Willingness of High School Students to Perform Cardiopulmonary Resuscitation and Automated External Defibrillation

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Abstract

Objective. To evaluate the willingness of high school students to perform cardiopulmonary resuscitation (CPR) and automated external defibrillation (AED). **Methods**. A convenience sample of high school students was surveyed regarding how they would respond if they witnessed a cardiac arrest. Participants were first shown a video segment on the operation of an automated external defibrillator. They were then shown a series of video clips depicting six different cardiac arrest scenarios: motor vehicle collision (MVC) with facial bleeding, pediatric drowning, intravenous (IV) drug user, choking family member, victim of differing race, and victim with facial vomitus. Following each video, the subjects were asked how they would respond had they actually witnessed a similar event. **Results**. With parental permission and institutional review board approval, 683 students participated, representing 6.8% of the total student body. Of these, 585 (86%) were trained in CPR and 142 (21%) in AED. One hundred six participants (16%) had witnessed a cardiac arrest prior to the survey. Of these, 24 (23%) had intervened in some way. Twenty (19%) had performed mouth-to-mouth resuscitation (MMR), 15 (14%) had performed chest compressions (CC), and one (0.9%) had performed AED. Across all six mock scenarios and all 683 respondents collectively (4,098 simulated cardiac arrest events), the respondents indicated they would be willing to perform AED 1,308 times (32%). In comparison, the respondents indicated they would be willing to perform MMR 1,768 times (43%) and CC 2,249 times (55%). More respondents were willing to intervene on behalf of a child or family member, while fewer were willing to act in the setting of blood, vomitus, or an IV drug user ($p < 0.05$). There was no association between willingness to intervene and prior experience with any of the interventions. Fear of infection, legal consequences, and fear of harming the patient were the most frequently cited reasons for not intervening. **Conclusions**. Among high school students, few are willing to perform automated external defibrillation. Willingness to perform MMR and CC appears to depend on the circumstances. **Key words**: defibrillation; public-access defibrillation; cardiac arrest; cardiopulmonary resuscitation; automated external defibrillator; mouth-to-mouth resuscitation.

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Cardiovascular disease is the leading cause of death in the United States, resulting in nearly 1 million deaths annually, with 300,000–400,000 of these being sudden cardiac death.[1,2] During the past 20 years, morbidity and mortality rates for cardiovascular disease have declined, yet there has been little improvement in the incidence or outcome after sudden cardiac arrest.[3] Approximately 600–1,000 Americans continue to experience sudden cardiac arrest each day.[4,5] Of these arrests, most occur outside the hospital and, historically, resuscitation rates have been relatively poor. Only 1%–5% of these patients are expected to survive to hospital discharge.[6,7] Survival from sudden cardiac death has been linked to presenting cardiac rhythm, bystander cardiopulmonary resuscitation (CPR), early defibrillation, and early access to advanced life support care.[8,9,10]

In an effort to improve survivability from sudden cardiac death, the American Heart Association (AHA) has promoted the "chain of survival" concept.[11] The links of the chain include early access to 911, bystander CPR, early defibrillation, and rapid definitive care. Of these, CPR and defibrillation have emerged as the most important interventions.[12, 13] However, reports indicate that only one in four witnessed arrests actually receive bystander CPR.[8, 14] Still fewer receive bystander CPR under certain circumstances, such as when the arrest involves a family member or there exists differing ethnic backgrounds between the victim and the would-be rescuer.[15, 16] In addition, many communities experience delays in defibrillation due to prolonged EMS response times.

To address these problems, the AHA has aggressively pursued CPR training of the masses and, more recently, promoted the concept of public-access defib-

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TABLE 1. Description of the Video Scenarios

Scenario	Description
Trauma	You witness a motor vehicle crash in which a small car has struck a telephone pole. Upon approaching the car, you notice the driver is unconscious and not breathing. He has a head wound that is bleeding. Blood is covering his face.
Child	While at the public swimming pool, you notice a nearby commotion. Upon investigating, you notice that an 8-year-old child has been pulled from the water. She does not appear to be breathing.
Intravenous drug user	After leaving the theater, a man approaches you from a side alley. He states that his friend has been using intravenous drugs and may have overdosed. He asks you to help his friend whom you find in cardiac arrest.
Choking family member	While eating at a restaurant with your family, you notice your uncle choking on food. After a moment, he collapses to the floor. When you reach him, you notice he is unconscious and not breathing.
Differing race	A Middle Eastern exchange student in your class collapses. He is pulseless and not breathing.
Vomitus	While at the library, you notice the librarian grab his chest and collapse. Upon closer examination, you notice that he is unconscious and there is a pool of vomitus by his head and partially covering his face. You check his pulse and find none.

rillation (PAD), whereby defibrillation is provided by untrained or minimally trained bystanders using defibrillators located in public places.[12] However, to be successful, both of these strategies rely on the willingness of the public to perform CPR and defibrillation. The purpose of this study was to determine the circumstances under which one segment of the population, high school students, would be willing to perform CPR and defibrillation.

