

Community involvement in out of hospital cardiac arrest

A cross-sectional study assessing cardiopulmonary resuscitation awareness and barriers among the Lebanese youth

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Abstract

Out of hospital cardiac arrest (OHCA) is a leading cause of death worldwide. Developing countries including Lebanon report low survival rates and poor neurologic outcomes in affected victims. Community involvement through early recognition and bystander cardiopulmonary resuscitation (CPR) can improve OHCA survival.

This study assesses knowledge and attitude of university students in Lebanon and identifies potential barriers and facilitators to learning and performing CPR.

A cross-sectional survey was administered to university students. The questionnaire included questions regarding the following data elements: demographics, knowledge, and awareness about sudden cardiac arrest, CPR, automated external defibrillator (AED) use, prior CPR and AED training, ability to perform CPR or use AED, barriers to performing/learning CPR/AED, and preferred location for attending CPR/AED courses. Descriptive analysis followed by multivariate analysis was carried out to identify predictors and barriers to learning and performing CPR.

A total of 948 students completed the survey. Participants' mean age was 20.1 (± 2.1) years with 53.1% women. Less than half of participants (42.9%) were able to identify all the presenting signs of cardiac arrest. Only 33.7% of participants felt able to perform CPR when witnessing a cardiac arrest. Fewer participants (20.3%) reported receiving previous CPR training. Several perceived barriers to learning and performing CPR were also reported. Significant predictors of willingness to perform CPR when faced with a cardiac arrest were: earning higher income, previous CPR training and feeling confident in one's ability to apply an AED, or perform CPR. Lacking enough expertise in performing CPR was a significant barrier to willingness to perform CPR.

University students in Lebanon are familiar with the symptoms of cardiac arrest, however, they are not well trained in CPR and lack confidence to perform it. The attitude towards the importance of bystander CPR and the need to learn CPR is very positive. Interventions should focus on public awareness campaigns regarding the importance of initiating bystander CPR while activating emergency medical services (EMS) and on making CPR training more available.

Abbreviations: AED = automated external defibrillator, CPR = cardiopulmonary resuscitation, EMS = emergency medical services, OHCA = out of hospital cardiac arrest.

Keywords: awareness, cardiac arrest, community, Lebanon, resuscitation

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1. Introduction

Cardiac arrest is a leading cause of death in the United States and worldwide with a large variation in survival rates between different communities.^[1,2] Early recognition of cardiac arrest and bystander cardiopulmonary resuscitation (CPR) have been shown to improve survival.^[3] Inside the United States, extensive efforts and funds have been channeled towards improving bystander CPR rates and out of hospital cardiac arrest (OHCA) survival in different communities and towards identifying and addressing barriers to early help in the event of a cardiac arrest. Numerous interventions have also been deployed to increase public awareness and community involvement including but not limited to bystander CPR and automated external defibrillator (AED) use learning programs and public access defibrillators deployment. These efforts and interventions aim at improving survival in victims of OHCA. Data from Arizona in 2010 showed that a statewide Hands-only CPR public awareness campaign increased bystander CPR rates from 28.2% to 39.9% and improved OHCA survival rate from 3.7% to 9.8%.^[4] In 2008,

the American Heart Association (AHA) released a statement supporting Hands-only CPR with the end goal of increasing the rate of bystander CPR.^[5]

Internationally, several studies from developing countries reported high incidences of OHCA with low survival rates.^[2,6,7] OHCA admissions accounted for 2.4% of all hospital admissions in a study from Doha, Qatar with higher survival rates among patients with witnessed OHCA and bystander CPR.^[8] Another study examined resuscitation practices from different Asian countries (Pan Asian Resuscitation Outcomes Study [PAROS] which included Japan, Singapore, South Korea, Malaysia, Taiwan, Thailand, and UAE-Dubai)^[9]; the majority of arrests occurred at home with bystander CPR rates varying from 10.5% (UAE) to 40.2% (Japan) and overall survival rates ranging from 0.5% to 8.5%.^[9] In Lebanon, OHCA survival to hospital discharge was 5.5% with a shockingly low bystander-CPR rate of 4.2%.^[7] Barriers to performing bystander CPR in more developed countries include deficient knowledge or training, lack of skill confidence, and fear or litigation.^[10] Assessment of the awareness and knowledge of students in Lebanon with regard to cardiac arrest and CPR/AED use is lacking. Younger population is more accessible, keen, and capable of learning newer skills^[11,12] and is more willing to perform CPR.^[13] Additionally, training students could ultimately translate to a wider spread of knowledge about CPR in the whole population.^[14]

