

AED Education: A Dilemma for Public Health and a Challenge for Critical Care Specialists

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Abstract

Objective: The proper management of out-of-hospital cardiac arrests (OHCA) includes proper CPR and early defibrillation with a public access AED (automated external defibrillator). However, the general public is largely ignorant of their role in OHCA. This behavior has resulted in only a minority of OHCA patients being successfully resuscitated and leaving the hospital neurologically intact. One particularly revealing study demonstrated that American college students not only were hesitant to employ an AED, they did not even know its location within their own campus. The purpose of this study was to ascertain whether this was true even among healthcare students in a healthcare academic environment.

Method: A local university population of students and faculty in nursing, medicine, public health, physician assistant, pharmacy, and biological sciences completed a survey which included not only the AED training and knowledge aspects, but also whether or not they knew the location of the nearest AED. A total of 553 participants (532 students and 21 faculty) agreed to participate and completed the anonymous IRB-approved survey.

Results: Of those that completed the survey, 89.5% received AED training, 55.3% within the prior twelve months. However, only 110 of those who received AED/CPR education (19.9%) knew the location of the AED in the building where they received the majority of their education. This lack of knowledge crossed all the disciplines. It ranged from as low as 17.5% for medical students up to 22.5% for PA students. These data reached statistical significance.

Conclusion: Health professionals and the general public need to know not only how to use an AED but where the nearest one is located to actually save lives in the pre-hospital environment. Critical care specialists and intensivists are advised to work with the local public health infrastructure to ensure that AED/CPR training includes empowering the trainees to actively seek out AED locations at the more popular public venues in a community. Knowledge of CPR and defibrillator training alone are useless if the individual cannot find the device in a timely manner.

Keywords: AED (Automated external defibrillator); Public health; Critical care

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Introduction

Up to 420,000 out-of-hospital-cardiac arrests (OHCA) occur in the United States annually [1, 2]. Studies have indicated that the sooner civilian first responders recognize an arrest state, initiate a 911 call, begin compressions, and employ an AED, the more

likely the victim will survive neurologically intact [3, 4]. Yet, on a granular level, this is not a common development. For example, one university study revealed that a majority of students not only did not know how to employ an AED, they were not able to locate one on campus [5]. We hypothesize that civilians may be assuming that it is the responsibility of others to locate, retrieve,

and administer a public access AED when there is a cardiac arrest. Dependence upon another's intelligence and level of training may be foolhardy given that minutes wasted can translate into cellular damage and/or death. Our objective was to determine whether healthcare students who have received CPR and AED education, also know where the AED is located at their usual venue of study on campus.

Method

An IRB-approved study was initiated in which 532 healthcare students agreed to participate in an anonymous survey (medical: 114; nursing: 275; PA: 40; public health: 66; pharmacy: 31; other: 5). The survey queried them about their area of study, their AED/CPR training, and the location of the AED in their primary educational venue should they be faced with a cardiac arrest victim. Frequencies were tabulated for each survey question and statistical significance was determined with Pearson's chi-square test – used to evaluate how likely any observed difference in frequency, compared to the expected frequencies, were due to chance. Statistical significance was determined with the alpha of 0.05 as the cut-point.

Results

A total of 553 individuals, 532 students and 21 faculty, completed the survey (Table 1). Most participants had received prior AED training (89.5%) and had this training within the past year (Table 2). However, only 110 participants (19.9%) knew where the AED was located in their primary class or workplace building. A statistically significant association was found between having been trained to use an AED and knowing where the AED was located (chi-square=8.896, df=1, p=0.01) (Table 3). Fewer year-one students but more year-two students knew where the AED was located in their primary building than expected (chi-square=8.556, df=3, p=0.04). Multivariate linear regression analysis indicated the lone statistically significant predictor of knowledge of the nearest AED was gender (p=0.01). No other variables were found to be confounders. Males (24.5%) were more likely to know the location of the nearest AED compared to females (18.1%) (Table 4). The majority of participants (92.9%) reported knowing how

Table 1 Demographic information of study sample.

