Save a Life: Implementation and Evaluation of a Community-Focused CPR Education Program in Houston, Texas

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Abstract
Over 350,000 people in the United States experience out-of-hospital cardiac arrest (OHCA) annually—and almost 90% die as a result. However, survival varies widely between counties, ranging from 3.4% to 22.0%—a disparity that the American Heart Association (AHA) largely attributes to variation in rates of bystander CPR. Studies show that regions with low rates of bystander CPR have low rates of CPR training, making CPR training initiatives a high-priority intervention to reduce OHCA mortality. In Houston, Texas, researchers have identified census tracts with higher OHCA incidence and lower rates of bystander CPR. We developed a free, annual Hands-Only CPR bilingual health education program central to these high-risk neighborhoods. In 5 years, this collaborative effort trained over 2700 individuals. In 2016, 2017, and 2018, we conducted a process evaluation to assess fidelity, dose delivered, and dose received. We also conducted an outcome evaluation using the Kirkpatrick Model for Training Evaluation to assess participants’ reactions and learning. Overall, the program yielded positive outcomes. Of the 261 respondents (from 314 attendees), 63% were first-time learners. The majority (87%) were satisfied with the event and 85% felt that information was presented clearly and concisely. Pre- and post-knowledge assessments showed a 51% increase in the proportion of respondents who could correctly identify the steps for Hands-Only CPR. This program exemplifies how collaborative education can impact a community’s health status. Leveraging each partner’s resources and linkages with the community can enhance the reach and sustainability of health education initiatives.

Keywords
out-of-hospital cardiac arrest, cardiopulmonary resuscitation, cardiopulmonary resuscitation training, bystander cardiopulmonary resuscitation

Introduction
Each year, over 356,000 people in the United States experience out-of-hospital cardiac arrest (OHCA). Most OHCA happen at home (68.5%) or in public (21%), where survival often depends on whether a bystander witnesses the event and initiates cardiopulmonary resuscitation.¹ Rapid response is crucial: Each minute without CPR decreases chance of survival by 7% to 10%.²³ According to the American Heart Association’s (AHA) “Heart Disease and Stroke Statistics—2018 Update,” bystander CPR (BCPR) increased survival to hospital admission by 4.7% (25.1% survival rate without CPR, 29.8% with CPR), survival to hospital discharge by 5.1% (7.5%, 12.6%), and survival with good neurological function by 5.4% (6.0%, 0.6%). In-hospital mortality for OHCA was 12.4% lower with bystander CPR (57.7% mortality compared to 70.1% mortality without CPR).⁴ Similarly, a retrospective study of over 30,000 OHCA cases in Sweden found that the OCHA 30-day survival rate was twice as high when CPR was performed before EMS arrival.⁵

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However, OHCA survival rates vary widely by region, corresponding with variation in rates of BCPR; more rural, lower income, and Black or Latino neighborhoods have lower BCPR rates and worse OCHA outcomes.6,7 Although the causes of this regional disparity are multifactorial,4 studies in the United States,8 South Korea,9 and Australia10 show that areas with lower rates of BCPR have lower rates of layperson CPR training, and the AHA attributes the wide county-by-county variation in OHCA survival (range, 3.4%-22.0%) to variation in rates of CPR training.4 In 2008, the AHA published a scientific statement linking low rates of BCPR to worse OCHA outcomes and recommended broadening public education and CPR training.11

Background

Studies show that CPR training improves rates of BCPR and OHCA outcomes. For instance, the North Carolina Regional Approach to Cardiovascular Emergencies Cardiac Arrest Resuscitation System (RACE CARS) program instituted a multifaceted public health campaign to improve OHCA processes and outcomes. Key interventions included compression-only CPR training and training emergency medical services (EMS) dispatchers to recognize OHCA and instruct bystanders to begin CPR. In the first 4 years of the program, rates of BCPR and OHCA survival increased significantly at home and in public.12 In Sweden, where CPR training is more common than in the US, researchers noted that BCPR initiated before calling EMS was associated with better survival than CPR after calling EMS; they concluded that lay people trained in CPR were able to initiate it faster and more effectively.

In the United States, only about 2.4% of the adult population received CPR education through certification programs within a 1-year period.8 Regional disparities in CPR training rates indicate that older age, less education, and lower income are associated with reduced likelihood of CPR training.13 Areas that are rural or have higher proportions of black and Hispanic residents also have lower rates of CPR training.8 In Houston, Texas, the fourth largest city in the US, researchers have used geospatial analysis to identify several contiguous areas with high OHCA rates and low BCPR.14

In 2013, we launched a Hands-Only CPR training program in Houston, central to the high-OHCA neighborhoods. This describes the 5-year collaborative effort to plan, implement and evaluate the annual Save a Life (SAL) program.