This study aims at assessing knowledge and attitude of University students in Lebanon and at identifying potential barriers and facilitators to performing and learning CPR.

2. Setting

Lebanon has a largely diverse population. The last official census in Lebanon dates back to 1932. Recent semi-official estimates of the total population in Lebanon estimate that a total of 6,184,701 people reside in Lebanon, of which 4.6 million are Lebanese with the remaining 1.6 million from neighboring countries (Syria, Palestine, and Iraq).^[15]

The American University of Beirut (AUB) is a private, non-profit organization considered one of the oldest universities in Lebanon and the Middle East. In 2013, the university had 8182 students enrolled, 77% of which were Lebanese.^[16] Despite the relatively high tuition fees, and because of the university's robust financial aid programs, applicants from different socio-economical statuses from all over Lebanon and from neighboring countries are able to enroll at AUB.

3. Methods

A cross-sectional survey was given to students at AUB in the form of self-administered questionnaire. The questionnaire included questions regarding the following data elements: demographics, knowledge and awareness about sudden cardiac arrest, CPR, and AED, prior CPR and AED training, ability to perform CPR or use AED, barriers to performing/learning CPR/AED, and preferred location to attend CPR/AED course. The survey was created initially in English. It was developed using review of the literature and relevant clinical background. The survey was then translated and back-translated into Arabic language by two independent translators, and any discrepancy was resolved through consensus. However, the survey was only administered in English since all AUB students must pass a standardized English test and be proficient in English. The Institutional Review Board at AUB approved this study.

The students were invited to participate in person by trained interviewers. A total of 1037 AUB students were asked in the university to consent to a structured questionnaire. Out of the students who were approached, 948 agreed to participate with a response rate of 91.4%. Data were collected from March 1st, 2015 to June 30th, 2015. We excluded students from the Faculty of Medicine and the Nursing School, as they are familiar with CPR/AED and are required to have basic life support training.

3.1. Sample size

We estimated that the proportion of students who knew about CPR and AED to be very low. A previous unpublished survey from Lebanon found that less than 20% of respondents were familiar with emergency medical numbers. We assumed that about 10% of the population had basic knowledge about CPR and AED with absolute precision of 2%. The required sample size was estimated to be 864 persons (considering the confidence limits to be 95%) and with the addition of 20% for non-response, it turned out to be 1037.

3.2. Statistical analyses

Statistical analyses were performed using SPSS 22 (Armonk, NY: IBM Corp) (Statistical Package for Social Sciences). Categorical variables were tabulated and analyzed using frequency and percentage whereas the continuous variables were summarized as mean and standard deviation.

A multivariate logistic regression was performed to identify predictors of willingness to perform CPR. Backward selection procedure was conducted by fitting the outcome variable (willingness to perform CPR: yes/no) with all risk factors found to be significant in the bivariate level. A *P* value of <0.05 was used to indicate statistical significance.

4. Results

A total of 948 students completed the survey. The mean age was 20.1 ± 2.1, (range, 16–34) years, with 53.1% women and 46.9% men (Table 1).

Table 1
Demographics.

Demographics	Number of participants (N = 948)	%
Age in years (mean [SD], range)	20.1 ((±2.1), 16–34)	
Gender		
Male	433	46.9%
Female	490	53.1%
Level of income (per mo)		
>\$1000	92	14.4%
\$500–\$1000	212	33.2%
<\$500	334	52.4%
Major source of information (more than one option may be selected)		
Internet	809	85%
TV	174	16.4%
Print media	95	8.9%
Radio	25	2.6%
Has a heart condition, or in proximity to someone with a heart condition		
Yes	171	18.2%
No	769	81.8%

SD = standard deviation, TV = television.

