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## Public awareness about the use of automatic external defibrillator (AED) in giving first aid

### Abstract

**Introduction.** Chances for survival of a patient who has suffered from sudden cardiac arrest (SCA) depend on a number of factors. One of the most important however, is the time within which the patient is provided with actions to restore normal heart function. In the *Guidelines for Resuscitation 2015*, The European Resuscitation Council states that defibrillation done within 3-5 minutes since a patient with SCA lost his/her consciousness can increase the survival rate up to 50-70%. However, such a short time of providing help is only achievable through the implementation of universal defibrillation programs and the automatic external defibrillator (AED) devices densely distributed in public places. By contrast, every minute of delay in defibrillation reduces the probability of survival by approximately 10-12% until the hospital discharge.

**Aim.** The purpose of the research was to elicit the opinions of adult respondents on first aid and the use of automatic external defibrillator (AED).

**Material and methods.** The research method used in this paper was a diagnostic survey, the technique was a web-based questionnaire, and a research tool was the authors' own questionnaire survey. The survey was active between April 8, 2016 and May 20, 2016. During this time, 116 opinions were collected.

**Results.** As many as 77% of respondents declared that they had attended a first aid course, but 21% of them stated that they no longer remembered the knowledge acquired. The number of 63% of respondents did not know what an automatic external defibrillator is. Only 27% of respondents knew that AEDs are public devices, and only 47% believed that using an AED would not worsen the health of the victim.

**Conclusions.** The availability of AEDs and knowledge of their use are insufficient. Low social awareness and irrational fear of using an AED (fear of deterioration of the victim's health) support the need for continuing education in this area.

**Keywords:** automated external defibrillator (AED), cardiopulmonary resuscitation, social awareness, first aid.

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### INTRODUCTION

The 2012 European Health Report published by the World Health Organisation states that cardiovascular diseases are the leading cause of mortality, accounting for nearly 50% of deaths. Ischaemic heart disease and cerebrovascular diseases are responsible for 35% of all deaths in Europe [1]. Immediate and efficient first aid performed by bystanders before medical rescue team arrives significantly increases the chances of survival of the victim. According to the Medical Rescue Act of 8 September 2006, first aid is: „a set of actions taken to rescue a person in the state of emergency performed by a person present at the scene of the emergency, including the use of medical products and equipment, within the meaning of the provisions of the Act of 20 May 2010 on medical devices and medicinal products issued without a prescription of a physician admit-

ted to trading on the territory of the Republic of Poland” [2]. In view of the above definition, a person giving first aid may not have medical education to provide help and use medical products (including an AED). Therefore, every person should have a basic knowledge of how to provide first aid, since everyone can witness an emergency and in such case is responsible for the life and health of the victim. If a person is experiencing a medical emergency, his/her health state may deteriorate within short period of time leading to a serious impairment of body functions or sudden cardiac arrest. The most common cause of out-of-hospital sudden cardiac arrest is ventricular fibrillation. Ventricular fibrillation is a chaotic and disorganised activity in the ventricles. During ventricular fibrillation chances of survival are the highest. Victims of sudden cardiac arrest with asystole have poor prognosis. It is estimated that 4 seconds of asystole causes dizziness or even loss of consciousness,

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and when it lasts longer, it is a life-threatening condition. Survival to discharge following cardiac arrest with asystole is 0-2% [3]. Defibrillation is a crucial element of basic life support with proven efficiency in treating cardiac arrest [4]. Every minute of delay in defibrillation reduces the probability of survival by 10-12% until the hospital discharge [5].

