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Knowledge of Students of Selected Fields at the Medical University of Lodz on Basic Resuscitation Procedures

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Abstract

Background: *Sudden cardiac arrest (SCA) is a sudden medical condition in which the mechanical function of the heart is impaired and consequently ceases. It is the most common cause of human death in Europe. In order to increase survival rates, it is essential to spread knowledge among the public about life-saving techniques. Medical students, as a specific health-related group, should be familiar with current life-threatening emergency management regimens.*

Objective: *The aim of the study was to assess the knowledge of students of selected faculties at the Medical University of Lodz on basic resuscitation procedures (BLS – Basic Life Support).*

Material and methods: *Online survey questionnaire consisting of 25 questions developed by the study authors. The study involved 327 students of selected faculties: medicine, nursing, paramedicine, public health at the Medical University of Lodz. Inclusion criteria for the study: age >= 18 years, status as a student of the aforementioned faculties at the Medical University of Lodz, informed consent to participate in the study.*

Results: *80.7% (264) of the students were familiar with the management algorithm: 85.6% (89) of medical students, 79.8% (67) of nursing students, 81.0% (60) of paramedic students, and 71.6% (48) of public health students; 81.5% (145) of those familiar with the algorithm were female, and 79.9% (119) were male students. 92.3% of medical students, 82.1% of nursing students, 90.3% of paramedic students and 64.1% of public health students had knowledge of AEDs. Among the respondents, the most common sources of knowledge about BLS were the medical school classes (68.5% (224)) and the Internet (24.16% (79)).*

Conclusions: *The knowledge of the students of selected courses of the Medical University of Lodz was satisfactory. The majority of students knew the procedure algorithm and emergency numbers. The main source of BLS knowledge for students were classes at the medical university and the Internet. The process of*

educating medical students and the entire society about BLS should be continuously pursued.

Key words: *knowledge, students, BLS, resuscitation*

Background

Sudden cardiac arrest (SCA) is a sudden medical condition in which the mechanical function of the heart is impaired and subsequently ceases. Such a condition leads to the hypoxia of vital organs, including irreversible brain damage. It is the most common cause of human death in Europe. In order to increase survival rates, it is essential to spread awareness among the public about life-saving techniques. It is believed that the initiation of CPR by witnesses to SCA increases a patient's chance of survival by an average of three times [1], while each minute of delayed CPR reduces the chance by up to 10% [2]. The incidence of CPR being undertaken by SCA witnesses varies between countries, averaging 58% (ranging from 13% to 83%) [3]. Basic CPR training provided to the general public and to medical and non-medical emergency personnel is of great importance in increasing the survival rate of people who have suffered a sudden cardiac arrest [4]. Protecting human life by ensuring that all citizens have access to high-quality resuscitation is an objective of the European Resuscitation Council. To achieve this, the organization issues up-to-date, evidence-based guidelines for the prevention and treatment of cardiac arrest and life-threatening conditions [3].

The current guidelines date back to 2021. In the guidelines, life-saving activities are divided into BLS, or basic resuscitation procedures, which all people should be familiar with, and ALS, or advanced procedures performed by medical personnel. Medical students, as a specific health-related group, should be familiar with the current life-saving regimens.

Among the main principles of BLS, the following are emphasized: the need to recognize SCA early and initiate CPR, call the emergency medical team, initiate high-quality resuscitation (chest compressions and ventilation), and use an AED, or Automated External Defibrillator [5].

The scheme includes: ensuring the rescuer's safety, checking the victim's reaction, consciousness, establishing an airway, checking breathing. If breathing is normal, the casualty should be placed in the safe lateral position, but if the casualty is not breathing, SCA should be recognized, and the rescuer should proceed with CPR. The BLS algorithm in this case is as follows: if the casualty is unresponsive and not breathing or not breathing properly, and you are the only person on the scene – start CPR, then call for help; if the casualty is unresponsive and not breathing or not breathing properly and there are other witnesses to the event with you – ask them to call for an emergency medical team, and start CPR immediately: perform 30 chest compressions, then perform 2 rescue breaths, and continue CPR at a ratio of 30:2. If AED is available – turn it on and follow the instructions. The victim's consciousness can be checked by shaking the person gently by the shoulders and asking, for example, "Are you OK?", "Hello, can you hear me?".