Table 2
Familiarity with the term SCA, identifying signs of SCA, and familiarity with and confidence in CPR/AED.

CPR and AED knowledge (N%)		
Sudden cardiac arrest is the same as a heart attack	N	%
False	570	60.90%
True	366	39.10%
Sudden cardiac arrest can happen to all people regardless of age and sex		
False	87	9.30%
True	848	90.70%
What are the signs of sudden cardiac arrest?		
Collapse, fainting	124	13%
Abnormal breathing	126	13.20%
Not responsive	35	3.60%
All of the above	401	42.90%
I don't know	29	3.10%
What to do when you are suspecting sudden cardiac arrest?		
Call 140 or 125 (emergency numbers)	353	37.80%
Perform CPR	64	6.90%
Run away	23	2.50%
Call 140 or 125 and perform CPR	493	52.80%
Familiarity with and confidence in CPR/AED		
Have you ever heard of the term "Hands-only CPR"?		
No	553	59.50%
Yes	376	40.50%
How to perform CPR?		
Push hard and fast in the center of the chest	610	65.30%
Push hard and fast in the center of the abdomen	84	9.00%
Shake the patient to try and wake him/her up	7	0.70%
I don't know	231	24.70%
Push hard and fast in the center of the chest and shake the patient to try and wake him/her up	2	0.20%
Knows what AED stands for		
Yes	316	33.90%
No	617	66.1%
CPR trained		
Yes	190	20.30%
No	747	79.70%
Previous CPR training (number of y)		
Less than 1	10	5.80%
≤5	133	77.80%
>5	28	16.40%
If yes, previous CPR training location?		
School	100	51.30%
University	25	12.80%
At work	9	4.60%
Other	61	31.30%
Feel confident performing CPR		
Yes	309	33.70%
No	609	66.30%
Feel confident using AED		
Yes	147	16.30%
No	757	83.70%

AED = automated external defibrillator, CPR = cardiopulmonary resuscitation, SCA = sudden cardiac arrest.

4.1. Knowledge about cardiac arrest

Most participants differentiated between the terms "Cardiac arrest" and "Heart attack" and the vast majority agreed that cardiac arrest could happen to anyone regardless of age and sex. Less than half of participants were able to identify all the presenting signs of cardiac arrest including collapse or fainting, abnormal breathing, and unresponsiveness (Table 2).

4.2. Bystander CPR/AED use and activation of the emergency response

Over half of respondents identified correctly immediate actions upon recognition of a cardiac arrest including calling 125 or 140 (emergency medical services [EMS] agencies access numbers) and starting CPR. Despite the relative lack of familiarity with the term "Hands-only CPR", most respondents described correctly the recommended CPR technique (Table 2).

Familiarity with the term "AED" and with AED use was not common with only 33.9% recognizing what AED actually stands and 16.3% feeling comfortable and capable of applying an AED to a cardiac arrest patient.

CPR training was also not frequent among the study participants. Only 20.3% of participants reported receiving some sort of CPR training mostly in schools. Relatively few CPR training programs included an AED component (21.7%).

4.3. Barriers to performing and learning CPR

Perceived barriers to performing CPR in descending frequencies were: lack of knowledge and expertise in CPR, fear of inflicting injury to the patient, contracting infection, patient's hygiene, litigation, and mouth to mouth resuscitation (Table 3).

Few participants (9.9%) considered touching and exposing the chest of a victim from the opposite sex as a barrier to performing CPR. More participants (17%) were, however, against exposing the chest in public in case the arrest victim was a woman relative.

Several main barriers to learning CPR were reported by participants including lack of accessible nearby CPR training, lack of time to attend CPR training, and unawareness that CPR is something a bystander could learn or perform. Overall, the participants showed willingness/interest in learning and performing CPR with 87.8% of them stating that bystanders should learn and perform CPR. Schools were also identified as the preferred location to receive CPR/AED training (44.1%) (Table 3).