METHODS

We developed a 35-item survey to assess the willingness of respondents to perform CPR and automated external defibrillation (AED). With permission of our institutional review board, the survey was presented to a convenience sample of students attending ten high schools located in three North Carolina counties. The survey was administered during a regularly scheduled class. Prior written consent was obtained from the parents of the respondents.

The participants were first shown a brief video on the operation of an automated external defibrillator. They were then shown a series of six video clips, each depicting a different cardiac arrest scenario (Table 1). The videos were shot from a "point-of-view" perspective such that the viewer had the sense of actually being at the scene. Furthermore, from the videos it was abundantly clear that CPR, and possibly AED, were indicated, and that no other person at the scene was trained, or willing, to intervene. Immediately following each video clip, the respondents were presented with a series of questions that asked how they would respond had they actually witnessed a similar event.

Statistical analysis was performed using SPSS 6.1 (Chicago, IL). Frequency data were analyzed using the chi-square statistic, Fisher's exact test, or Cochrane Q statistic as appropriate. Alpha was set at 0.05.

RESULTS

With parental permission, 683 students participated in the study, representing 6.8% of the total student body. Characteristics of the sample are given in Table 2. Of the respondents, 585 (85.7%) were trained in CPR and 142 (20.8%) had received prior training in AED. One hundred six participants (15.5%) had witnessed an actual cardiac arrest prior to the survey. Of these, 24 (22.6%) had intervened in some way. Twenty (18.9%) had performed mouth-to-mouth resuscitation (MMR), 15 (14.2%) had performed chest compressions (CC), and one (0.9%) had performed AED. The remaining 82 (77.4%) had not provided any emergency intervention.

Across all six scenarios and all 683 respondents collectively (4,098 simulated cardiac arrest events), the respondents indicated they would be willing to perform AED 1,308 times (31.96%). In comparison, respondents indicated they would be willing to perform MMR 1,768 times (43.33%) and CC 2,249 times (54.96%). There was no difference between those participants planning to enter a health career and those planning to pursue non-health-related careers in their willingness to perform MMR ($p = 0.243$), CC ($p = 0.086$), or AED ($p = 0.175$). Participants who had previously witnessed a cardiac arrest were no more willing to perform MMR ($p = 0.965$), CC ($p = 0.646$), or AED ($p = 0.833$) than those who had not previously witnessed a cardiac arrest. Of the 585 participants who had received CPR training, 503 (85.9%) were willing to perform CC in at least one of the scenarios, compared with 68 of the 94 (72.3%) who had not received CPR training ($p = 0.001$). The participants who had received CPR training were no more likely to perform MMR than those without CPR training ($p = 0.192$). Similarly, those who had received prior training in AED were no more willing to perform AED than those who had not received prior training ($p = 0.568$).

Table 2. Demographic Characteristics of the Study Sample

	Frequency	Percent of Sample
Race		
White	509	74.63
African American	107	15.69
Hispanic	19	2.79
Middle Eastern	1	0.15
Other	46	6.74
Missing	1	0.15
Gender		
Male	317	46.41
Female	364	53.29
Age		
13 years	1	0.1
14 years	183	26.8
15 years	338	49.5
16 years	85	12.4
17 years	42	6.1
18 years	29	4.2
19 years	4	0.6
Missing	1	0.1
Grade		
9	549	80.4
10	52	7.6
11	48	7.0
12	32	4.7
Missing	2	0.2
Plan to enter health profession		
No	458	67.1
Yes	225	32.9

Overall, the respondents were more willing to perform CC (54.9%) when compared with the other interventions, but their willingness varied considerably across the scenarios ($p = 0.000$) (Table 3). The respondents were most willing to perform CC on a choking family member (74.34%) and least willing to intervene on behalf of the intravenous (IV) drug user (34.31%).