Student	N	%	Student Year	N	%
Medical	114	21.4	First	213	40.0
Nursing	275	51.7	Second	182	34.2
Physician Assistant	40	7.5	Third	46	8.7
Public Health	66	12.4	Fourth	91	17.1
Pharmacy	32	6.0			
Doctoral	1	0.2	Gender		
Biological Sciences	3	0.6	Female	394	71.2
Medical/Public Health	1	0.2	Male	159	28.8
Total	532				
Faculty					
Medical	8	38.1			
Nursing	8	38.1			
Public Health	5	23.8			
Total	21				

Table 2 Responses to selected survey questions.

Question	N	%
Did you ever receive training on the use of the AED?		
Yes	495	89.5
No	55	10.0
I don't know	3	0.5
Do you know where the closest AED is located?		
Yes	110	19.9
No	442	79.9
Missing	1	0.2
How long ago was your AED training?		
Within one year	306	55.3
One to five years	185	33.5
Six to ten years	3	0.5
More than ten years	1	0.2
Missing	58	10.5
Do you know how to properly perform cardiac compressions?		
Yes	514	92.9
No	23	4.2
I don't know	12	2.2
Missing	4	0.7
Were you ever taught how to perform cardiac compressions?		
Yes	527	95.3
No	18	3.3
I don't know	7	1.3
Missing	1	0.2

Table 3 Previous AED training and knowledge of AED location.

Did you ever receive training on the use of the AED?	Do you know where the closest AED is located?	
	Yes	No
Yes—Observed Count	107	387
Yes—Expected Count	98.4	395.6
No—Observed Count	3	52
No—Expected Count	11.0	44.0
Pearson chi-square=8.896, df=1, p=0.01		

Table 4 Gender and Knowledge of AED Location.

Gender	Do you know where the closest AED is located?	
	Yes	No
Male—Observed Count	39	120
Male—Expected Count	31.7	127.3
Female—Observed Count	71	322
Female—Expected Count	78.3	314.7
Pearson chi-square=2.963, df=1, p=0.08		

to perform chest compressions. Most had received CPR training within the past year (60.4%) and all but six percent had received training with the past five years. Knowledge of AED location by student discipline ranged from as low as 17.5% for medical students to as high as 22.5% for physician assistant students.

Discussion

“Time is muscle” is the mantra of cardiac arrests and return of spontaneous circulation. The earlier a fibrillating myocardium receives efficacious compressions followed by defibrillation, the greater the likelihood the patient will survive with fewer complications and sequelae. Based on American and European guidelines [2], the rapid succession measures that should be instituted immediately in an OHCA are:

1. Recognize that a cardiac arrest has occurred;
2. Call 911 or equivalent;
3. Perform CPR;
4. Defibrillate.

And yet, in a multidisciplinary healthcare and academic community, approximately 80% of the study population declared they had no knowledge of the location of the AED within the building where they received the majority of their education. This was a consistent finding across all the healthcare disciplines. Even the faculty had similar results although the data did not reach statistical significance due to faculty sample size.

These results serve to underscore the *laissez-faire* factor that seems to exist for OHCA [6]. Despite ongoing research indicating that early bystander CPR and defibrillation result in improved survival scores with less neurological dysfunction, the message does not appear to be reaching healthcare students and faculty, nor the general public. Now, we are learning that even within healthcare academia, the message is somewhat obfuscated. Though many in our study had received prior CPR and AED training, few knew the location of the AED in their building. Thus, the intensity of their training may be insufficient. Have they been taught to assume that when confronted with an OHCA someone would automatically be available who would know the location of the closest public-access AED? There are too many confounding variables upon which to rely on this assumption including but not limited to: 1) type of public setting; 2) time of day; 3) day of the week; 4) staff presence; 5) level of training of the staff; 6) re-education schedule; and 7) staff commitment. The precious seconds and minutes spent searching for the device can literally be the difference between life and death.

