Education for security – is the first aid curriculum effective?

(Edukacja dla bezpieczeństwa – czy program nauczania w zakresie pierwszej pomocy jest efektywny?)

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Abstract – Introduction. Education for safety is the subject of vocational education, including, among other things, first aid education. In spite of the existence of the core curriculum, the object of the course depends largely on the technique taught by a pedagogue and a number of practical tasks.

Aim of the study. The aim of the study is to evaluate the effectiveness of high school education in first aid.

Materials and methods. The study was conducted in January 2017 in the School Complex No. 23 in Warsaw. The study group consisted of 80 students from the technical high schools as well as the general high school and medical rescue schools. The results obtained from the author's knowledge test and practical tasks carried out using the advanced computer system Ambu® CPR Software were analyzed.

Results. The average knowledge score for all subjects was M = 13.65 (SD = 2.979) on a scale of 0 to 20, and M = 10.3 (SD = 3.230) on a scale of 0 to 20. The medical-rescue classes achieved higher results in practical tasks (class I: M = 12.55, SD = 2.03, class II = 10.6, SD = 3.56), than other classes (general class MD=9,9 ; SD=2,29 ; technical class MD = 8.15, SD = 3.37).

Conclusions. The students of the technical and general high school classes do not meet the curriculum requirements of the first aid curriculum. Classes with a medical-rescue profile demonstrate more knowledge and skills than general-purpose classes, but their level is not satisfactory.

Key words - first aid, high school students, education, effectiveness.

Streszczenie – Wstęp. Edukacja dla bezpieczeństwa jest przedmiotem kształcenia zasadniczego, obejmującym między innymi naukę w zakresie pierwszej pomocy. Pomimo istnienia podstaw programowych, realizacja przedmiotu zależy w dużej mierze od techniki prowadzenia zajęć przez pedagoga i ilości zadań praktycznych.

Cel pracy. Celem pracy jest próba oceny efektywności kształcenia uczniów szkół ponadgimnazjalnych w zakresie pierwszej pomocy.

Materiał i metody. Badanie przeprowadzono w styczniu 2017 r. w Zespole Szkół nr 23 w Warszawie. Grupę badaną stanowiło 80 uczniów z klas technikum, a także liceum o profilu ogólnym i ratownictwa medycznego. Analizie poddano wyniki uzyskane z autorskiego testu wiedzy oraz zadań praktycznych realizowanych za pomocą zaawansowanego systemu komputerowego Ambu® CPR Software.

Wyniki. Średni wynik poziomu wiedzy dla wszystkich badanych wyniósł M=13,65 (SD = 2,979) w skali od 0 do 20, zaś umiejętności praktycznych M=10,3 (SD = 3,230) w skali od 0 do 20. Klasy o profilu ratowniczym uzyskały wyższe wyniki w zadaniach praktycznych (klasa I: M=12,55; SD=2,03 ; klasa II M=10,6 ; SD=3,56), niż pozostałe klasy (liceum MD=9,9 ; SD=2,29 ; technikum MD=8,15 ; SD=3,37).

Wnioski. Uczniowie badanych klas technikum i liceum nie spełniają założeń programowych nauczania w zakresie pierwszej pomocy. Klasy o profilu ratownictwo medyczne prezentują większą wiedzę i umiejętności, niż klasy o profilach ogólnych, lecz ich poziom nie jest zadowalający.

Słowa kluczowe - pierwsza pomoc, młodzież ponadgimnazjalna, kształcenie, efektywność.

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I. INTRODUCTION

Accurate and timely first aid administered by witnesses is essential for the health and life of the victim. Research confirms that the high quality of resuscitation in pre-hospital conditions significantly increases the probability of survival of patients until discharge from the hospital [1]. In the light of normative acts in Poland, the concept of *first aid* is defined as a set of actions taken to rescue a person in a state of emergency, carried out by a person at the place of occurrence, including through the use of commercially available medical devices and medicinal products [2].

The legal obligation to provide first aid is not the same as its effectiveness. Broadly conducted social campaigns in this area are aimed at raising awareness and teaching the basic principles of witnesses` behavior. The effectiveness of teaching, using modern forms of communication, is varied [3]. Therefore, it seems appropriate that the first aid knowledge is provided as widely as possible, and that education in this area is at a high level, at all stages of education.

