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Effect of Smartphone Dispatch of Volunteer Responders on Automated External Defibrillators and Out-of-Hospital Cardiac Arrests
The SAMBA Randomized Clinical Trial

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IMPORTANCE Smartphone dispatch of volunteer responders to nearby out-of-hospital cardiac arrests (OHCAs) has emerged in several emergency medical services, but no randomized clinical trials have evaluated the effect on bystander use of automated external defibrillators (AEDs).

OBJECTIVE To evaluate if bystander AED use could be increased by smartphone-aided dispatch of lay volunteer responders with instructions to collect nearby AEDs compared with instructions to go directly to patients with OHCAs to start cardiopulmonary resuscitation (CPR).

DESIGN, SETTING, AND PARTICIPANTS This randomized clinical trial assessed a system for smartphone dispatch of volunteer responders to individuals experiencing OHCAs that was triggered at emergency dispatch centers in response to suspected OHCAs and randomized 1:1. The study was conducted in 2 main Swedish regions: Stockholm and Västra Götaland between December 2018 and January 2020. At study start, there were 3123 AEDs in Stockholm and 3195 in Västra Götaland and 24 493 volunteer responders in Stockholm and 19 117 in Västra Götaland. All OHCAs in which the volunteer responder system was activated by dispatchers were included. Excluded were patients with no OHCAs, those with OHCAs not treated by the emergency medical services, and those with OHCAs witnessed by the emergency medical services.

INTERVENTIONS Volunteer responders were alerted through the volunteer responder system smartphone application and received map-aided instructions to retrieve nearest available public AEDs on their way to the OHCAs. The control arm included volunteer responders who were instructed to go directly to the OHCAs to perform CPR.

MAIN OUTCOMES AND MEASURES Overall bystander AED attachment, including those attached by volunteer responders and lay volunteers who did not use the smartphone application.

RESULTS Volunteer responders were activated for 947 patients with OHCAs. Of those, 461 were randomized to the intervention group (median [IQR] age of patients, 73 [61-81] years; 295 male patients [65.3%]) and 486 were randomized to the control group (median [IQR] age of patients, 73 [63-82] years; 312 male patients [65.3%]). Primary outcome of AED attachment occurred in 61 patients (13.2%) in the intervention arm vs 46 patients (9.5%) in the control arm (difference, 3.8% [95% CI, −0.3% to 7.9%]; $P = .08$). The majority of AEDs were attached by lay volunteers who were not using the smartphone application (37 in intervention arm, 28 in control). There were no significant differences in secondary outcomes. Among the volunteer responders using the application, crossover was 11% and compliance to instructions was 31%. Volunteer responders attached 38% (41 of 107) of all AEDs and provided 45% (16 of 36) of all defibrillations and 43% (293 of 666) of all CPR.

CONCLUSIONS AND RELEVANCE In this study, smartphone dispatch of volunteer responders to OHCAs to retrieve nearby AEDs vs instructions to directly perform CPR did not significantly increase volunteer AED use. High baseline AED attachement rate and crossover may explain why the difference was not significant.

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Visual Abstract

Editorial

Supplemental content

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Survival after out-of-hospital cardiac arrest is dependent on prompt initiation of cardiopulmonary resuscitation (CPR) and defibrillation.[1,2] If performed within minutes, most patients can be saved.[3,4] Despite a substantial number of publicly available automated external defibrillators (AEDs) and widespread CPR training among the public, low bystander CPR and defibrillation rates are major obstacles to increased survival.[5-7]

In a prior randomized clinical trial, a system for mobile phone dispatch of volunteer responders to nearby out-of-hospital cardiac arrests increased overall bystander CPR rates.[8] If these systems integrate with registries containing publicly available AEDs, volunteer responders can also be dispatched to fetch the nearest accessible one and bring it to the scene of the arrest. This concept has emerged in several emergency medical services (EMS)[9-14] and is recommended in international resuscitation guidelines, but the effects have never been evaluated in a randomized clinical trial, to our knowledge.[15]

The aim of the Swedish AED and Mobile Bystander Activation (SAMBA) trial was to evaluate if a smartphone application, called Heartrunner, for dispatch of volunteer responders, named Heartrunners, could increase bystander use of AEDs in patients with out-of-hospital cardiac arrest.

Key Points

Question In out-of-hospital cardiac arrests, can the use of public automated external defibrillators (AEDs) be increased by using a smartphone application for dispatch of volunteer responders with instructions to bring public AEDs compared with instructions to go directly for cardiopulmonary resuscitation only?

Findings In this randomized clinical trial including 947 patients with out-of-hospital cardiac arrests, there was no statistical difference in the primary outcome of overall AED attachment rate, as 59% of all AEDs were applied by lay volunteers who were not using the smartphone application for dispatch of volunteer responders.