Methods

Study Design

The Houston Methodist Research Institute determined that the annual SAL program and associated procedures did not meet the definition of Human Subject Research per 45 CFR 46 and did not require prior IRB review and approval. A pre-post study design was used to analyze the impact of SAL on attitudes, self-efficacy, perceived norms, and intentions of participants in 2017 and 2018. Each SAL participant was at least 12 years old and minors were accompanied by an adult. Only participants who completed the evaluation survey (in English) were included in the sample for data analysis related to program outcomes. For the CPR certification course (1 segment of the annual SAL program), there was a minimum age requirement of at least 18 years old and priority was given to healthcare professionals.

Community Engagement and Partnerships

Houston Methodist DeBakey Heart and Vascular Center’s education arm, DeBakey Institute for Cardiovascular Education and Training (DeBakey CV Education) collaborated with the following community-based organizations, nonprofit organizations, and media outlets to enhance its programmatic reach to Houston residents: the American Heart Association, Multicultural Initiatives, Houston Museum of Natural Science, Minute Maid Park, City of Houston Fire Department, Houston Rotary Club, Boys Scouts of America, North Brook High School, Sterling High School, Clear Creek High School, Taylor High School, Rice University, D. Bradley McWilliams YMCA, Alpha Phi, Black Nurses Rock!, Boston Scientific-Close the Gap, NRG, Houston Style Magazine, Houston Life, Fox 26, Click2Houston’s Houston Life TV program, Telemundo, KHOU Great Day Houston TV program, and KPRC Channel 2.

Save a Life Program Description

While we had diverse partnerships and collaborations, our formal partnership between Houston Methodist Hospital (specifically, DeBakey CV Education) and the American Heart Association (AHA) stemmed from a mutually aligned mission: to provide community education and training in basic CPR skills, choking relief, and AED awareness. To this end, we developed the SAL program, and representatives from both organizations met every other week to plan the event. From 2013 to 2018, we offered free Hands-Only CPR training and certification to hundreds of Houstonians each year except 2014. Participants learned CPR in under 30min and went home with a CPR Anytime kit, a self-contained training module that participants could use to train friends and family.

In addition to having the right partners in place to plan and implement SAL, we applied the Theory of Reasoned Action/Theory of Planned Behavior to guide implementation.15 In essence, we employed an “intention-focused” model for CPR training.16 The key tenets of this model are (1) intention
influences the likelihood of performance of CPR; (2) beliefs serve as determinants of intention; (3) bystander characteristics are distal variables rather than primary determinants of intention or CPR behavior; and (4) accounts for the interplay of skills, environmental constraints and intention to perform CPR (Figure 1).16

Evaluation Plan
In 2018, we conducted a process evaluation for SAL addressing the following:

1. Recruitment/reach: Which recruitment procedures worked and how well? What was the attendance and attrition rate? What were notable barriers to participation?
2. Fidelity: To what extent did we implement SAL as planned, what changes did we make on the day of to accommodate unanticipated changes?
3. Dose delivered: How much of the program did we deliver? How many CPR kits were distributed?
4. Dose received: To what extent were the participants engaged, receptive to the training, and satisfied?17
5. For the outcome evaluation, we employed the first 2 steps of the Kirkpatrick model for evaluating training programs.18 For level 1 (reaction), we posed the question: To what extent did the participants find the SAL CPR training relevant, favorable or engaging? For level 2 (learning), we asked: To what extent did participants acquire the intended knowledge, skills, attitude, confidence or commitment to perform CPR? Table 1 illustrates evaluation components aligned with data collection tools and data points.

Results
The SAL program ran for 4 of 5 years. In that time, we trained 2,792 people in basic CPR skills, infant CPR, choking relief, and automated external defibrillator awareness. Participants learned CPR in under 30 min during group training sessions, had an option for CPR certification, and took home the AHA’s CPR Anytime kit to practice and teach friends and family. In a 2007 study published in Circulation, investigators found that for each CPR Anytime kit distributed in a training program, 2.5 additional people learned CPR.19 Using that metric, we estimate the total reach of Save a Life to be around 8,750 people trained.

In alignment with the Theory of Planned Behavior, cardiac arrest survivors gave their testimonials and healthcare providers discussed the benefits of CPR training—addressing all theoretical constructs contributing to intention/applying CPR training. We also held a mini health fair with heart-health organizations that educated attendees about heart.