Bivariate analysis (Table 4) followed by multivariate analysis (Table 5) examining willingness to perform CPR when faced with a cardiac arrest showed the following significant predictors: earning higher income, having received previous CPR training, and feeling confident in one's ability to apply an AED or do CPR. Lacking enough expertise in performing CPR was a significant barrier to willingness to perform CPR.

5. Discussion

This is the first study to assess knowledge about CPR and AED use in the Lebanese community and to examine the attitude of a sample of university students in Lebanon towards CPR in cardiac arrest. Sudden cardiac arrest (SCA) is a global health concern and is responsible for more than 6 million deaths annually.^[17] It is, however, still at the bottom of the list of medical priorities in Lebanon with most government and EMS initiatives currently focusing on trauma and injury prevention.

The study findings highlight relatively good knowledge about OHCA but a major deficiency in CPR training (79.7%) and poor confidence (33.7%) in performing bystander CPR on cardiac arrest victims. These numbers are lower than those from other communities in more developed countries where rates of trained individuals from different communities ranged from 34.7% (Japan, New York, United Kingdom) to more than 70% in Seattle.^[18-21] This finding is concerning especially in Lebanon, where the median time from collapse to EMS arrival was previously reported to be around 15 minutes.^[6] Increased public

Table 3**Perceived barrier to performing CPR, major barriers to learning CPR, and learning and performing CPR/AED.**

	N	%
Perceived barriers to performing CPR (more than one option may be selected)		
Lack of knowledge and expertise	520	56.4%
Fear of injuring the patient	497	53.50%
Contracting an infection	300	32.50%
Hygiene, bad denture, vomit, blood	281	30.30%
Fear of getting sued	230	24.80%
Mouth to mouth ventilation	181	19.40%
Female Chest exposure	158	17.00%
Touching and exposing the opposite gender	92	9.90%
CPR will change the outcome		
• Yes	835	90.90%
• No	83	9%
Major barriers to learning CPR (more than one option may be selected)		
Opposed to bystanders performing CPR	18	2%
CPR is of no interest to me	19	2.10%
No time to join CPR training	333	37.80%
Inconvenience of having to leave the house (bad health, or childcare)	10	1.10%
No CPR training is available near me	465	52.80%
Never occurred to me that CPR training was something I should be doing	226	25.60%
Financial burdens of attending a CPR class	25	2.80%
Additional reasons	102	11.50%
Learning & performing CPR/AED		
Do you believe that bystanders including yourself should learn & perform CPR/AED?	818	87.80%
If you were given the choice to select a place to attend a CPR training class, where would that be? (More than one option may be selected)		
• School	409	44.10%
• Place of worship	14	1.50%
• Community center	131	14.10%
• Workplace	73	7.80%
• Recreational building/gym	96	10.30%
• At home via self learning videos	67	7.20%
• Others	230	24.80%

AED=automated external defibrillator, CPR=cardiopulmonary resuscitation.

awareness and CPR training should constitute the core elements of any initiative to improve OHCA survival in Lebanon.

The study also identified barriers to performing bystander CPR. "Lack of knowledge and expertise in CPR" was the highest perceived barrier to performing CPR, which is comparable to previously published studies examining this topic among students.^[22,23] Addressing this knowledge deficit would be a good objective for any initiative aiming at improving bystander CPR in the Lebanese community. Other identified barriers, mainly fear of causing additional harm, fear of disease transmission, poor hygiene of victim, and presence of vomit or blood were also previously reported as factors influencing bystander CPR.^[24–28] One way to address these barriers is to promote Hands-only CPR especially that the majority of the participants were not familiar with this term. Hands-only CPR has simplified the learning process and has made it easier for the general public to overcome many of the reported barriers such as mouth-to-mouth resuscitation, complexity of CPR technique, lack of confidence, hygiene and fear of disease transmission.^[5] Hands-only CPR has also been proven to be as effective as conventional CPR if not better when it comes to lay persons performing CPR.^[29–31]

