non-compulsory classes, not included in the basic curriculum mandatory for all pupils.

The teachers are eager to invite paramedics to schools as instructors running workshops in rescue techniques, terms of safe behaviour in the face of a threat and the correct way to call a Medical Rescue Team (MRT). During such workshops, both the pupils and the teachers are interested the most in practical classes in cardiopulmonary resuscitation on a dummy providing the opportunity to practice chest compressions and mouth-to-mouth breathing with and without instrumentation.

According to the recommendations of the European Resuscitation Council (ERC) and the World Health Organisation (WHO), teaching children how to perform rescue techniques is recommended when they attain 12 years of age.

Benefits from implementing CPR knowledge and skills at that age were noticed already in 2015, when the Kids Safe Life (KSL) project was being implemented (Plant, 2013, p. 415-21). In addition, 16 October was set as the date of the European Restart a Heart Day, a campaign that is to bring awareness to the fact that everyone can learn how to perform CPR and that education should start already in primary schools. Moreover, in 2011 the American Heart Association (AHA) recommended compulsory resuscitation trainings in American schools (Cave, 2011, p. 691-706, Wissenberg, 2013, p. 1377-1384, Lockey, 2013, p. 399-400). Furthermore, a lot of institutions and foundations promote education of children in rescue techniques in the form of workshops connected with play in a form adapted to the children's age. In Poland, the initiatives implementing the ERC recommendations are carried out under the slogan "Kids Save Lives." The campaign is dedicated to year 7 pupils of primary schools. The programme includes the so-called chain of survival and the diagram of the most important actions to perform to help the injured in a life-threatening condition (checking breath, recovery position, chest compressions) (Bohn, 2012, p. 619-25).

Helpful in increasing the awareness of young people in the field of CPR are applications for the phone, information, comments on social media, activities related to the day established by the ERC Restoring Heart Function on October 16 (Semeraro, 2021, p. 80–97).

Aim

Building awareness and safety culture in the field of first aid among Polish schoolchildren through additional, non-obligatory classes in medical rescue. Establish baseline knowledge on motor skills for CPR, based on the principle that the acquired CPR knowledge increases the chances of future readiness.

Materials and methods

The participants in the study were 97 pupils from primary schools in Lubelskie Voivodeship. The study group were pupils from primary school grades 6 through 8 (aged 12-14). After the management staff of the schools gave their permission, a form of parents' consent to the participation of their children in the study was provided. The participation in the study was voluntary, the classes were run in rooms chosen by the management staff in the presence of teachers employed by the given school. Each pupil was asked about their willingness to participate in the study (practical provision of cardiopulmonary resuscitation over 2 minutes), in addition/ in parallel to the prior consent granted by their parents.

The procedure did not involve collection of pupils' personal data such as names, surnames or dates of birth. The school year, sex and body mass index (BMI) of the trainee were taken into account in order to calculate the impact of those parameters on the quality of chest compressions. The analysis included data provided by the software, i.e. training time expressed in seconds, frequency of chest compressions performed on the dummy, percentage share of correct and incorrect compressions (too deep, too shallow, incorrect site of chest compression, lack of relaxation). Consent of the Bioethics Committee no. 7/2019 of 12 June 2019 at the XXXXX was obtained for carrying out the study.

Description of the study group

The study included 97 pupils: 60 boys (61.9%) and 37 girls (38.1%). Age profile of the pupils: 12 years old (n=31), 13 years old (n=34) and 14 years old (n=32). The studied sample included school youth, pupils of years 6 through 8 of primary schools randomly selected in Lubelskie Voivodeship. The authors of the study deemed it proper to include the three oldest years in primary schools. It was assumed that the pupils in younger years will not have strength and body size (BMI) sufficient to ensure proper quality of chest compressions on a dummy in terms of depth which, in real-life conditions, allows to obtain effective resuscitation parameters. The authors assumed that if the pilot study shows that proper quality of compressions could be obtained by the study group, the sample could be extended with younger school years.