Community Partnerships
Community partnerships were key to our ability to plan and implement Save a Life each year. The central partnership was between Houston Methodist and the AHA, with representatives from each comprising the SAL steering committee. Houston Methodist was primarily responsible for funding, logistics, evaluation and updating the program annually in response to evaluation data. They recruited cardiovascular physicians and nutrition specialists to participate, whereas the AHA brought OHCA survivors and CPR trainers to events. The AHA also spearheaded community engagement efforts and provided the Hands-Only CPR training curriculum and CPR Anytime kits. These primary partners leveraged their individual networks of contacts in the community to form secondary partnerships for event promotion, day-of support, and venue sourcing.

Promotion. For instance, Houston Methodist’s public relations team and representatives from the AHA filmed promotional segments on local news stations, including interviews featuring a woman who had an OHCA and her husband who performed CPR. They promoted the event through 7 local news outlets, including a Spanish-language television station. Houston Methodist also advertised the event via a flyer in both English and Spanish (Figure 2) and highlight video (available at https://youtu.be/oc5SU-0W24Oo).20 Event organizers worked with community groups to target different demographics; for instance, in 2017, the AHA worked with Asian community centers to advertise the event in Houston’s Asian Community, and partnerships with groups such as Multicultural Initiatives and Black Nurses Rock reached out to non-white communities at higher risk for cardiovascular disease.

Day-of support. Outside of paid Houston Methodist and AHA personnel, SAL events were largely staffed by volunteers. Community groups such as the Houston Fire Department, Rotary Club, and Boy Scouts of America volunteered at events.
Venues. The event was held at different locations around Houston each year, bringing in diverse local stakeholders to act as event hosts. These partners included several schools, the YMCA, a museum, and 2 professional sports teams.

Event and Evaluation Summary

2013. The first SAL took place on June 1 at the indoor training facility for the Houston Texas NFL team. We trained 929 people, distributing 1,350 CPR Anytime kits (Table 2). Of the attendees, 35% (324) earned Heart Saver CPR AED certification. One of the highlights was an appearance by the Mayor of Houston, who briefly spoke about the importance of CPR. Overall, the program was implemented as planned, yielding a high implementation fidelity. According to surveys of 741 attendees, the top recruitment method was friends and family, closely followed by television. Most participants rated the program as excellent (dose received) and said that the information was clear and concise (Level 1: reaction).

Figure 2. Examples of program flyers (English and Spanish) used in 2017.

Table 1. Evaluation Strategy for Save a Life Program.

| Component                  | Tool                | Data                                                                 |
|----------------------------|---------------------|----------------------------------------------------------------------|
| Recruitment/reach          | Survey              | “I heard about this event through...”                                |
|                            | Debriefing sessions | Attendee demographics                                                 |
|                            |                     | Attendance log                                                        |
| Implementation fidelity    | Observation guide   | Count of deviations between planned implementation and actual execution |
|                            | Debriefing sessions | Count of CPR kits distributed                                         |
| Dose delivered             | Observation guide   | “I was satisfied with the 2017 Save a Life event.”                    |
|                            | Debriefing sessions |                                                                      |
| Dose received              | Observation         | “I attended this event because I am interested in learning these CPR skills for my friends and family.” |
| Level 1 and 2 outcome      | Survey              |                                                                      |
|                            | Survey              |                                                                      |
| Date(s) | Venue & reach (total number of attendees) | Dose delivered | Dose received | Level 1: Reaction | Level 2: Learning |
|---------|------------------------------------------|----------------|---------------|------------------|------------------|
| 2013 June 1 | Houston Texans (NFL) training facility 929 attendees | 35% (324) of attendees completed CPR/AED certification | Of those who completed the survey (n = 741), 85% (630) rated program “excellent” | | No evaluation data |
| No event in 2014 | | | | | |
| 2015 March 28 | Sterling High School Gym D. Bradley McWilliams YMCA | No evaluation data captured | | | |
| April 11 | Clear Lake High School Rice University | | | | |
| April 25 | Wheeler Field House Taylor High School 850 attendees | | | | |
| 2016 October 1 | Minute Maid Park (MLB stadium) 394 attendees | 349 CPR Anytime kits distributed | >75% (200+) rated program “excellent” | 74.6% (~200) strongly agreed: information was clear and concise | >50% (134+) were interested in learning CPR skills for family/friends |
| 2017 June 3 | Houston Museum of Natural Science 620 attendees | 620 CPR Anytime kits distributed | >90% (383+) satisfied | 96% (410) agreed information was clear and concise | 48% (205) were interested in learning CPR skills for family/friends |
| 2018 June 3 | Houston Museum of Natural Science 314 attendees | 314 CPR Anytime kits distributed | 87% (227) satisfied | 85% (222) agreed information was clear and concise | Pre/post-knowledge assessments: 51% increase in respondents who could correctly identify steps for CPR |
2014 to 2015. We did not have the event in 2014 because of logistical challenges, but it resumed in 2015. The 2015 event took place at 6 schools and community centers over 3 days. This geographical spread captured diverse audiences, with 580 people trained across Houston. We did not capture evaluation data for 2015.