At present, the leading topic that addresses the issues of first aid is education for security. The objectives of the course are:

- providing the students with the necessary knowledge to prepare the state institution for crisis action;
- equip students with the knowledge and skills needed to work effectively in an emergency and preventive action;
- preparation of students to give victims first aid when conditions permit;
- shaping the attitudes of protecting own life and health as well as other people;
- shaping students readiness to help the needy, humanitarism and altruism;

- developing students' organizational and communication skills and leadership skills "[4].

In accordance with the Ordinance of the Minister of Health of 26 August 2009 on the preparation of teachers for teaching first aid (Journal of Laws 2009, No. 139, item 1132) they must undergo appropriate training and acquire the knowledge and skills necessary to teach classes. The training program is delivered through lectures and exercises and is completed with an examination consisting of theoretical and practical parts. The final grade consists of the arithmetic mean of the partial grades obtained by the individual members of the committee. By obtaining a positive assessment, the teacher receives a certificate for a period of 5 years, giving the right to teach first aid. Undoubtedly, one of the main disadvantages of the course is that the curriculum does not take into account the teaching methodology, which should be adapted to the specificities of the discussed issues of sudden health and life threat.

The results of other authors`research show that first-aid teachers' knowledge and skills are surprisingly low. The results of the analysis of the teachers's knowledge of procedures in the case of an afflicted diabetic patient showed that 26% of the respondents declared that they had diabetic students in their class, including 8% who had direct contact with the student in hypoglycemia. In the same group, only 46% of teachers said they knew how to use the meter, and 42.3% did not know how to provide first aid in this situation [5]. On the other hand, teachers` knowledge assessment in the UK indicates good knowledge of the principles of first aid in emergencies. The authors have shown that 74.3% of teachers declare sufficient knowledge in the case of a student suffering from epilepsy, and 65% of the respondents know how to effectively help a diabetic patient who is hypoglycemic [6].

Taking into account the above data, the effectiveness of teaching children and young people in the subject of education for safety needs to be questioned. The low level of preparation of the teaching staff can significantly influence the quality of first-aid classes, despite the existence of some guidance in the curriculum. The authors attempted to evaluate the effectiveness of first aid education for upper secondary students on the basis the level of knowledge and practical skills analysis.

II. MATERIALS AND METHODS

The study was conducted in January 2017 in the School Complex No. 23 in Warsaw. The study group consisted of eighty students of general education and technical secondary schools. The results of knowledge tests and practical tasks were analyzed. The research tool was a questionnaire with 25 questions. Five of them were sociodemographic questions, the other twenty were first aid questions, divided into 10 thematic categories (assessment of vital functions, occluded respiratory, shock, legal aspects, trauma, adult resuscitation, infant resuscitation, AED, sudden illness traffic accidents). In each thematic category, a maximum of 2 points could be awarded. Practical skills tests were conducted using a scorecard of 0 to 20 points and a phantom with the Ambu® CPR Software computer program (Figure 1) for detailed record of resuscitation activities. In assessing practical skills, attention was paid to: safety assessment; the location of the event; state of consciousness; streamlining airways; breath assessment; call the medical rescue team; starting CPR from chest compressions; correct position for chest compressions; place of oppression; depth of pressures; compressions made by hand; tempo of pressure; unreasonable interruption of chest compressions; 2 rehearsals of rescue breathing; duration of single inhalation; number of cycles per cycle; chest relaxation during CPR.

Figure 1. Software test tool for practical tasks (resuscitation phantom) [7]

For statistical analysis were used the T-Student, Levene's test, Mauchly's spherical test with Greenhouse-Geisser correction, one-way analysis of variance and post-hoc tests and post-hoc tests with Bonferroni correction. All results were considered significant at p <0.05.

III. RESULTS

Participants in the study

The study involved eighty students, including 50 women and 30 men. Mean age was M = 16.81 years (SD = 0.549). Seven respondents came from rural areas, 22 people came from cities with less than 100,000 inhabitants, and 51 students from cities with more than 100,000 inhabitants. 25% of the respondents (n = 20) attended a general high school, 25% of the students (n = 20) a technical school, and 50% (n = 40) attended rescue-medical classes of a general high school.