These results should serve as an alarm to healthcare facilities in general to develop an Interprofessional Educational Quality Assurance Board to monitor, assess, and remediate any external educational programs that they provide for their students. That type of Board would be best served with the inclusion of emergency, intensivists, and critical care specialists. With regards to AED training, this type of committee may expertly advise the following modifications:

1. Make CPR/AED training interprofessional;
2. Mandate that AED education commences at the beginning of any student curriculum, followed by a review near the end of their program.
3. Emphasize that the interprofessional students be taught not

only how to use AEDs, but where they are located on campus and at other public venues.

4. Advocate for the placement of public-access AEDs at a common location in all buildings on campus and possibly elsewhere.
5. Advocate that AED locations be identified with appropriately obtrusive signage.

In the meantime, a crowdsourcing tournament, the MyHeart Map Challenge, demonstrated that valuable information, including mapping the location of AEDs, was possible through public engagement and social media [7]. This endeavor would be useful for universities, particularly those with hospitals, to engage their students, faculty, staff, and healthcare providers and gather information for everyone to use. Additionally, training members of the general public in CPR and AED use has proven to be helpful in improving survival when actual incidents occur where these services are needed [8, 9]. Linkage of information about location of an OHCA and AED locations to mobile phones or EMS dispatch has been advocated [10]. The technology exists to both map the location of AEDs in communities and to locate individuals through global positioning system (GPS) on phones and other devices.

An additional responsibility for this Board would be to collaborate with emergency medical personnel, fire and rescue, and police to design a community-based system where the closest AED to the caller can be located by the 911 dispatcher and relayed to the caller. The efforts of this Board could be facilitated and enhanced by the recruitment of “care manager” nurses as outlined by Ciccone et al [11]. These care managers serve as a bridge between healthcare provider and patient to evaluate, monitor, educate, and communicate. Properly trained, they could be an important stopgap with regard to CPR/AED training for patient and family. The care manager’s intimate relationship with the client may facilitate the empowerment of both client and family to inquire about the location of public AEDs at frequently-visited venues.

Having an interprofessional board making these recommendations should inherently convey a sense of gravitas to the issues at hand. In the meantime, AED trainers should emphasize to students that prior knowledge of public-access AED locations is important and each student should be empowered to look for or inquire about AED locations at public venues that they frequent.

Limitations

A study limitation is that our results emanate solely from one medical educational venue. Results may be different at other schools of higher learning. However, we believe that possibility is unlikely. That belief is supported by a recent study involving 267 undergraduate and graduate students at a private university among whom only 18% knew their student union had an AED and only 2% could recall the precise location in the building [5].

Further, as the data were collected via survey as a self-report, there was no attempt to evaluate student and faculty competency in utilizing an AED. Thus, we cannot be sure that what they reported in the survey is completely accurate. However, that was not the focus of the research. Regardless of how competent or

incompetent a healthcare student is with regard to AEDs, the issue is moot if they cannot locate an AED or tell a bystander where to retrieve one. At one medical educational institution, while the vast majority of healthcare students received CPR and AED education, most had no idea of the location of the closest AED at the venue where they received the majority of their medical education. We therefore propose that AED education should begin with advising the learner to seek out the closest AED when entering or visiting an unfamiliar location so as to save time when time is precious should a person collapse.

Conclusion

With sufficient motivation from local public health authorities, the health care infrastructure, and critical care specialists, in

particular, there may come a time when communities universally find it feasible to create high-tech linkages between civilian responders and 911. Then, there may not be a pressing need for the casual bystander to know the exact location of the AED. However, until that time comes, we must keep in mind that survival rates for OHCA remain less than 6% [6]. The purpose of the AED is defeated if students, professionals, and others who are trained to use the device cannot locate the nearest device in the event of a cardiac arrest, particularly one that occurs in a non-hospital setting. We believe that an Interprofessional Quality Assurance Educational Board would, by its very nature, influence not only proper AED education for its multidisciplinary healthcare students, but also influence appropriate OHCA preparedness and response activities in the community.

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