Meaning In this study, smartphone dispatch of volunteer responders to out-of-hospital cardiac arrests with instructions to retrieve nearby AEDs vs instructions to directly perform cardiopulmonary resuscitation did not significantly increase overall bystander AED use.

Methods

Trial Design and Setting

This study was a community-based randomized clinical trial, conducted in the Swedish regions of Stockholm (area of 6519 km^2 and 2.3 million inhabitants) and Västra Götaland (area of 23 942 km^2 and 1.7 million inhabitants)[16] between December 7, 2018, and January 31, 2020, as the first phase of 2, with an adaptive design approach. The aim of the first phase was to evaluate proxy clinical outcomes to adjust power prior to a second and continuous phase with 30-day survival as the primary outcome (the trial protocol is available in Supplement 1). The ethics review board in Stockholm approved the study (2016/1531-31/4). Information about the study and general data protection regulation was given to all survivors by mail.

Volunteer Responder System

In 2010, a mobile phone positioning system for dispatch of CPR-trained volunteer responders to nearby out-of-hospital cardiac arrests was implemented in the Stockholm region.[17] In 2016, the system was updated with a smartphone application named Heartrunner, developed for map-aided dispatch of CPR-trained volunteer responders. The volunteer responders enroll in the system, which has been previously described, by means of installing the application in their smartphones and registering as users.[18] Upon registration, the volunteer responders consent to have undergone CPR training and that their data can be used for research purposes and to be located and dispatched in case of suspected out-of-hospital cardiac arrest. To enable dispatch to nearby AEDs, the volunteer responder system was integrated with a national register of AEDs.[19] At study start, 3123 devices were registered in Stockholm and 3195 in Västra Götaland, and 19 117 volunteer responders were registered in the Västra Götaland Region and 24 493 were registered in the Stockholm Region.

Dispatch by the Emergency Medical Services of First Responders and Volunteer Responders

Calls to the Emergency Medical Communication Center are handled in accordance with a computer-aided standard medical index. When an out-of-hospital cardiac arrest is suspected (categorized as an unconscious adult with no or abnormal breathing), a 2-tier system of ambulances providing advanced life support is dispatched. In parallel, a pop-up box on the dispatcher's computer screen urges the dispatch of on-duty first responders (fire services and police) and activation of the volunteer responder system. The volunteer responder system locates a maximum of 30 volunteer responders within a 1.3-km radius from the suspected out-of-hospital cardiac arrest. Volunteer responders are requested via their smartphone application to accept or decline the alert. After acceptance of an alert, the volunteer responders receive map-aided route directions to the location of the suspected arrest. Depending on the type of assignment and additional information about the nearest accessible AEDs is also displayed (eAppendix and eFigure 1 in Supplement 2).

Patients, Randomization, and Study Procedure

Cases eligible for activation of the volunteer responder system (randomization) were emergency calls presenting as suspected out-of-hospital cardiac arrest between 7:00 AM and 10:59 PM. Cases not eligible for activation of the volunteer responder system (randomization) were emergency calls presenting as suspected out-of-hospital cardiac arrest due to trauma or suicide and in children (age ≤8 years) and cases occurring in a hazardous environment.

Inclusion criteria were all cases where the volunteer responder system was activated. Postrandomization exclusion criteria were (1) patients without out-of-hospital cardiac arrest, (2) patients not treated by the EMS, and (3) patients where the cardiac arrest was witnessed by the EMS.

Study Procedure

In patients allocated to intervention, 4 of 5 of all volunteer responders who accepted the alert received instructions to collect the nearest available AED and then go directly to the patient with suspected out-of-hospital cardiac arrest. Route directions to the scene of the cardiac arrest and the AED were displayed on their smartphones. One (closest to the cardiac arrest) of 5 volunteer responders was dispatched to go directly to initiate CPR. In patients allocated to the control group, all volunteer responders who accepted the alert were instructed to go directly to the patient with suspected out-of-hospital cardiac arrest to perform CPR. No route directions to or locations of AEDs were displayed (eFigure 1 in Supplement 2).

Allocation Procedure

The randomization (1:1) procedure was computerized and integrated within the volunteer responder system server. The allocation sequence was executed in blocks of 4, 6, and 8, where the different blocks had individual random seeding, and the block types were also in random sequence. Allocation was blinded to both researchers and dispatchers until final analysis was performed.

Study Outcomes and Other Prespecified Outcomes

The primary outcome was bystander-attached AED. The proportion of patients in which an AED was attached by any bystander (including volunteer responders and other lay volunteers who were not using this app) before arrival of EMS or on-duty first responders (fire and police services). Secondary outcomes were (1) bystander CPR (the proportion of patients where bystander CPR was performed by any bystander before arrival of EMS or on-duty first responders) and (2) bystander defibrillation (the proportion of patients where defibrillation was performed by any bystander before arrival of EMS or on-duty first responders). Primary and secondary observational outcomes in both study groups combined were prespecified.