The results of substantive tests

The average knowledge score for all subjects was M = 13.65 (SD = 2.979) on a scale of 0 to 20, while the practical skills average M = 10.3 (SD = 3.230) on a scale of 0 to 20. Detailed scores for the individual classes of students are shown in Figure 2.
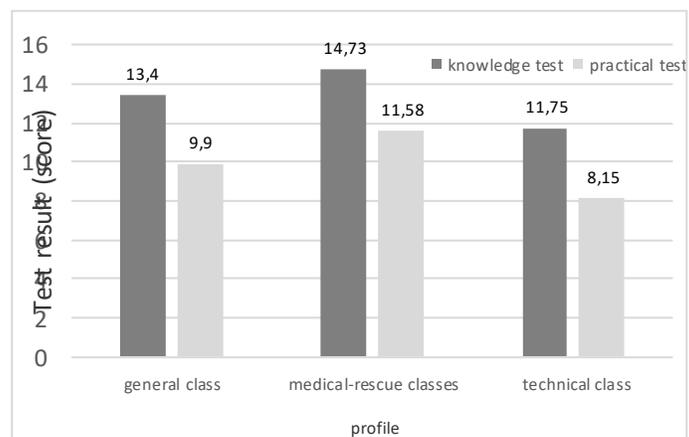

Figure 2. Comparison of results in the knowledge test and practical test in the classroomdifferent profiles

Analysis of the topic categories of the knowledge test

In order to verify if the level of knowledge of the students in each category is different, a variance analysis with repeated measurements was performed, where the independent variable was the question category and the dependent variablewas the obtained result. This analysis was performed separately for each of the three types of classes. In the case of a rescue-medical class, the Mauchly spherical test was statistically significant (p = 0.003). A detailed

summary of the results of the three subgroups in the different categories of questions is presented in Table 1

Table 1. Results in different categories of questions in classes of different profiles

Category question	General class		Medical-rescue classes		Technical class	
	M	SE	M	SE	M	SE
Legal	1.900	0.069	1.725	0.071	1.750	0.099
Breath	1.400	0.169	1.825	0.061	0.950	0.185
Obstruction of the respiratory tract	0.750	0.176	0.750	0.106	1.100	0.161
Shock	1.650	0.109	1.700	0.089	1.600	0.112
haemorrhage	0.800	0.186	1.100	0.112	0.800	0.156
CPR adult	1.650	0.131	1.825	0.061	1.700	0.105
CPR child	1.300	0.179	1.600	0.086	1.350	0.131
Convulsions / stroke	1.750	0.099	1.575	0.101	1.250	0.176
AED	1.100	0.191	1.650	0.076	0.850	0.182
Accidents	1.100	0.176	0.975	0.121	0.400	0.152

Analysis of the topic categories of the practical test

The mean scores obtained from the results of the practical task in individual classes are as follows: 53% and 62.75% in the classes of medical rescue, 40.75% in the technical school and 49.5% in the general high school. Table 2 shows the results of the practical tasks obtained by the students of the medical rescue classes.

Table 2. Results of practical tasks of students of the medical rescue profile class

No.	Practical activities to be evaluated	Number of students correctly performing the task [%] (group n = 40)
1.	Safety assessment	52,5
2.	Recognizing the location of the event	45,0
3.	Condition of consciousness	97,5
4.	Airway breathing	85,0
5.	Evaluation of the breath	85,0
6.	Call the ZRM	95,0
7.	Starting CPR from chest compressions	100,0
8.	Correct position for CPR	82,5
9.	Place of oppression	82,5
10.	Depth of compression (5-6 cm)	75,0
11.	The palm rest	52,5
12.	Pressure (100-120 ')	70,0
13.	No unjustified CPR breaks	92,5
14.	2 successful rescue breathing exercises	12,5
15.	Correct single breath duration (max 1 s)	2,5
16.	Number of presses per cycle (30)	45,0
17.	Proper chest relaxation during CPR	2,5