### Automatic External Defibrillators (AED)

Defibrillation is a procedure in which a brief electric shock is given to the heart to depolarise (to stimulate a muscle or nerve cell, in general [6]) a critical mass of the heart muscle and to restore normal heart rhythm [7]. Its aim is to stop fibrillation, that is to „reset” the chaotic and ineffective functioning of the heart [4]. An optimal dose of electric current used in defibrillation should stop the fibrillation and cause as little damage to the heart muscle as possible. Only 4% of the administered electric current reaches the heart [8]. According to the European Resuscitation Council, defibrillation within 3-5 minutes of collapse can produce survival rates as high as 50-70% [5]. This can be achieved by the implementation of public access defibrillation programmes and the placement of AEDs in public places. Every minute that passes, decreases the probability of successful defibrillation and the chances of survival of the victim. Therefore, providing rapid defibrillation is one of the most important factors influencing the patient's survival without neurological damage. The problem is the time passing before the professional help arrives and provides defibrillation. Most of the times paramedics are not able to provide defibrillation within the first minutes after the notification. Therefore, in the 80s of the XX century the concept of automatic external defibrillators (AED) [9] was developed to increase the accessibility of defibrillation. AEDs are devices used for providing defibrillation in case of ventricular fibrillation or pulseless ventricular tachycardia. Many types of AEDs are produced, but all of them have the same mechanism of action. AEDs automatically analyse the heart rhythm and determine the type of arrhythmia. Then, the information is given to the rescuer in form of visual or voice prompts [10]. Additionally, each AED has an embedded memory, it charges itself automatically to a pre-determined level and indicates to the operator that a shock should be given. Originally, AEDs were only available in hospitals and other healthcare facilities [8]. However, over the years they have been placed in other public places, such as shopping malls [11], museums, airports or underground stations [12,13]. According to current recommendations, not only medical personnel may use AEDs to provide basic life support. AEDs may also be used by bystanders with no medical education. The device is programmed to give voice prompts to the person providing first aid [8]. The implementation of AEDs in public places has allowed more people to provide defibrillation. The construction of the device prevents from delivering an unnecessary shock to the heart, because the shock button will be activated only if a type of shockable arrhythmia is determined. New technologies allow to produce more and more advanced defibrillators. State-of-the-art AEDs give voice prompts, which enable bystanders to maintain an appropriate compression pace. They also monitor the depth of chest compressions and give audible alerts, if the CPR is done incorrectly.

### Public access defibrillation programme (PAD)

Automatic external defibrillators are small devices, resembling the size of a first aid kit, which are easy to use, as they have been programmed to be used in an intuitive manner. The main purpose of implementing AEDs in public places is to increase the chances of survival of a SCA victim. Therefore, public access defibrillation (PAD) programme has been developed. The implementation of this programme has increased the survival rate by about 49-74% [14]. According to the *Guidelines for Resuscitation 2015*, AEDs should be deployed in places where one cardiac arrest per 5 years can be expected [5]. Therefore, AEDs are placed at the airports, in shopping malls, sports venues, offices, underground stations, buses, trains and in many other places. The elements of PAD programme are:

- Basic life support (BLS) and AED trainings,
- planning,
- integrated medical emergency system,
- programs improving the quality of life-saving actions.

Therefore, many trainings and educational initiatives are organised to equip the public with knowledge of how to give first aid in case of an emergency, including how to give first aid using an AED [14]. The Resuscitation Council recommends the implementation of PAD programme in private homes, as the majority of SCAs occurs at home [15]. To make it easier for the citizens to identify an automatic external defibrillator, the International Liaison Committee on Resuscitation (ILCOR – an international committee, whose purpose is to standardize the principles of providing first aid) has developed a universal sign indicating the location of the device (Figure 1), which has been approved and is used worldwide [16].



FIGURE 1. The AED sign.