When it comes to airway management, the head-tilt/chin-lift maneuver should be performed. The Esmarch maneuver, or mandibular protrusion, is reserved for experienced medical personnel; a casual witness should not perform it.

Breathing should be controlled for max. 10 seconds, by checking if the chest rises and trying to hear and feel the breath – the so called 'look, listen, feel' procedure. It is important to bear in mind that up to 40% of victims with SCA may give out so-called agonal breathing.

The emergency medical team can be called on 112 or 999.

If there is more than 1 rescuer, of them should be sent for the nearest AED. AEDs can be found in public places such as train stations, airports, and shopping malls [6]. They are placed in places where 1 cardiac arrest per 5 years is expected. Special maps locating the devices are available on the Internet [7]. The AED analyzes the heart rhythm itself and has pre-programmed energy volumes. The victim should not be touched during rhythm analysis using the AED. No training is required to use the AED. If performing CPR alone, the victim should not be left alone.

CPR should be performed on a hard surface. You should begin with chest compressions and perform them in adults at a ratio of 30:2, in children – 15:2 and in neonates – 3:1. Place of compressions: in adults it is the center of the chest, i.e., the lower half of the sternum [8]. In children it is also the lower half of the sternum [9].

Depth of compressions:

- in adults ≥5 cm but <6 cm,
- in children ≥1/3 of the anteroposterior dimension of the chest (5 cm for children, 4 cm for infants).

Compression rate: 100–120 compressions/min. In children, five rescue breaths should be performed before the chest compressions. Rescue breaths should be performed mouth-to-mouth or mouth-to-nose. The length of the inspiration to be delivered is 1 second and the tidal volume, i.e., the volume needed to raise the chest, is 500–600 ml (6–7 ml/kg). The two rescue breaths should not cause a pause in chest compressions of more than 10 seconds.

CPR should be terminated when:

- the professional medical services have taken over and a message is received from them indicating that it is possible to terminate the operations
- the victim's circulation has been restored
- the rescuer is exhausted [10].

As far as pregnant women are concerned, it is important to remember that after the 20th week of pregnancy the enlarged uterus may compress the inferior vena cava and the aorta, causing a decrease in venous return and cardiac output. The result can be a preceding drop in blood pressure or shock, which in critically ill patients can lead to cardiac arrest. The easiest way to relieve pressure on the aorta and inferior vena cava is to manually shift the uterus to the left side, which may prove more effective than tilting the patient's body to the left side [11]. ERC guidelines recommend positioning the pregnant patient on the left side or gently shifting the pregnant uterus manually to the left side to relieve pressure on the inferior vena cava and aorta [12].

Aim

The aim of the study was to assess the knowledge of students of selected faculties at the Medical University of Lodz on basic resuscitation procedures (BLS – Basic Life Support).

Material and methods

Online survey questionnaire consisting of 25 questions developed by the authors. The study involved 327 students of selected faculties: medicine (long-cycle Master's degree program), nursing (undergraduate and postgraduate studies), medical emergency (undergraduate studies), and public health (undergraduate and postgraduate studies) at the Medical University of Lodz. Inclusion criteria for the study: age ≥18 years, status as a student at the Medical University of Lodz in the above listed fields of study, informed consent to participate in the study.

The information that was collected in the surveys was analyzed by entering it into an Excel spreadsheet. The material was developed using descriptive methods and statistical inference methods. The chi^2 independence test was used to compare the relationship between the qualitative characteristics and the frequency of individual characteristics in the study groups. Differences between frequencies and correlations between traits that were considered statistically significant were the ones for which the chi^2 test value presented itself equal to or greater than the critical value. The critical value was derived from for the corresponding number of degrees of freedom with a probability of error of $p<0.05$.

Among all participants surveyed (327 people), women represented 54.4% (178), and men 45.6% (149). As far as the distribution of students representing different fields of study is concerned, medical students accounted for 31.8% (104), nursing students – 25.7% (84), paramedic students – 22% (72), and public health students – 20.5% (67 people) (Figure 1).

