Call-Push-Shock: A Community Education Initiative to Strengthen the Out of Hospital Cardiac Arrest

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ABSTRACT

Background: Out-of-hospital cardiac arrest (OHCA) is a global health concern with an incidence of 8.9 million people annually. More than 350,000 incidences of OHCA occur yearly in the United States, with an average survival of 10%. Provision of bystander cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) use have been noted to significantly improve survival rates. **Aim:** The aim of this quality improvement project was to strengthen the OHCA chain of survival on the university campus and within the surrounding community.

Methods: This was a multifaceted evidence-based quality improvement project involving community CPR/AED education, improving AED awareness, and policy creation.
Results: Participant (n = 759) knowledge of CPR and AED use improved between pre-test (M = 3.34, SD = 1.18) and post-test scores (M = 5.23, SD = 0.82). Participant knowledge of AED locations in areas they frequent improved from 58% to 91%, and comfort level for performing CPR improved from 59% to 97% post implementation. Adoption of a Cardiac Emergency Response Plan for the university was achieved, an additional 23 AEDs were placed on campus and uploaded to an AED location app.
Conclusion: There is strong evidence to support that communities who place an emphasis on strengthening the OHCA chain of survival report better OHCA outcomes.

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INTRODUCTION

Out-of-Hospital Cardiac Arrest (OHCA) remains a leading cause of death internationally and is a global health burden with an incidence of 8.9 million episodes annually (Brooks et al., 2022). It is estimated that more than 350,000 incidences of OHCA occur yearly in the United States; however, this number may be a gross underrepresentation of reality because there is no national mandatory reporting database for incidences of OHCA (Virani et al, 2021).

The Cardiac Arrest Registry to Enhance Survival (CARES) is a voluntary national database which collects detailed information regarding episodes of OHCA, such as provision of bystander cardiopulmonary resuscitation (CPR) as well as public automated external defibrillator (AED) use from participating emergency medicine services (EMS) agencies. According to the CARES database, in 2023, 41.2 % of OHCA victims were provided bystander CPR, an AED was applied in 11.7 % of cases, and the national survival rate was reported as a mere 10.2 %. An additional concern is the median national EMS response rate is reported at 7.6 minutes, and delays in the provision of CPR and application of an AED are directly related to poorer outcomes. Survival rates have been reported at 47 % when bystander defibrillation is initiated vs. 25.8 % when the first shock is provided by EMS (CARES, 2023).

The majority of OHCAs (71%) occur in the victim's home, followed by 15% occurring in public settings (CARES, 2023). There is compelling evidence to support that communities placing a strong emphasis on strengthening the OHCA chain of survival report better outcomes. The six steps in the OHCA chain of survival are: (1) Activation of emergency response, (2) provision of early CPR, (3) rapid defibrillation (AED), (4) advanced resuscitation by EMS, (5) post arrest care (in hospital), and (6) recovery (American Heart Association, 2024).

This ongoing multifaceted quality improvement project builds upon the "Creation of a Sudden Cardiac Arrest Safety Net" pilot program which was published in the *Building Healthy Academic Communities Journal*, Volume 5 (2021). The overarching goal of this project was to strengthen the OHCA chain of survival both on campus and in the surrounding community. This community engagement program involved the provision of layperson CPR/AED education, improving awareness and public access to AEDs, policy creation, and advocacy. Securing key stakeholder buy in was an integral component leading to the success of the project.

METHODS

This was a multi-group educational intervention with a pre- and post-test design. The program was categorized as Quality Improvement/Quality Assurance (QI/QA) by the Chair of the University Institutional Review Board and was not considered human subjects' research. Participants were volunteers, demographic data as well as pre and post test results were de-identified, and informed consent was not required.

The CPR and AED educational sessions took place over the past two years, both on campus and in the community at large. Participants were recruited via email and through forming relationships with key community stakeholders. The American Heart Association's *CPR in Schools*® curriculum was implemented while educating middle and high school students, and the American Heart Association's *CPR Anywhere*® program was used when educating university students, staff, and outside community groups. Both curriculums can be implemented by course facilitators and do not require a certified basic life support instructor. The sessions are facilitated by faculty and student volunteers. The instructional kit contains all the necessary materials for students to learn about and practice Hands Only CPR® and each session lasts approximately 45 minutes.

Setting

The community is located in Nassau County, New York with a total population of 25,662 (U.S. Census, 2022). The university has a student population of 4,838 and employs approximately 1,300 faculty and staff members. Sessions were held in classrooms and event spaces on campus, local schools, and various community centers.