Additionally, barriers to learning CPR were identified. These were mainly lack of access or availability of CPR training centers and lack of time (inconvenience). In Lebanon, there are very few centers that provide CPR training (mainly volunteer EMS agencies

centers). In the absence of national standards for prehospital curriculum and training, it is also very common to have prehospital providers staffing ambulances without having any medical background or training.^[32] CPR training in schools is not part of a formal curriculum and is usually provided by volunteer EMS providers, part of community outreach activities. Hospitals offer Basic Life Support training, however, only to healthcare workers. Addressing the availability of centers/programs providing CPR/AED use training is another element that needs to be addressed.

This study also explored the impact of culture and societal norms on bystander CPR/AED use in a relatively conservative society by assessing the attitude towards bystander CPR/AED use based on the victim's sex (mainly woman sex). To our knowledge, this topic has not been previously addressed in the published literature. Few respondents (9.9%) considered touching and exposing the chest of a victim from the opposite sex as a barrier to performing CPR. A higher proportion of respondents (17.7%) were less likely to allow exposing the chest of a woman relative in public. AED application consists of exposing the chest of the victim and applying the AED pads to deliver a shock. The study findings highlight that exposing the chest of a woman who is a cardiac arrest victim might not be that culturally acceptable in public in a conservative society in Lebanon and possibly in other Middle Eastern countries. Although this sex related barrier to CPR was not a significant in the multivariate analysis results, public education about AED and early defibrillation on scene regardless whether it is in public or not

Table 4**Bivariate analysis with significant variables based on willingness to perform CPR.**

	Perform CPR (N[%])		P
	No	Yes	
Monthly income			
Less than 500\$	147 (44.7%)	182 (55.3%)	0.009
500–1000\$	67 (31.6%)	145 (68.4%)	
More than 1000\$	34 (37.4%)	57 (62.6%)	
What are the signs of sudden cardiac arrest?			
Collapse, fainting	30 (34.9%)	56 (65.1%)	<0.001
Abnormal breathing	31 (35.6%)	56 (64.4%)	
Not responsive	8 (34.8%)	15 (65.2%)	
All of the above	140 (35.0%)	260 (65.0%)	
I don't know	152 (52.8%)	136 (47.2%)	
Collapse, fainting and abnormal breathing	10 (31.3%)	22 (68.8%)	
Collapse, fainting and not responsive	1 (16.7%)	5 (83.3%)	
Abnormal breathing and not responsive	2 (33.3%)	4 (66.7%)	
Have you ever heard of the term "Hands-only CPR"?			
No	236 (43.0%)	313 (57.0%)	0.032
Yes	134 (35.9%)	239 (64.1%)	
How to perform CPR?			
Push hard and fast in the center of the chest	215 (35.6%)	389 (64.4%)	<0.001
Push hard and fast in the center of the abdomen	29 (34.5%)	55 (65.5%)	
Shake the patient to try and wake him/her up	6 (85.7%)	1 (14.3%)	
I don't know	123 (53.5%)	107 (46.5%)	
Push hard and fast in the center of the chest and shake the patient to try and wake him/her up	0 (0%)	2 (100%)	
What does an AED stand for?			
Automatic electrical device	46 (36.8%)	79 (63.2%)	<0.001
Automatic electrical drug	3 (42.9%)	4 (57.1%)	
Automated external defibrillator	86 (27.2%)	230 (72.8%)	
I don't know	238 (49.8%)	240 (50.2%)	
Would you be able to apply an AED if in the presence of a person with cardiac arrest?			
Strongly disagree	134 (46.5%)	154 (53.5%)	<0.001
Disagree	56 (38.9%)	88 (61.1%)	
Neutral	138 (43.1%)	182 (56.9%)	
Agree	22 (26.8%)	60 (73.2%)	
Strongly agree	12 (18.5%)	53 (81.5%)	
Would you be able to apply an AED if in the presence of a person with cardiac arrest?			
No	328 (43.6%)	424 (56.4%)	<0.001
Yes	34 (23.1%)	113 (76.9%)	
Have you ever received CPR training?			
Yes	57 (30.0%)	133 (70.0%)	0.001
Never	317 (42.9%)	422 (57.1%)	
Lacking enough expertise is a barrier to performing CPR			
Disagree	128 (32.1%)	271 (67.9%)	<0.001
Agree	243 (47.0%)	274 (53.0%)	
Fear of inflicting injury on the patient is a barrier to performing CPR			
Disagree	144 (33.7%)	283 (66.3%)	<0.001
Agree	227 (45.8%)	269 (54.2%)	
Would you be able to perform CPR if in the presence of a person with cardiac arrest?			
No	280 (46.4%)	323 (53.6%)	<0.001
Yes	85 (27.5%)	224 (72.5%)	
Do you believe that people including yourself should learn/and perform CPR-AED?			
Disagree	56 (50.0%)	56 (50.0%)	0.021
Agree	313 (38.6%)	498 (61.4%)	