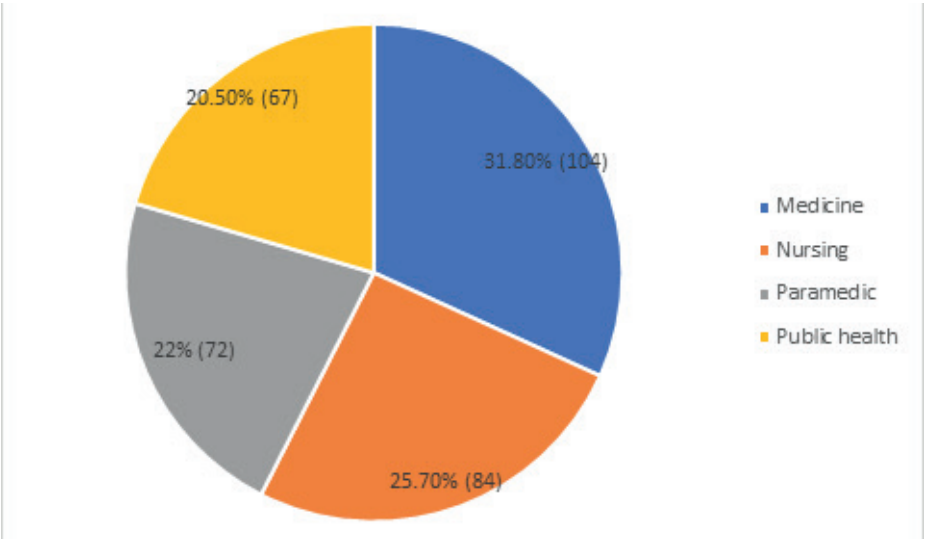

Figure 1. Distribution of students by their field of study

Results

80.7% (264) of the respondents were familiar with the procedure algorithm, including 85.6% (89) of medical students, 79.8% (67) of nursing students, 81.0% (60) of paramedic students and 71.6% (48) of public health students. The observed differences proved to be statistically insignificant – $p>0.05$. The rate of chest compressions was known to 96.2% (100) of medical students, 91.7% (77) of nursing students, 97.2% (70) of paramedic students, and 65.7% (44) of public health students, and to the total of 89% (291) of all respondents. The differences observed were found to be statistically significant – $p<0.001$, $chi^2=48.228$.

Knowledge of emergency telephone numbers was declared by 100% of medical students, 100% of nursing students, 100% of paramedic students and 98.5% of public health students. The differences observed were found to be statistically insignificant – $p>0.05$ (Table 1).

Table 1. Knowledge of individual BLS procedures according to field of study

Knowledge of BLS procedures	Medicine		Nursing		Paramedic		Public health		Total		
Procedure algorithm	No.	%	No.	%	No.	%	No.	%	No.	%	p
Knew	89	85.6	67	79.8	60	81.0	48	71.6	264	80.7	p>0.05
Did not know	15	14.4	17	20.2	12	19.0	19	28.4	63	19.3	
Rate of chest compressions	No.	%	No.	%	No.	%	No.	%	No.	%	p
Knew	100	96.2	77	91.7	70	97.2	44	65.7	291	89.0	p<0.001; chi^2=48.228
Did not know	4	3.8	7	8.3	2	2.8	23	34.3	36	11.0	
Emergency numbers	No.	%	No.	%	No.	%	No.	%	No.	%	p
Knew	104	100	84	100	72	100	66	98.5	326	99.7	p>0.05
Did not know	0	0.0	0	0.0	0	0.0	1	1.5	1	0.3	

81.5% (145) of female respondents and 79.9% (119) of male ones were acquainted with the management algorithm. The rate of chest compressions was known to 91.6% (163) of women and 85.9% (128) of men. 100% of female respondents and 99.3% of male ones knew the emergency numbers. The differences observed were found to be statistically insignificant – p>0.05 (Table 2).