The respondents indicated they would perform MMR in 43.3% of the scenarios, but that, too, varied considerably across the scenarios ($p = 0.000$) (Table 4). The respondents indicated they would perform MMR in 74.6% of cases of the drowning child scenario, but that fell to a low of 15.7% of cases of the IV drug user scenario.

Willingness to perform AED was the lowest among the three interventions. Overall, the respondents were willing to perform AED in 31.9% of the cases. However, as with MMR and CC, willingness varied according to the situation ($p = 0.000$) (Table 5). As with MMR and CC, the respondents were least willing to intervene on behalf of the IV drug user. Only 176 (25.8%) of the respondents were willing to perform AED on the IV drug user. The respondents were most likely to perform AED on a family member. However, this was only 39.0% of cases.

Across all scenarios and respondents, when asked why they would be unwilling or hesitant in performing MMR, the most often cited reason was fear of infection (34.8%), followed by fear of injuring the patient (24.7%) (Table 6). When asked the same question concerning CC, the most frequent response was fear of injuring the patient (24.7%), followed by fear of legal consequences (13.0%) and fear of infection (11.6%). In the case of AED, fear of injuring the patient (31.2%) and fear of legal consequences (16.9%) were the most frequent responses.

Discussion

Bystander CPR is an important link in the chain of survival. Numerous studies have shown an improved outcome when CPR is started by a witness to the event.[17-21] More recent studies indicate that outcome is further improved if defibrillation is also provided prior to the arrival of emergency medical services and definitive care.[22-24] Unfortunately, several investigations have identified a reluctance of bystanders, including off-duty medical personnel, to intervene after witnessing a cardiac arrest.[25-28] Our findings parallel these previous studies, and in addition, we have identified a reluctance of high school students to perform AED. Previous studies noted that bystanders were more reluctant to perform MMR than CC. We too observed this trend, but, surprisingly, we also observed our study sample to be more willing to perform MMR than AED.

The AHA has devoted considerable resources to training the public in CPR and, more recently, PAD. However, despite the fact that nearly 86% of our study respondents had received training in CPR, a disappointingly small proportion of them indicated a willingness to perform CPR. Even more disturbing is the limited number of respondents willing to perform AED, especially among those with prior AED training.

Consistent with previous studies, we found the willingness of our participants to intervene highly dependent upon the circumstances of the arrest and the relationship between the victim and the would-be rescuer. Although these facets of out-of-hospital cardiac arrest are beyond the control of planners of community emergency response, it is apparent that CPR and AED training should address these issues. For example, fear of infection was a frequently cited reason for failure to intervene. Perhaps a greater emphasis on the use of barrier devices and limited risk of disease transmission may improve bystander response. In addition, our findings suggest a considerable degree of concern for harming the patient when performing CPR or AED. While iatrogenic injury is an occasional consequence of CPR, it occurs rarely, and even then, the injury poses a lesser threat to life than delayed CPR.[29] Furthermore, automated external defibrillators have been shown to be extremely reliable, thus limiting the risk of injury to the user or the patient. These points should receive greater emphasis in public CPR classes. A final concern

TABLE 3. Willingness to Perform Cardiac Compressions

		Would Perform Compressions		Would Not Perform Compressions	
Video	Scenario	Frequency (*n*)	Percent	Frequency (*n*)	Percent
1	Motor vehicle collision with blood	287	42.08%	395	57.92%
2	Child drowning	473	69.35%	209	30.65%
3	Intravenous drug user	234	34.31%	448	65.69%
4	Family member choking	507	74.34%	175	25.66%
5	Differing race	420	61.58%	262	38.42%
6	Vomitus present	328	48.09%	354	51.91%
	TOTAL	2,249	54.96%	1,843	45.04%

TABLE 4. Willingness to Perform Mouth-to-mouth Resuscitation

		Would Perform Mouth-to-mouth		Would Not Perform Mouth-to-mouth	
Video	Scenario	Frequency (*n*)	Percent	Frequency (*n*)	Percent
1	Motor vehicle collision with blood	206	30.29%	474	69.71%
2	Child drowning	507	74.56%	173	25.44%
3	Intravenous drug user	107	15.74%	573	84.26%
4	Family member choking	468	68.82%	212	31.18%
5	Differing race	338	49.71%	342	50.29%
6	Vomitus present	142	20.88%	538	79.12%
	TOTAL	1,768	43.33%	2,312	56.67%