Community CPR/AED Education

Historically, CPR sessions were geared towards healthcare professionals, six hours in length and required participants to incur the cost. These traditional courses created various barriers for laypersons seeking CPR training. The American Heart Association's CPR in *Schools*® and CPR *Anywhere*® programs were created with the intent to remove these barriers and offer free layperson CPR/AED training in less than an hour across various settings. There is substantial evidence to support that abbreviated Hands Only CPR and AED training sessions have been equally effective in training laypersons when compared to formal certification courses (Edinboro & Brady, 2022; Roppolo et al, 2007).

To provide evidence-based CPR training sessions to the public, the project team implements the CPR in *Schools*® (n = 58) program when educating middle and high school students and the CPR *Anywhere*® program with college students, staff, and outside adult community groups (n = 759). The CPR *Anywhere*® curriculum is created for delivery across multiple settings including workplaces, religious houses of worship, and community centers. The pre/posttest is associated with the CPR *Anywhere*® program and consists of six knowledge questions, including one question addressing comfort related to performing CPR, and an additional question regarding knowledge of AEDs in public places.

Training sessions have been offered to various groups both on campus as well as in the community at large, including university students, faculty, and staff, local government officials, boy/girl scout troops, senior citizens, local middle, and high school faculty/staff. Additionally, the project team holds "Pop Up" Hands Only CPR sessions/AED demonstrations at local community events (n = 293). In an effort to gain an exponential effect, 55 participants were

provided with American Heart Association *CPR Anytime®* Kits to take home and share the training with their loved ones and trained an additional 161 laypersons.

RESULTS

Descriptive statistical analysis of the sample (n = 759) revealed that 71.5% of participants were female, 27.3% male, 0.5% preferred not to answer, and 0.6% identified as non-binary. The age ranges of the participants were as follows: 17 years (8.7%), 18-24 years (53.2%), 25-44 years (22%), 45-64 years (22.4%) and > 65 years old (2.4%) (Table 1).

Table 1

Sample Demographics

Sample Characteristics (n = 759)			
		n	%
What is your age?	17 years	66	8.7
	18-24 years	388	53.2
	25-44 years	138	22.0
	45-64 years	147	22.4
	65 years >	20	2.4
Race			
	Asian	45	5.9
	Black/African American	58	7.6
	Multiple	104	13.7
	Native Hawaiian/Pacific Islander	3	0.4
	White	549	72.3
How do you identify?			
	Male	207	27.3
	Non-Binary	5	0.6
	Prefer not to answer	4	0.5
	Female	543	71.5
Have you attended a CPR Course Before?			
	Yes	336	44.3
	No	423	55.7
Total		759	100.0

According to a paired samples t-test, there was a significant improvement in mean scores from the pre-test scores (M = 3.34; SD = 1.18) to the post-test scores (M = 5.23; SD = 0.821). The paired sample t-test result was $t(758) = -41.058$, $p < .00$ (Table 2). There was no significant difference noted in pre/post test scores between gender or ethnicity.

Table 2

Paired Samples Test

		Paired Differences					
		Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pair 1	Post-Test Score – Pre-Test Score	1.89	1.27	.046	-41.06	758	.000

Prior to attending the CPR session, 59% of participants felt comfortable performing Hands Only CPR and post intervention 97% of participants felt comfortable.

Participants' knowledge of the location of public access of AEDs at venues they frequent was only 58% prior to participating in the CPR *Anywhere*® educational program and increased to 91% afterwards. The paired sample t-test result was significant: $t(758) = -18.91$, $p < .001$ for AED location and $t(758) = -21.721$, $p < .001$ for Hands Only CPR comfort level (Table 3).

Table 3

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	*t*	df	Sig. (2-tailed)
Pair 1	WhereAED - PostWhereAED	-.331	.482	.017	-.365	-.296	-18.908	758	.000
Pair 2	ComfortableUsing ComfortUsing	-.383	.487	.018	-.418	-.349	-21.710	758	.000

Improving Automated External Defibrillator Access and Awareness

Public access AED use by laypersons in the community has the potential to save countless numbers of lives. Strategic placement of public access AEDs is an important public health initiative, but of equal importance is that community members are aware of AED locations. Advances in technology have made it possible for the development of AED location apps which enable users in real-time to identify the closest AED.

Pulse Point AED® is an AED location app designed to enhance emergency response efforts and improve public safety. This app utilizes real-time data to pinpoint the exact locations of AEDs within a community. The app not only identifies the nearest AEDs but also provides crucial information such as their accessibility status and current condition, ensuring that users have the most up-to-date information in case of a cardiac emergency. Pulse Point AED® notifies individuals responsible for AED maintenance via email one month prior to battery or defibrillator pad expiration.