Table 2. Knowledge of individual BLS procedures by gender

Knowledge of BLS procedures	Women		Men		Total		
Procedure algorithm	No.	%	No.	%	No.	%	p
Knew	145	81.5	119	79.9	264	80.7	p>0.05
Did not know	33	18.5	30	20.1	63	19.3	
Rate of chest compressions	No.	%	No.	%	No.	%	p
Knew	163	91.6	128	85.9	291	89.0	p>0.05
Did not know	15	8.4	21	14.1	36	11.0	
Emergency numbers	No.	%	No.	%	No.	%	p
Knew	178	100	148	99.3	326	99.7	p>0.05
Did not know	0	0	1	0.7	1	0.3	

As for the differences in the management scheme for adult and child patients, the data indicated that the knowledge of adult-specific BLS was more common than the knowledge of child-specific BLS.

94.2% of medical students, 89.3% of nursing students, 94.4% of paramedic students and 83.6% of public health students knew the appropriate ratio of compressions to breaths when helping an adult casualty. The differences observed were found to be statistically insignificant – $p>0.05$ (Table 3).

The proper location of adult chest compressions was known to 95.2% of medical students, 89.3% of nursing students, 93.1% of paramedic students and 58.2% of public health students. The differences observed were found to be statistically significant – $p<0.001$, $chi^2=50.682$.

The depth of compressions was known to 81.7% of medical students taking part in the survey, 76.2% of nursing students, 80.6%, of paramedic students, and 47.8% of public health students. The observed differences were found to be statistically significant $p<0.001$, $chi^2=28.252$ (Table 3).

Table 3. Knowledge of the CPR treatment scheme in adults and children depending on the field of study

Adult CPR management	Medicine		Nursing		Paramedic		Public health		Total		
Compression to ventilation ratio	No.	%	No.	%	No.	%	No.	%	No.	%	p
Knew	98	94.2	75	89.3	68	94.4	56	83.6	297	90.8	p>0.05
Did not know	6	5.8	9	10.7	4	5.6	11	16.4	30	9.2	
Place of chest compressions	No.	%	No.	%	No.	%	No.	%	No.	%	p
Knew	99	95.2	75	89.3	67	93.1	39	58.2	280	85.6	p<0.001; $chi^2=50.682$
Did not know	6	5.8	9	10.7	5	6.9	28	41.8	47	14.4	
Depth of chest compressions	No.	%	No.	%	No.	%	No.	%	No.	%	p
Knew	85	81.7	64	76.2	58	80.6	32	47.8	239	73.1	p<0.001; $chi^2=28.252$
Did not know	19	18.3	20	23.8	14	19.4	35	52.2	88	26.9	
Child CPR management	Medicine		Nursing		Paramedic		Public health		Total		

Adult CPR management	Medicine		Nursing		Paramedic		Public health		Total		
Compression to ventilation ratio	No.	%	No.	%	No.	%	No.	%	No.	%	p
Knew	93	89.4	64	76.2	55	76.4	45	67.2	257	78.6	p<0.05; chi^2=12.948
Did not know	11	10.6	20	23.8	17	23.6	22	32.8	70	21.4	
Place of chest compressions	No.	%	No.	%	No.	%	No.	%	No.	%	p
Knew	88	84.6	61	72.6	60	83.3	14	20.9	233	68.2	p<0.001; chi^2=90.405
Did not know	16	15.4	23	27.4	12	16.7	53	79.1	104	31.8	
Depth of chest compressions	No.	%	No.	%	No.	%	No.	%	No.	%	p
Knew	83	79.8	59	70.2	55	76.4	3	4.5	200	61.2	p<0.001; chi^2=115.79
Did not know	21	20.2	25	29.8	17	23.6	64	95.5	127	38.8	

The ratio of compressions to breaths in adults was known to 91% of women and 90.6% of men surveyed, and to a total of 90.8% of all respondents. The location of compressions on the chest was known to 84.3% of women and 87.3% of men, while the depth of compressions was known to 73% of women and 73.2% of men. The differences observed were found to be statistically insignificant – $p>0.05$. The ratio of compressions to breaths in children was known to 83.7% of women and 72.5% of men. The differences observed were found to be statistically significant – $p<0.05$, $chi^2=6.074$ (Table 4).

The location of chest compressions in children was known to 71.9% of women and 63.8% of men surveyed, while the depth of compressions in children was known to 63.5% of women and 58.4% of men. The differences observed were found to be statistically insignificant – $p>0.05$ (Table 4).