Source: [www.ilcor.org/images/ILCOR-AED-sign.jpg](http://www.ilcor.org/images/ILCOR-AED-sign.jpg)

In Poland the public defibrillation programme was first introduced in 2003 with the initiative called „Orlen Pierwsza Pomoc (First Aid Orlen)” developed by the foundation „Dar Serca (The Gift of Heart)”. Within the framework of this initiative gasoline stations were equipped with AEDs and employees were trained in the field of first aid [13]. In 2007 there was an initiative called „Trzebinia Miastem Bezpiecznego Serca (Trzebinia – the Town of Safe Heart)”, which initiated a big-scale educational campaign concerning first aid and led to the purchase and placement of 20 automated external defibrillators on the territory of the commune [14]. Then, in 2008 the program “Kraowska Sieć AED – Impuls Życia (Cracow AED Network – The Impulse of Life)” was introduced, which was developed by the authorities of Cracow in cooperation with the Polish Resuscitation Council in accordance with the European BLS/AED standards. Within the framework of the program 26 external defibrillators were purchased and deployed

near busy streets, railway stations and offices [17]. Another initiative promoting public access to defibrillation is a website and mobile application called „Ratuj z sercem – Mapa AED (Rescue with Heart – The Map of AED)” developed in 2009, which originally was realised only on the territory of Silesian Province. Over time it has become a national initiative with the aim to search for AEDs in Poland and then to put their location on the map enabling people to quickly find the defibrillator in case of an emergency [18]. Additionally, it is getting more and more popular to place AEDs in communes which are located far away from an ambulance station. Usually the devices are installed in places important for the residents, to make AEDs visible and accessible. They are also frequently made available for fire brigades.

## AIM

The aim of this paper was to elicit the opinions of adults in the field of providing first aid and using an automated external defibrillator (AED).

## MATERIAL AND METHODS

The research method used in this paper was a diagnostic survey provided online and the research tool was the authors' own survey questionnaire. The sampling method used in this research was snowball sampling. The online survey was developed by means of the website [www.profitest.pl](http://www.profitest.pl), which enables to transfer the results to Microsoft Office Excel spreadsheet. The link to the survey questionnaire was distributed using social media. Adult Internet users were asked to fill the questionnaire and to forward it to their friends. The survey was active between April 8, 2016 and May 20, 2016. During this time, 116 opinions were collected.

## RESULTS

A total of 116 respondents took part in the research. As many as 78% of them were women and 22% were men. The age of respondents was between 18 and 52 years old. Therefore, they were classified into three groups of age: between 18 and 25 years old, between 26 and 35 years old and 36 and above. Respondents aged between 18 and 25 years old were the most numerous group – 65%, followed by respondents aged between 26-35 years old (20%). The least numerous group were the oldest respondents (36-52 years old) – 16%. More than half of respondents came from rural areas (59%), 21% from cities with less than 100 000 inhabitants, and 20% from metropolitan areas (more than 100 000 inhabitants). Most of respondents had higher education, namely 35% were undergraduates and 22% had the master's degree. The number of 34% of respondents had secondary education, 7% had basic vocational education, 2% received basic education. Most of respondents declared that their financial situation was good (47%) or average (also 47%). Only 4% of respondents said that their financial situation was very good and 2% that it was bad. More than half of respondents (56%) worked in non-medical fields, 22% were students of non-medical universities, 17% of respondents were students of medical universities, and the remaining 5% were healthcare professionals.

As many as 77% of respondents declared that they had attended a first aid course, but 21% of them stated that they no

longer remembered the knowledge acquired. The remaining 23% of respondents declared that they have never attended a first aid course. When it comes to 12% of respondents, they admitted to have given first aid at the scene of an accident or in another emergency situation. Only 38% of respondents stated that they knew the “AED” abbreviation, whereas 62% had never encountered this abbreviation and they did not know what it meant (results presented in Figure 2).