Description of the study

The study commenced with introduction to the topic of the class, followed by the theoretical part concerning the provision of CPR. The declared level of CPR skill varied. A small group of the pupils had had an opportunity to carry out simulated CPR before, during extra-curricular classes, rescue shows or as members of the Youth Fire Squads or teams of the Polish Scouting and Guiding Association. Taking into account the varied knowledge and skills of young people in terms of CPR, the authors assumed that one training group should include 5 trainees and an instructor. The introduction to the topic of the class in a small group allowed more space for pupils during the training and good visibility of the training station. The preliminary training was to eliminate initial differences in knowledge and practical skills in CPR among the pupils. After that training, each trainee was to practice CPR without writing down the results. The training station was connected to a computer with the SkillReporter QCPR (Laerdal) software, which allowed controlling and archiving test results. Subsequently, each pupil provided CPR within the specific timeframe of 2 minutes (i.e. for the maximum of 120 seconds).

Limitations

The size of the sample was affected by the SARS-CoV-2 epidemic, which prevented performance of the study in further schools where the consent for the study was granted.

Results and discussion

94 pupils completed the planned task fully (a 2-minute cycle of chest compressions on a training model). Three pupils ended the task after 102, 105 and 114 seconds out of the planned 120. A statistically significant relationship was found between the parameter of BMI and the studied parameter of CPR provision quality (% of too shallow compressions, i.e. < 40 mm), i.e. the children who have a lower BMI much more frequently carried out CPR incorrectly as they compressed the chest too shallowly compared to children with higher BMI (rho = 0.216, p = 0.033).

The continuous variables were characterised with abnormal distribution (Shapiro–Wilk test, $p < 0.05$). Therefore and in connection with the limited sample size, the null hypotheses concerning the impact of the variables of sex, school year and BMI were verified by means of nonparametric tests: two-tailed Fisher's exact test or chi-square test, Mann–Whitney–Wilcoxon test or Kruskal–Wallis one-way analysis of variance. All analyses were performed with STATISTICA version 13.3 (TIBCO Software Inc., Palo Alto, California, United States). A P-value of less than 0.05 was considered to indicate statistical significance. Table 1 shows the parameters significant for the study.

Table 1. *Characteristics of CPR-Related Variables*

Compressions	N	%
not enough	8	8.25
Normal	35	36.08
too much	54	55.67
compressions – normal	N	%
No	62	63.92
Yes	35	36.08
> 60mm	N	%
0%	90	92.78
>0%	7	7.22
<40mm	N	%
0%	1	1.03
0% <x<=20%	37	38.14
20% <x<=40%	10	10.31
40% <x<=60%	13	13.40
60% <x<=80%	9	9.28
80% <x<=100%	27	27.84

The CPR quality was assessed with 4 parameters:
- number of correct chest compressions (yes vs. no)
- too deep > 60 mm (yes vs. no)
- too shallow < 40 mm [%]
- incorrect hand placement (yes vs. no)

The impact of the following three variables on CPR quality parameters was assessed:

- year (6 vs. 7 vs. 8)
- sex (F vs. M)
- BMI

The study did not find any statistically significant impact of the year and sex on CPR quality. The low general numerical strength of the sample and individual subgroups and low variation of data determining the parameters of CPR quality made it more difficult to carry out statistical inference with desired statistical power. Tables 2-3 compare the description of categorical and continuous variables under study.