2016. We returned to the 1-day format in 2016, training 349 people at a professional baseball stadium in central Houston. We distributed 249 CPR Anytime kits and implemented the program as planned. Overall, 76.8% (268) of attendees responded to the evaluation survey. Most said they heard about the program through a family member or friend or on social media. More than 200 respondents ranked their impressions of the program as “excellent,” and 74.6% strongly agreed that information was presented clearly and concisely. For the first time, we measured Level 2 (learning), with more than half of the respondents indicating that they attended the program because they were interested in learning CPR skills for their family and friends.

2017. The next SAL program trained 620 individuals at the Houston Museum of Natural Science on June 3, 2017. This day was recognized as “Save a Life Day” by a proclamation from the City of Houston. Overall, the program was implemented as planned, with high fidelity except for the following modifications: check-in process was revised due to overcrowded spaces, the start time was delayed for the certification segment, and crowd management strategies were adjusted to work in the venue layout. We distributed 620 CPR Anytime kits. Of the 425 attendees who completed the evaluation survey, over 40% identified as Asian. Family/friend was the most common way respondents found out about the program, followed by web/internet. Over 90% of respondents indicated that they were satisfied with the program. All but 15 respondents agreed that the information provided was presented clearly and concisely, and most expressed interest in learning CPR skills for their family/friends (Figure 3).

2018. The final SAL was held on June 3, 2018, at the Houston Museum of Natural Science. The program trained 314 participants, each of whom received a CPR Anytime kit. Overall, the program yielded positive outcomes. Of the 261 survey respondents, 63% were first-time learners. The majority of respondents were satisfied with the program and felt that information was presented clearly and concisely. For the first time, we conducted pre- and post-knowledge assessments to evaluate learning, showing a 51% increase in the proportion of respondents who could correctly identify the steps for Hands-Only CPR.

Discussion

Implications for Practice

This program exemplifies how collaboration can impact a community’s health status through education programming. Leveraging each partner’s resources and linkages with the community can enhance the reach and sustainability of health education initiatives.

The results from the Save a Life program align with similar programs using the American Heart Association’s CPR Anytime curriculum taking place around the United States. We have consistently received positive feedback to the CPR Anytime program. Word of mouth is typically in the top 2 responses for “how did you hear about this event,” and in programs that more consistently measured “knowledge gained,” an increase is always measured.

Through the SAL program’s 5-year span, a few themes emerged as lessons learned for community-based CPR trainings: (1) Use of both electronic and oral means of communication is critical for engagement. Media messaging was vital in creating “buzz” leading to the event. This also fed into word-of-mouth promotion. (2) Engaging with community organizations with strong “word-of-mouth” networks yielded a large ROI for attendance. This is clearly demonstrated in the results of the 2017 SAL and the large population of Asian attendees. AHA staff worked closely with Asian community centers to advertise the event and it proved effective. (3) Venue matters. Certain venues drew larger crowds. For example, the Methodist Training Center is not typically open to the public. Utilizing the space was enticing for attendees. Further, the Museum of Natural Science offered day passes for the remainder of Save a Life Day for event attendees. Event attendees were excited and pleased with the free museum access. The importance of selecting an appropriate setting for delivering health promotion programs...
such as SAL (eg, selecting familiar locations for the public) has been noted in previous studies.22-24

Strengths

Our results show that Save a Life was an effective method of training laypeople in the community how to perform CPR. Strengths unique to the program included: the relationship between the Houston Methodist Hospital and American Heart Association teams, relationships held by each partner (media, community organizations, civic, etc.), and the CPR Anytime curriculum.

Limitations

Limitations included funding, waning public interest in CPR, affordable event space for the number of attendees, and time constraints for the event. We were limited in our evaluation of the program over the years because evaluation data was not collected until 2016. However, the rigor of evaluation improved year after year.

Conclusion

The SAL program is an effective model to train Greater Houston community members in CPR, Hands-Only CPR, choking relief, and AED use. Similar programs could be effective in other locations. Public health practitioners should work with local authorities and community organizations to evaluate if a similar program could benefit their local communities.

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