Table 3. Results of practical tasks of students of the technical classes

No.	Practical activities to be evaluated	Number of students correctly performing the task [%] (group n = 20)
1.	Safety assessment	15,0
2.	Recognizing the location of the event	10,0
3.	Condition of consciousness	55,0
4.	Airway breathing	35,0
5.	Evaluation of the breath	35,0
6.	Call the ZRM	70,0
7.	Starting CPR from chest compressions	80,0
8.	Correct position for CPR	65,0
9.	Place of oppression	70,0
10.	Depth of compression (5-6 cm)	70,0
11.	The palm rest	50,0
12.	Pressure (100-120 ')	15,0
13.	No unjustified CPR breaks	95,0
14.	2 successful rescue breathing exercises	5,0
15.	Correct single breath duration (max 1 s)	0,0
16.	Number of presses per cycle (30)	30,0
17.	Proper chest relaxation during CPR	15,0

Table 4. Results of practical tasks of pupils of the general high school class

No.	Practical activities to be evaluated	Number of students correctly performing the task [%] (group n = 20)
1.	Safety assessment	30,0
2.	Recognizing the location of the event	20,0
3.	Condition of consciousness	50,0
4.	Airway breathing	75,0
5.	Evaluation of the breath	80,0
6.	Call the ZRM	90,0
7.	Starting CPR from chest compressions	65,0
8.	Correct position for CPR	65,0
9.	Place of oppression	65,0
10.	Depth of compression (5-6 cm)	50,0
11.	The palm rest	60,0
12.	Pressure (100-120 ')	25,0
13.	No unjustified CPR breaks	90,0
14.	2 successful rescue breathing exercises	10,0
15.	Correct single breath duration (max 1 s)	5,0
16.	Number of presses per cycle (30)	40,0
17.	Proper chest relaxation during CPR	10,0

In order to verify if there are differences in the general level of knowledge between persons of different sex, age, place of residence or class attendance, a series of t-student tests and one-way analysis of variance were performed, where the dependent variable was the knowledge score in the test, and the independent variables were the above mentioned factors.

The t-student test, where the independent variable was sex, was statistically insignificant, $t (78) = 0.65$; $p = 0.52$. The results obtained by men ($M = 13.37$, $SD = 3.18$) did not differ substantially from the results obtained by women ($M = 13.82$, $SD = 2.91$). Due to the unequal distribution of the examined age, it was decided to make a comparison betweeen the youngest group of 16-year-olds and a group of 17, 18 and 19-year-olds.

Levene's test was statistically insignificant ($p = 0.15$), so the assumption of equality of variance was not broken. The t-test was statistically significant, $t (78) = 2.59$; $p = 0.012$. The 16-year-olds had lower scores ($M = 12.20$, $SD = 2.53$) than the at least 17-year-olds ($M = 14.13$, $SD = 3.00$). One-way analysis of variance, where the independent variable was the place of residence, was not statistically significant, $F (2,77) = 1.91$; $p = 0.16$, thus there were no significant differences in the results of the tests between indivisuals living in different populations.

Effect of class profile

One-factor analysis of variance was used to examine the differences between the results of the knowledge test. Levene's test was statistically insignificant ($p = 0.68$), therefore variance analysis was performed without corrections and it turned out to be statistically significant, resulting in $F (2, 77) = 7.80$; $p = 0.001$. Bonferroni's post-hoc analysis showed that students in the rescue-medical classes achieved higher scores in the Knowledge Test ($M = 14.73$, $SD = 2.50$) than those from other technical classes ($M = 11.75$, $SD = 2.69$); $p = 0.001$.

The comparison of the results of the practical test in individual class profiles showed a statistically significant difference. The results were obtained by means of one-way ANOVA variance analysis for independent groups with the Fisher post-hoc test. It showed a statistically significant difference in the results of the practical test between rescue class and other classes ($F = 7.19$; $p = 0.000116$). Rescue classes achieved a higher average result in the practical task (1st class with rescue profile $M = 12.55$, $SD = 2.03$, 2nd class with rescue profile $M = 10.6$, $SD = 3.56$) Class (MD $= 9.9$, $SD = 2.29$, MD class $= 8.15$, $SD = 3.37$).

IV. DISCUSSION

In the event of a sudden health or life threatening crisis, the first few minutes when bystanders can help are crucial. Despite numerous information campaigns on first aid and the developed system of State Medical Rescue, survival of patients with sudden cardiac arrest is low. According to the European Resuscitation Council data, in 2016 there were 350,000 non-hospital cardiac arrests.
In 46% of cases, with support provided by witnesses, the survival of patients with neurological deficits and discharged from the hospital was 12%. [8]. Early detection of cardiac arrest, emergency call, resuscitation and external defibrillation increase the chance of survival by up to 50-70% [9].