Table 4. Knowledge of CPR regimen in adults and children by gender

Adult CPR management	Women		Men		Total		
Compression to ventilation ratio	No.	%	No.	%	No.	%	p
Knew	162	91.0	135	90.6	297	90.8	p>0.05
Did not know	16	9.0	14	9.4	30	9.2	
Place of chest compressions	No.	%	No.	%	No.	%	p
Knew	150	84.3	130	87.3	280	85.6	p>0.05
Did not know	28	15.7	19	12.7	47	14.4	
Depth of chest compressions	No.	%	No.	%	No.	%	p
Knew	130	73.0	109	73.2	239	73.1	p>0.05
Did not know	48	27.0	40	26.8	88	26.9	
Child CPR management	Women		Men		Total		p
Compression to ventilation ratio	No.	%	No.	%	No.	%	
Knew	149	83.7	108	72.5	257	78.6	p<0.05, chi^2=6.074
Did not know	29	16.3	41	27.5	70	21.4	
Place of chest compressions	No.	%	No.	%	No.	%	p
Knew	128	71.9	95	63.8	223	68.2	p>0.05
Did not know	50	28.1	54	36.2	104	31.8	
Depth of chest compressions	No.	%	No.	%	No.	%	p
Knew	113	63.5	87	58.4	200	61.2	p>0.05
Did not know	65	36.5	62	41.6	127	38.8	

Knowledge of what an AED is, where to find the device and of the fact that the victim should not be touched during rhythm analysis was known to 92.3% of medical, 82.1% of nursing, 90.3% of paramedic and 64.1% of public health students. The differences observed were found to be statistically significant – p<0.001, chi^2=26.504 (Figure 2). As for the gender difference, 81.5% of women

and 85.9% of men were aware of the above mentioned facts. The differences observed were found to be statistically insignificant – p>0.05 (Figure 3).

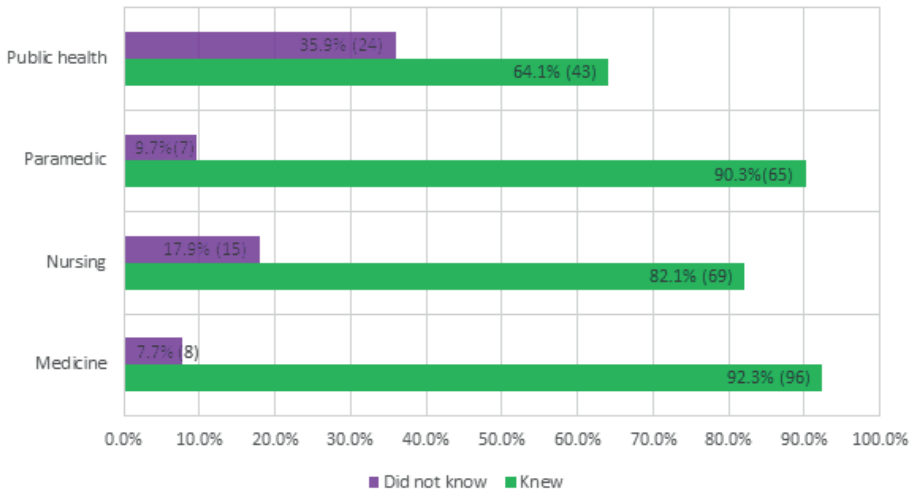

Figure 2. Knowledge of AEDs by field of study

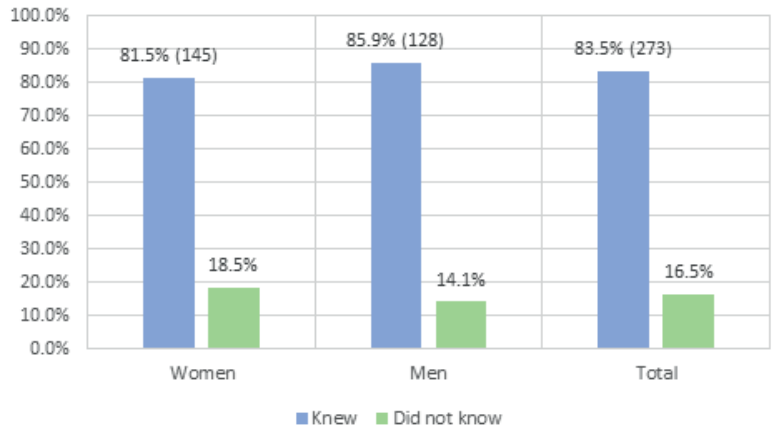

Figure 3. AED knowledge by gender

88.5% of medical students, 95.2% of nursing students, 83.3% of paramedic students and 41.8% of public health students who took part in the survey were