Table 2. *Descriptive statistic for the categorical variables*

Variable	Variant	N	%
Gender	female	37	38.1
	male	60	61.9
School class	VI	31	32.0
	VII	34	35.1
	VIII	32	33.0
Number of compressions in accordance with the standard	no (<100 or >120)	62	63.9
	yes (from 100 to 120)	35	36.1
Too deep > 60mm	no (0%)	90	92.8
	yes (>0%)	7	7.2
Wrong hands position	no (0%)	85	87.6
	yes (>0%)	12	12.4

Table 3. *Descriptive statistic for the continuous variables*

	M	SD	Mdn	IQR/2	Mini-Max	W	p-value*
BMI	21.25	2.44	21.1	1.50	16.5 – 32.6	0.947	<0.001
Too shallow <40mm [%]	44.20	35.96	41.08	36.33	0.00-100.00	0.876	<0.001

M – mean, SD – standard deviation, Mdn – median, IQR/2 – semi-quartile range
* Shapiro–Wilk test

Tables 4-5 describes the results of the comparative analysis of CPR quality by gender of the student participating in the training. For categorical variables the two-tailed Fisher's exact test along with an estimate of the odds ratio were used. However, for a continuous variable, the comparison was made using the Mann-Whitney-Wilcoxon test.

Table 4. *Influence of gender on the quality parameters of CPR performance*

	Boys (n = 60)		Girls (n = 37)		p-value*	OR (95%CI)
	N	%	N	%		
Number of compressions in accordance with the standard						
no (<100 or >120)	40	66.7	22	59.5	0.518	1.36
yes (from 100 to 120)	20	33.3	15	40.5		(0.58-3.18)
Too deep > 60mm						
no (0%)	55	91.7	35	94.6	0.705	0.63
yes (>0%)	5	8.3	2	5.4		(0.12-3.42)
Incorrect hand placement						
no (0%)	55	91.7	30	81.1	0.202	2.57
yes (>0%)	5	8.3	7	18.9		(0.75-8.79)

OR – odds ratio, CI – confidence interval
* two-tailed Fisher's exact test

Table 5. *Influence of gender on the quality parameters of CPR performance*

	Boys (n = 60)		Girls (n = 37)		z	p-value*
	Mdn	IQR/2	Mdn	IQR/2		
Too shallow <40mm [%]	29.8	33.5	54.5	35.3	-1.422	0.156

Mdn – median, IQR/2 – semi-quartile range
* Mann–Whitney–Wilcoxon test

Data in tables 6-7 describes the results of the comparative analysis of CPR quality by the class attended by the student participating in the training. The chi-square test was used for categorical variables. However, for a continuous

variable, the comparison was made using the Kruskal-Wallis one-way analysis of variance.

Table 6. *Influence of school class on the quality parameters of CPR performance*

	VI (n = 31)		VII (n = 34)		VIII (n = 32)		χ^2	p-value*
	N	%	N	%	N	%		
Number of compressions in accordance with the standard								
no (<100 or >120)	22	71.0	17	50.0	23	71.9	4.402	0.111
yes (from 100 to 120)	9	29.0	17	50.0	9	28.1		
Too deep > 60mm								
no (0%)	31	100.0	31	91.2	28	87.5	5.879	0.052
yes (>0%)	0	0.0	3	8.8	4	12.5		
Incorrect hand placement								
no (0%)	28	90.3	30	88.2	27	84.4	0.532	0.767
yes (>0%)	3	9.7	4	11.8	5	15.6		

* chi-square test

Table 7. *Influence of school class on the quality parameters of CPR performance*

	VI (n = 31)		VII (n = 34)		VIII (n = 32)		H	p-value*
	Mdn	IQR/2	Mdn	IQR/2	Mdn	IQR/2		
Too shallow <40mm [%]	24.2	38.6	43.6	35.1	41.8	38.4	0.388	0.824

Mdn – median, IQR/2 – semi-quartile range

* Kruskal–Wallis one-way analysis of variance

Data in tables 8-9 describes the results of the analysis of the impact of enrolled students' BMI on CPR performance. The Mann-Whitney-Wilcoxon test was used for categorical variables. However, for a continuous variable, a correlation analysis was performed by calculating Spearman's rank correlation coefficient.