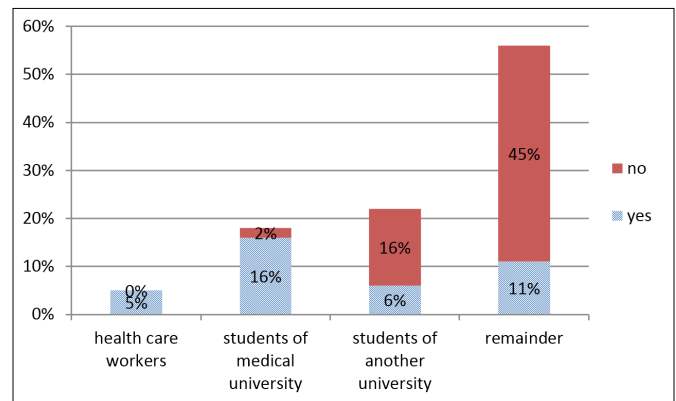


FIGURE 2. Declaration of respondents concerning their knowledge of what an AED is.

Most of respondents (44%) did not know if an automated external defibrillator is a device available to general public, 28% thought it is not and the same number of respondents (28%) considered the AED available to general public. The detailed results are presented in Figure 3.

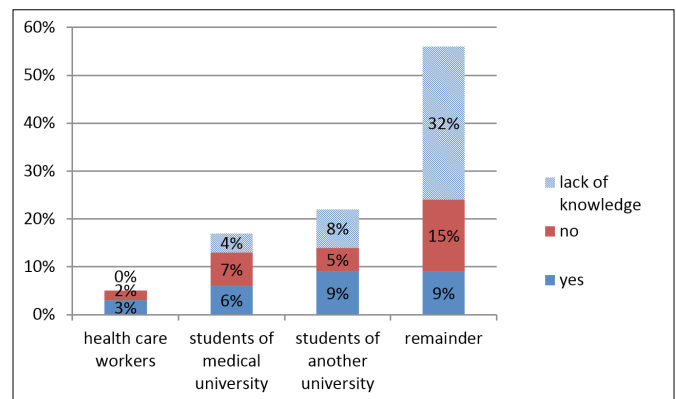


FIGURE 3. Answers to the question if the AED is a public device and the respondents' opinions.

The majority of respondents (67%) believed AEDs to be devices placed in healthcare facilities, 52% thought that they are deployed in public areas (shopping malls, airports, etc.) and 47% believed they are placed in state institutions (offices, courts, police stations, medical universities, etc.). The least popular answer was – in every building next to the fire extinguisher (7%). When it comes to 11% of respondents, they admitted that they did not know the answer. On the basis of the previous respondents' answers, it can be concluded that the respondents who decided to indicate the location of AEDs must have guessed the answer, as most of them were declaring not to know the AED abbreviation and not to have encountered it before.

Next, the respondents were asked to specify the number of AEDs that they were able to locate in their place of residence/work/education. Only 9% of respondents said that they were

able to locate from 3 to 5 AEDs, whereas 22% could name the location of 1-2 AEDs. As many as 59% could not locate even one AED in their neighbourhood.

The next question verified the opinions of respondents concerning the procedures while using an AED. The number of 66% of respondents would step away from the victim and would not touch the victim. They would also instruct the other bystanders to stand clear, when the AED analyses the heart rhythm of the victim. When it comes to 23% of respondents, they would provide cardiopulmonary resuscitation at the time, and 10% would hold the victim.

When asked who is authorised to use an AED to provide defibrillation, the respondents replied as follows: a doctor – 75%; a paramedic – 76%; a person after an appropriate course – 59%; everyone – 35%, and every healthcare professional – 33%. Only 3% of respondents admitted that they did not know the answer.