First-aid education and shaping appropriate social attitudes should begin at an early age. In upper secondary schools, the subject is education for safety, which conducts activities that prepare students to help victims of accidents and emergencies. In some educational institutions, medical and even life-saving profiles are sometimes created. Lessons are taught by teachers who have been through thirty hours of training. Proper preparation of pupils, in the framework of basic education, to provide first aid gives the possibility of increasing the survival of victims [10, 11]. Thus, a great care must be taken to ensure a high level of education through a sound assessment of the programs implemented.

The results of the study clearly show that students in the medical-rescue class have more first-aid knowledge than those in other classes. There were no statistically significant differences in the level of knowledge between men and women, as well as the place of residence and population of the inhabitants. The only feature that turned out to be statistically significant was the age of the respondents. Younger people at the age of 16 were getting lower results than older people aged 17-18 and 19.

It should be noted that although during general assessment of practical skills, students in the medical-rescue classsesscored better than those of the technical school or the general class, we can still find elements where the students in the medical classes, scored significantly worse than the other classes, as exemplified by be lack of correct chest relaxation during CPR. In the medical classes, only 2.5% of the students got the correct result, and in the technical class the result reached az much as 15%.

A significant part of the research results is that the responders achieved better results during tests than during practical tasks. This applies to both general and rescue

classes. This proves that the students the medical-rescue profile also show shortcomings in practical skills, despite the fact that their teaching process puts more emphasis on learning the elements of first aid. Causes should be sought in the absence of training programs for classes of such a specialty. At present, first aid is based directly on a program linked to the subject of safety education or proprietary curriculums. Therefore, giving a certain degree of freedom to the teachers as to the content of the program may give rise to concerns about the quality and level of the classes. The knowledge transfer should be based on current medical knowledge and the teacher's experience, and should be presented in a practical and accessible manner so that information provided to students is more understandable and persistent. [12] As indicated by other studies, the correlation between the number of students and the first-aid teacher may also be a problem. Less numerous groups where contact with a teacher is more available show greater achievement in acquired first aid knowledge [13].

An attempt to determine the effectiveness of teaching high school students first aid is quite difficult and requires a multidimensional analysis. Assuming a minimum score of 51%, the students technical and general high schools do not meet the educational program requirements for safty because they have not even reached half the points in the practical assignment. In spite of the higher average rating of medical emergency classes compared to the other groups, there are numerous deficiencies in their knowledge and skills. Basic CPR activities, such as proper inspiratory time and successful rescue breathing exercises, are not at a high level in the class of this profile, which may underpin the discussion of the level of education. The analysis indicates a lack of consistency in teaching effectiveness during safety education lessons in all class profiles. The data suggest the need for thorough changes in the pre-university education system and in professional development of education for safety teachers. Incorporation of scenarios and simulations would greatly increase their knowledge level and would also positively impact stress management in such situations. [14]

Creating a medical-rescue profile is an interesting and innovative solution for people who have a future career in medical profession. However, at this stage, such classes should be subject to a special course of study designed for advanced first aid and other disciplines. The lack of curricula and appropriately prepared teaching staff results in the fact that, in spite of significantly higher average results, in some respects students of rescue classes are less prepared than students from other profile classes.

Broadly promoting and using other out-of-school learning approaches, e.g. through first-aid self-study, has a positive impact on education in this area. Personal engagement in the search for knowledge allows for higher results compared to traditional education methods [15, 16]. It is also important for teachers to continually improve their competences and to ensure the participation of experienced medical staff in their safety education classes.

V. CONCLUSIONS

- Students of technical high schools and general high schools do not meet the requirements of the first aid curriculum.
- Students in the profile medical-rescue classes have more knowledge and skills in providing first aid compared to students in other directional classes.
- There is no curriculum dedicated to medical-rescue classes, which sometimes hinders them from achieving better first aid results.
- Solutions to improve students' skills in life-saving work should be sought. One possibility is to involve the National Medical Rescue system in the medical staff education and training process.
- The first-aid curriculum should be continued, updated and adequately monitored at each educational stage.

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