Table 8. *Influence of BMI on the quality parameters of CPR performance*

	Number of compressions in accordance with the standard				z	p-value*
	No (<100 or >120)		Yes (from 100 to 120)			
	Mdn	IQR/2	Mdn	IQR/2		
BMI	21.1	1.45	21.1	1.85	-0.872	0.383
	too deep > 60mm					
	No (0%)		Yes (>0%)			
	Mdn	IQR/2	Mdn	IQR/2		
BMI	21.1	1.55	22.9	1.55	-1.471	0.144
	Incorrect hand placement					
	No (0%)		Yes (>0%)			
	Mdn	IQR/2	Mdn	IQR/2		
BMI	21.1	1.45	21.1	1.80	-0.449	0.653

Mdn – median, IQR/2 – semi-quartile range

* Mann–Whitney–Wilcoxon test

Table 9. *Relationship between BMI and percentage of shallow chest compressions during CPR performance*

Pair of variables	Rho	t	p-value
% too shallow <40mm & BMI	-0.216	-2.159	0.033

Rho – Spearman's rank correlation coefficient

Teaching CPR from the youngest years is important and increases the probability of saving someone's life in the future. A lot of study authors have noticed that. In the publication of 2014, children were trained how to teach their relatives BLS (Stroobants 2014 p. 1769-1774).

It must be stressed that the conducted study gave the authors real-time results and detailed feedback on CPR quality. In addition, for pupils it was a reminder or an opportunity to learn the CPR rules and allowed the trainees to effectively learn or improve the quality of skills acquired earlier. A similar observation was noted by the authors of the publications from 2012 and 2017 (Colquhoun, 2021, p. 543-544, Semeraro, 2017, p. 27-32).

The study from (Bakalarski, 2020, p.18-23) regarded knowledge of the rules of first aid and resuscitation at schools but, contrary to this study, it pertained to the teachers of Polish schools.

Yet another study described an interesting international educational project on first aid and resuscitation among pupils and teachers, which aimed to promote first aid among the highest possible number of people (Curt, 2020, p. 9-17).

Modern and effective solutions improving the quality of BLS and CPR training offer remote modes of conducting it (e.g. during the pandemic). It was confirmed by studies into the effectiveness of CPR examination by means of multimedia and interactive tools (Leszczyński, 2018, p. 151-162, Leszczyński, 2017, p. 265-276, Kipp, 2021, p.61–81, Wejnarski, 2018, p. 1-15).

Education and studies on CPR provided already at a young age are of great significance, as shown by study results confirming the frequency of cardiac arrest in the pre-hospital setting and the number of ROSCs (Szymczuk, 2019, p. 1-10, Anderson, 2014, p. 194–201, Nadolny, 2020, p. 404-411).

Our study focused on the motor abilities of adolescents performed by CPR (Martinez-Isasi, et al, 2022 17-24) showed that training also helps to improve the ability of children younger than 13 years old to recognise the emergency, start the chain of survival, except for chest compression.

Interesting results were obtained by (Pollock et al. 2022 p.46). Task instructions promoted either enhanced or routine autonomy, and either external or internal focus of attention during the chest compression.

A similar concept to the own study was carried out by (Kłosiewicz, 2021, p. 295–300) in a group of 7-12 years old children. The author concluded that this age group is not really in a position to perform a high-quality CPR, but importance and role of CPR training cannot be neglected.

Conclusions

Young people are rarely required to provide CPR. It is recommended to extend the study with a larger group and consider targeted sampling in terms of the school year and BMI rather than randomised sampling, as the quality of chest compressions is significantly related to motor abilities. Children with a lower BMI value were characterized by significantly more frequent errors in CPR in terms of too shallow pressure performance than children with higher BMI values. A large percentage of children in their sample were not able to perform the compressions correctl. The resuscitation skills require both motor and mental skills and some young children might not be mature enough, or physically strong to start training. There was no statistically significant influence of age group and gender on the quality of CPR performance.

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