TABLE 5. Willingness to Perform Automated External Defibrillation (AED)

		Would Use AED		Would Not Use AED	
Video	Scenario	Frequency (*n*)	Percent	Frequency (*n*)	Percent
1	Motor vehicle collision with blood	186	27.27%	496	72.73%
2	Child drowning	208	30.50%	474	69.50%
3	Intravenous drug user	176	25.81%	506	74.19%
4	Family member choking	266	39.00%	416	61.00%
5	Differing race	250	36.66%	432	63.34%
6	Vomitus present	222	32.55%	460	67.45%
	TOTAL	1,308	31.96%	2,784	68.04%

of our respondents was fear of legal liability. This, too, can be ameliorated through greater focus on Good Samaritan legislation during CPR training and, especially, AED training.

While our findings cannot be generalized to other segments of the population, they do raise concern regarding the concept of PAD by untrained bystanders (defined as Level 4 PAD by the AHA). Previous studies have demonstrated the cost–effectiveness of PAD by minimally trained responders, such as police and firefighters.[30,31] However, the cost–effectiveness of PAD by untrained bystanders has not been fully investigated. Our concern with implementation of PAD programs for untrained laypersons is the underlying assumption that the mere purchase and public display of automated external defibrillators will ensure their use. If other segments of the population are as equally reluctant to perform external defibrillation as our study subjects, both effectiveness and cost–effectiveness of Level 4 PAD (programs that rely upon widespread dispersal of automated external defibrillators and layperson intervention) are substantially reduced. Further research into the willingness of other population segments to perform AED is needed before substantial investment is made into layperson PAD programs. Until then, investment into PAD programs should target settings where dedicated responders can be identified and trained, such as nursing homes, shopping malls, sports arenas, and airports, as well as first-responder programs such as police, fire, and rescue agencies.

LIMITATIONS

Our study has several limitations. As a surrogate to observing actual behaviors during a true cardiac arrest event, we surveyed how our participants perceived they would react upon witnessing a simulated cardiac arrest. Participants may be more or less forthcoming during an actual event. Furthermore, our convenience sample was limited to high schools located in three North Carolina counties and does not represent a ran-

TABLE 6. Reasons for Not Intervening

	Mouth-to-mouth		Automated External Defibrillation		Chest Compressions	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Fear of harming others	178	4.34%	312	7.62%	172	4.20%
Fear of infection	1,428	34.88%	432	10.54%	476	11.62%
Belief that one should not interfere with a natural death	160	3.91%	159	3.88%	160	3.91%
Fear of legal consequences	675	16.48%	693	16.92%	535	13.06%
Fear of injuring the patient	1,014	24.75%	1,281	31.27%	1,014	24.75%
Fear of injury to self	299	7.30%	391	9.54%	243	5.93%

dom sample of high school students, nor does it represent the general population. The sample was predominantly ninth graders whose maturity level and lack of AED training may have biased our results.

In administering our survey, we asked the respondents to assume that no one else at the scene was willing to perform CPR or AED. These conditions should lead more respondents to indicate they would intervene than would be the case if they believed someone else at the scene may be trained and willing to intervene. An additional source of bias might also be present in the scenario involving the Middle Eastern exchange student. This scenario was designed to assess the willingness of respondents to cross cultural and racial barriers. However, the scenario presented the student as a "friend" of the survey participant rather than a stranger. This presentation may have upwardly biased the willingness of participants to intervene, reflecting a willingness to intervene on behalf of an acquaintance rather than a victim of a differing race.

Despite these limitations inherent in our sample and methods, we believe the data are valid, are congruent with findings of similar studies, and point to the need for further efforts at improving bystander response in the setting of cardiac arrest.

CONCLUSION

Our survey found that high school students were generally unwilling to intervene on behalf of victims of cardiac arrest. They indicated a greater willingness to perform chest compressions than mouth-to-mouth resuscitation or use an automated external defibrillator. In addition, willingness to intervene was influenced by the circumstances of the arrest as well as the relationship to the victim. Our findings suggest that considerable work remains before this segment of the population can be considered a reliable source of medical intervention at the scene of a cardiac arrest. Additional research is warranted to quantify the willingness of other segments of the general population to intervene on behalf of victims of out-of-hospital cardiac arrest. Such research is necessary to fully evaluate the potential cost–effectiveness of Level 4 public-access defibrillation.

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