The app also allows for uploading information regarding additional lifesaving tools such as Bleeding Control Kits, Epi-Pen® and Narcan® which may be co-located in the AED cabinet. Furthermore, Pulse Point AED® promotes community engagement by allowing users to contribute to the AED database, ensuring that the app's information remains accurate and comprehensive. This crowd sourcing approach strengthens the overall effectiveness of the app, making it a valuable tool for both individuals and communities dedicated to creating safer environments and improving emergency response outcomes.

At the onset of this initiative, there were nine public access AEDs located on the university campus. Due to the ongoing efforts of the project team, there are now 32 public access AEDs available on campus and ongoing communication with local politicians has resulted in the purchase of 28 additional AEDs to be placed throughout the greater community. The project team, consisting of faculty and student volunteers have uploaded the AEDs on campus and in the community at large to the Pulse Point AED® App and have encouraged community members to upload the app to their smartphones.

Policy Creation and Advocacy

In order to provide victims of OHCA with the best chance of survival, prompt recognition and immediate provision of CPR and AED use is paramount. Delays in recognition of the arrest and response times have a negative impact on survival rates (Merchant et al., 2024). School buildings and workplaces are legally obligated to have policies and procedures in place in the event of a fire or active shooter; yet many states have not adopted legislation mandating cardiac emergency response plans. Cardiac Emergency Response Plans (CERPs) are protocols providing detailed information on how to recognize and respond to suspected episodes of cardiac arrest.

Members of school communities as well as workplaces should be notified of these policies and practice them often. Through a collaborative partnership between the project team and university public safety a CERP for the campus was created and approved by the university. Members of the project team have lobbied with sudden cardiac arrest awareness advocacy groups both at the state and national level for legislation changes which would mandate all schools and workplaces have CERPs in place. Recently, legislation was passed in New York State requiring camps and youth sports programs to establish AED implementation plans and mandate that at least one person trained to properly use the AED is present at all camp activities, games, and practices (New York State Public Health Law, CPR and AED instruction; youth leagues, 2024). The project team has begun to collaborate with leaders of local youth sports leagues and camps to ensure compliance with this new policy.

DISCUSSION

Research Summary

Communities placing a strong emphasis on strengthening the OHCA chain of survival boast better survival rates (CARES, 2023). Evidence consistently demonstrates the majority of OHCAs occur in homes, followed by public settings. In many instances, a layperson is the first person to recognize the OHCA and call for help. Time is of the essence when responding to OHCA and the sooner the arrest is identified and CPR is started, the better the outcome.

Empowering layperson community members with CPR/AED knowledge and skills is an integral step towards strengthening the OHCA chain of survival. This program has demonstrated that participant CPR/AED knowledge,

awareness of AED locations and comfort performing CPR all improved after participating in the *CPR Anywhere*® program. Academic-community partnerships provide benefits to both the university and community at large. University campuses are embedded in neighborhoods across the country and are well equipped to spearhead community engagement projects. Student volunteers are exposed to community service, serve as mentors for high school students and develop leadership skills along the way. Engagement with local politicians and sudden cardiac arrest advocacy groups provide students with real life lobbying and advocacy experiences.

Limitations

Participants in this project are self-selected volunteers with the majority identifying as white (72.3%) and female (71.5%). The sessions have primarily been conducted on the University Campus and in the surrounding community. In order to be more generalizable, future samples should include a more diverse population parallel to represent the general public.

Implications for Future Research

Despite ongoing efforts, over the past decade, to improve bystander CPR and AED use, nationwide OHCA survival rates remain low with notable disparities in vulnerable communities. Inequity among low-income communities continue to prevail with disproportionate rates of individuals affected by OHCA. Black, Hispanic, or Latino individuals have an increased incidence of OHCA and experience lower survival rates (Huebinger et al., 2023). Adding insult to injury is that residents in low-income communities are less likely to receive CPR training, have limited access to publicly available AEDs, and perform bystander CPR less often than in higher income communities (Uny et al., 2023). It is evident that to address these inequities, programs geared towards improving bystander CPR/AED use, improving access to publicly available AEDs, and lobbying for policy changes in these under resourced communities through collaborative team approach is essential (Merchant et al., 2024).

CONCLUSION

In an effort to address inequities, the American Heart Association has identified specific goals to improve outcomes for cardiac arrest. The targets are to increase bystander CPR rates to greater than 50%, increase the amount of people who have an AED applied during bystander CPR to greater than 20%, and to increase OHCA survival rates to > 24% (Merchant, et al., 2024). We have a societal obligation to ensure that all individuals have an equal chance of surviving an OHCA regardless of their zip code. To achieve these goals, ongoing community outreach programs geared toward strengthening the OHCA chain of survival are imperative.

The next phase of this project involves replicating this program in socioeconomically disadvantaged communities adjacent to the campus in collaboration with the university mobile health van.

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