aware of the distinctive features of CPR in pregnant women. The observed differences were found to be statistically significant – $p<0.001$; $chi^2= 77.028$ (Figure 4).

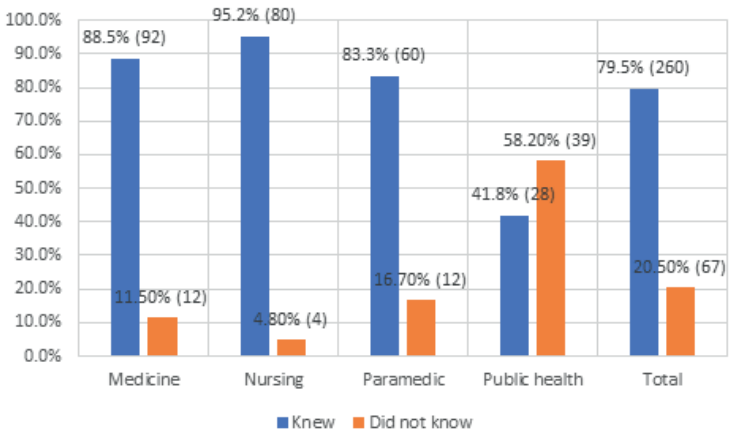

Figure 4. Knowledge of the distinctive features of CPR in pregnant women according to the field of study

Knowledge of the distinctions in CPR in pregnant women was known to 79.2% of the women surveyed and 79.9% of the male respondents. The differences observed were statistically insignificant – $p>0.05$ (Figure 5).

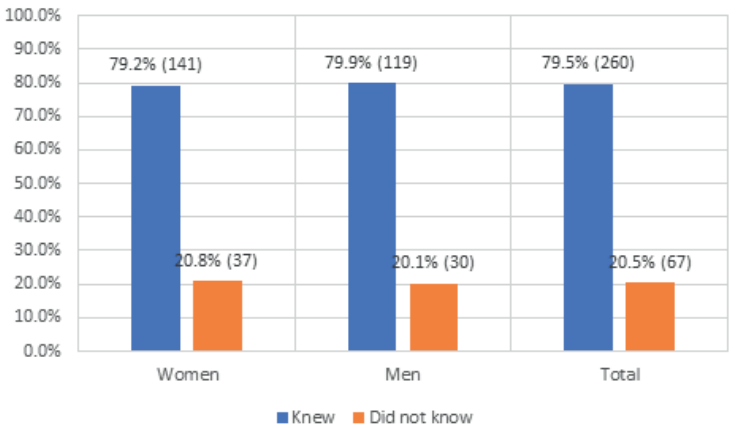

Figure 5. Knowledge of distinctive features of CPR in pregnant women according to gender

Among the respondents, the most common sources of knowledge about BLS mentioned were medical school classes 68.5% (224) and the Internet 24.16% (79). The least frequently declared source of knowledge was social media 0.61% (2) (Figure 6).