AED = automated external defibrillator, CPR = cardiopulmonary resuscitation.

should be part of any intervention aiming at improving bystander CPR/AED use in Lebanon.

Fortunately, the majority of respondents believed that CPR actually changes outcomes of patients and improves survival, and that the general public should learn and perform CPR. This positive attitude and willingness to do CPR should serve as a starting point to increase CPR and cardiac arrest awareness in the Lebanese population. The Internet was identified to be the major

source of information and schools were the preferred sites of training for the study participants, both of which should be considered as ways of reaching the community.

This study has few limitations. The study participants though from different backgrounds represent only a section of the Lebanese population in terms of age, categories, and educational level. Assessing knowledge and abilities about performing CPR and AED use of this subpopulation is only a first step but begs the following

Table 5**Multiple logistic regression analysis performing CPR with best model (adjusted odds ratios OR, 95% CI, and P value).**

Variables	OR	95% CI	P
Monthly income (Less than 500\$)			
500-1000\$	1.907	1.283–2.835	0.001
More than 1000\$	1.347	0.808–2.245	0.253
Would you be able to apply an AED if in the presence of a person with cardiac arrest? (No)			
Yes	1.761	1.021–3.036	0.042
Have you ever received CPR training? (Never)			
Yes	1.627	1.018–2.600	0.042
Lacking enough expertise is a barrier to performing CPR (Disagree)			
Agree	0.581	0.406–0.829	0.003
Would you be able to perform CPR if in the presence of a person with cardiac arrest? (No)			
Yes	1.93	1.285–2.898	0.002

Variables entered into the model:

- Monthly income.
- Have you ever heard of the term “Hands-only CPR”?
- Would you be able to apply an AED if in the presence of a person with cardiac arrest?
- Have you ever received CPR training?
- Lacking enough expertise is a barrier to performing CPR.
- Fear of inflicting injury on the patient is a barrier to performing CPR.
- Would you be able to perform CPR if in the presence of a person with cardiac arrest.

AED=automated external defibrillator, CI=confidence interval, CPR=cardiopulmonary resuscitation, OD=odds ratio.

question: if a relatively highly educated sample of the Lebanese population is not CPR trained, then who is? Second, all the students at the AUB are proficient in English, thus we could not assess for language as a barrier to learning CPR. There is a need to generate educational material in Arabic for interventions that target a larger segment of the Lebanese population. Third, knowing that Lebanon is composed of a religiously diverse population, the study analysis did not account for religion and for its impact on the results. Fourth, the study included students from only one university in Beirut. Despite the diverse background of AUB students, the findings might be different in other universities or among youth who do not attend university. Furthermore, the impact of the recent major change in demographic background within the Lebanese population secondary to displaced Syrians or refugees (around 2 million people) with some being students at AUB was not assessed.

6. Conclusion

University students in Lebanon are familiar with the symptoms of cardiac arrest, however, they are not well trained in CPR and lack confidence to perform it. The attitude towards the importance of bystander CPR and the need to learn CPR is very positive. Interventions should focus on public awareness campaigns regarding importance of initiating CPR while activating EMS and on making CPR training more available.

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