The next multiple choice question checked the respondents' knowledge of when to stop cardiopulmonary resuscitation. After the analysis of the obtained data it can be observed that the majority of respondents (81%) replied „until the emergency services arrives”, 70% “until the victim regains consciousness”, 47% “until the AED starts to analyse the heart rhythm again”. Only 1% of respondents thought that CPR should be carried on for maximum 10 minutes. The next question was related with the safety of AEDs. The vast majority of respondents considered the AED as safe if the instructions given by the device are followed. This answer was given by 71% of respondents. When it comes to 26% of respondents, they declared that AEDs are completely safe, only 3% thought that using the AED can be dangerous for the person giving first aid to the victim and that is why the AED should only be used by authorised persons. When asked if using an AED could worsen the health state of the victim, almost half of respondents (47%) admitted not to have any knowledge in this area, also 47% of respondents stated that using an automated external defibrillator could not worsen the health state of the victim, and 6% were of the opinion that using an AED could negatively influence the health state of the victim. According to 82% of respondents, using the AED is not complicated, as the device gives instructions, whereas 18% of respondents thought that using the AED is complicated, because it requires the knowledge of what to do and in what order. As many as 66% of respondents thought that after delivering an electric shock to the heart, 30 chest compressions before 2 rescue breaths should be provided immediately, 22% thought that the rescuer should wait and see what happens, 8% would start resuscitation applying the ratio of 15:2, and 5% would put the victim into recovery position.

## DISCUSSION

The results of the authors' own research showed that the majority of respondents (77%) had attended a first aid course, but only 38% of them identified the AED sign. Moreover, a significant number of respondents stated that they no longer remembered the knowledge acquired. It is alarming, especially taking into consideration the fact that the sample group consisted mostly of very young people (85% were people aged between 18-35). It is surprising that as many as 23% of respondents have not attended any first aid course. There are many opportunities to take part in such course (even many times), for example, at school (first aid course being a part

of school subject “safety education”), during a driving licence course or mandatory OHS training at work. First aid demonstrations with the possibility to obtain quick training are frequently provided at various types of cultural events, open days and other events, so it is really shocking that such a numerous group of respondents has never had a first aid training. According to the results of the research of D. Olejniczak, D. Miciuk and U. Religioni [19], as well as of the analysis of E. Chemperek et al. [20], the knowledge of the right number of rescue breaths and chest compressions is quite common in the society. The authors' own research also showed that most of respondents knew the correct sequence which included providing 30 compressions before 2 rescue breaths, but only 56% of respondents declared that they had knowledge of how to provide first aid, and this result is unsatisfactory. Similar results were obtained by other authors measuring the level of knowledge in the field of first aid. P. Musiał et al. came to the conclusion that the inhabitants of Cracow and Kielce had unsatisfactory level of knowledge and that there was a great need to implement a system of teaching first aid according to international standards [21]. To the same conclusions came K. Strzyżewska et al., who measured the level of knowledge of students in the Tricity agglomeration [22] and A. Wojczyk who researched the knowledge of students of nursing in the field of cardiopulmonary resuscitation [23]. In the authors' own research 63% of respondents did not know what the AED is, but after the analysis of the answers concerning, for example, how to proceed after the delivery of the shock, it was observed that most of respondents intuitively gave the correct answer. It can be presumed that the correct answers can result from various information campaigns in mass media or they can be related with watching medical dramas and/or films. Furthermore, as many as 97% of respondents considered the AED safe for the user, whereas only 47% knew that it is also safe for the victim. In Poland, like in other highly developed countries, the number of automated external defibrillators is constantly growing. They are being deployed, for example, in trains, at railway stations, in churches, sports venues, catering and entertainment facilities and in various other places [24, 26]. Unfortunately, as the authors' own research and that of the other authors showed, the public awareness of what these devices really are, where to find them or how to use them, is still low and therefore, continuing education in this area needs to be provided. A significant percentage (approximately 60%) of respondents were not able to name the location of even one AED in their neighbourhood. Considering this result, it can be concluded that in Poland there are still not enough places with automatic external defibrillators available. Fortunately, their number is constantly growing, but it should be combined with the promotion and trainings in the field of using these devices. Also A. Cacko et al. came to the conclusion that the number of AEDs should be increased and demonstrations/trainings should be organised to teach how to use these devices [27].

## CONCLUSIONS

The availability of AEDs and the knowledge of their use are insufficient. The low social awareness and unjustified fear of using AEDs (the fear of worsening the health of the victim) support the need for continuing education in this area.



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