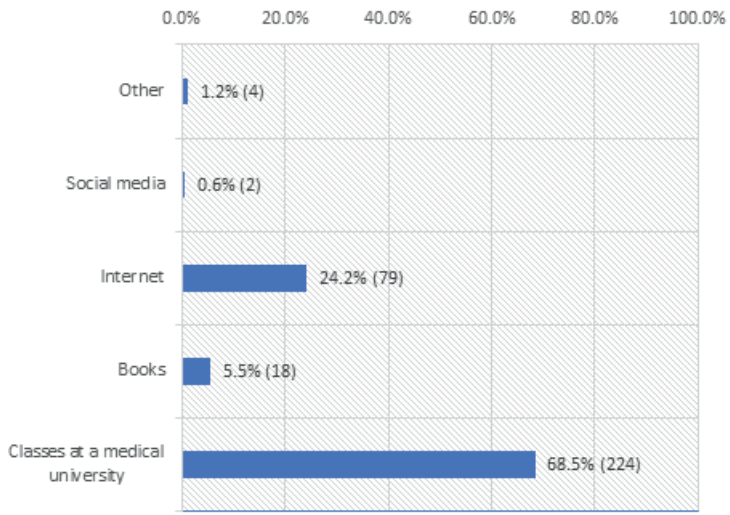

Figure 6. Sources of the surveyed students' knowledge on BLS

Discussion

The topic of BLS, or basic resuscitation, and CPR, or cardiopulmonary resuscitation, is extremely important and often discussed in scientific papers. Medical students are a specific group who should have up-to-date knowledge in the field and serve as an example to the rest of the society. According to a 2012 Polish survey including medical students, doctors in training and firefighter-rescuers, the greatest number of inaccuracies in CPR knowledge concerned the problem of where to perform chest compressions on infants [4]. In the study being the subject of this article, most errors were related to the depth of compressions. In the Systematic Review conducted in 2019 it was concluded that that one of the priorities should be to improve the assessment of medical students' knowledge of CPR and to minimize errors [13].

In the survey conducted among high school students in Kansas City (USA) it was found that the majority of students answered the questions concerning BLS steps correctly, but they lacked knowledge about AEDs. Additionally, 70% of the students said they would take a BLS course at school if it was offered [14]. This is in line with the belief that there a continuous effort should be taken to spread knowledge on basic life-saving techniques. The results of the 2019 study from Saudi Arabia's Jeddah University are in line with the abovementioned conclusions, according to which there is an urgent need to organize BLS courses for medical students to enrich their knowledge, improve their resuscitation skills, and teach them proper resuscitation techniques [15]. Numerous world literature reports also suggest that the dissemination of BLS knowledge, especially among medical personnel, is extremely important, as it helps save lives at minimal cost. In a study conducted in Yemen in 2022 it was found that the knowledge of nurses there was below the acceptable levels to ensure maximum chances of survival in the event of cardiac arrest. Dissemination of BLS knowledge and providing training in the field in a more effective manner would offer the benefit of lives saved at minimal cost [16]. In a study from Nepal it was concluded that health workers' knowledge of basic resuscitation techniques was also inadequate [17]. The BLS knowledge of medical students in Oman was found to be insufficient as well; however, they declared their willingness to develop their skills in the field and claimed they would provide BLS to a stranger if necessary. This highlights the importance of providing sufficient BLS training to medical students early in the course of their studies [18]. The above-mentioned countries were characterized by a lower level of BLS knowledge of students and medical staff. According to the results of the study discussed in this article, the level of BLS knowledge of students of the Medical University of Lodz was satisfactory. In the Swiss study conducted in 2022 it was concluded that implementing corrective measures to improve communication, restore motivation, and ultimately increase BLS knowledge among medical and dental students should be considered [19]. The results of a study performed at the Dilla University in 2021 showed that health sciences students attending graduate classes during the study period had unsatisfactory knowledge of

BLS, and the introduction of BLS training to the study curriculum was recommended [20]. Therefore, it can be concluded that the authors of numerous reports from around the world agree that although the topic of BLS has been addressed many times before, a continuous effort should be made to raise the awareness in the field, improve people's skills and educate them on the topic, which is especially important for health-related students.

Conclusions

- The level of knowledge of the students of selected faculties of the Medical University of Lodz was satisfactory, but considering the type of the university where the study was conducted, better results were expected.
- Students were mostly familiar with the procedure algorithm and emergency numbers, and they had knowledge of AED management.
- The students were more familiar with the adult CPR regimen than with the child CPR regimen. They found it most difficult to determine where to perform chest compressions and how deep the compressions should be.
- The main sources of BLS knowledge for students were classes at the medical school and the Internet.
- Continuous efforts should be made to educate medical students, especially those studying public health, as well as the general public about BLS.

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