Definitions of Study Outcomes

The primary and secondary outcomes of bystander-attached AED and bystander CPR and defibrillation before the arrival of the EMS (ambulance) or on-duty first responders (police and fire services) was defined as any AED attachment, CPR or defibrillation provided by any bystander before the arrival of the EMS (ambulance) or on-duty first responders (fire and police). This includes the actions of occasional bystanders not dispatched by the volunteer responder system in addition to the actions of dispatched volunteer responders.

Safety

During parts of the study period, there were recurrent meetings every 3 months with all stakeholders affected by the project (EMS, firefighters, police) and safety concerns and incidents (harm to volunteer responders, patients, or property as well as thefts and violation of patient secrecy) were urged to be reported. The county incident reporting system was used to collect safety issues and volunteer responders could report incidents in a free text field in the follow-up online survey.

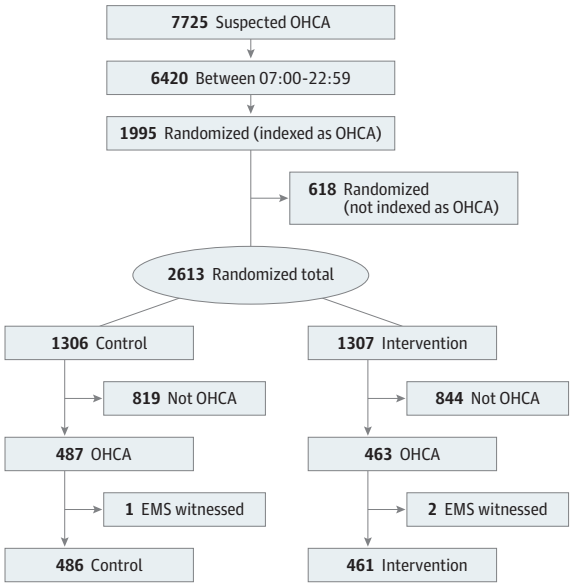
Data Collection

The Swedish Register of Cardiopulmonary Resuscitation was used for data collection. EMS personnel report data on attempted resuscitation according to a standardized template.[20] Additionally, computerized EMS patient records were searched with an algorithm for all patients in which the volunteer responder system was triggered to detect patients not reported to the registry. The Emergency Medical Communication Center data system contains digital time stamps for all emergency dispatch-related measures and geographical data for all emergency calls. The volunteer responder system server contains time stamps, location, and dispatch data of volunteer responders as well as the type of mission assignment. Actions by volunteer responders were collected in an online survey sent out as a short message system (SMS) text link 90 minutes after an alert to all dispatched volunteer responders. If no answer was received, a reminder was sent out twice more (eAppendix in Supplement 2). If they stated that they attached an AED, this was validated via a structured telephone interview.

Statistics and Sample Size Estimation

Postrandomization exclusion was planned for all patients without out-of-hospital cardiac arrest in both study arms, and sample size estimation was calculated for patients treated by the EMS. Based on the results of previous studies before the implementation of the volunteer responder system, we estimated a baseline AED attachment rate of 3% by bystanders before arrival of EMS and on-duty responders.[4] A previous observational feasibility study of the current system where all patients were handled as in the intervention group in the current study revealed an overall bystander attachment rate of 7%.[18] After planned technical and logistic improvement of the system, we hypothesized that we could improve the bystander AED attachment rate from a baseline of 3% in the control group to 9% in the intervention group. A total sample size of 628 patients ($\beta = 0.2$; $\alpha = 0.05$) was estimated. Results are presented as counts and percentages for categorial variables and median quartiles for continuous variables. All outcome analyses were performed among patients with out-of-hospital cardiac arrest confirmed by the Swedish Cardiac Arrest Register or EMS medical records. The primary and secondary outcomes are presented in proportions, with dichotomous analysis of between-group differences, using χ^2 tests, and results with 95% CIs. As a nonprespecified supplementary analysis, observational study outcomes were analyzed by comparing all randomized patients (regardless of group allocation) where 1 or more volunteer responder(s) arrived at the scene of the out-of-hospital cardiac arrest prior to the EMS or professional first responders to patients where the EMS or first responders arrived first. These data were analyzed using multivariable logistic regression and presented as odds ratios and 95% CIs. These results are presented in the eAppendix in Supplement 2. All analyses were conducted in R version 4.0.3 (R Foundation).

Figure 1. Allocated Patients With Suspected Out-of-Hospital Cardiac Arrest (OHCA)



Indexed as OHCAs indicates the dispatcher at the emergency dispatch center has assigned the call to be a suspected OHCA according to the medical index. EMS indicates emergency medical services.

Results

Patients

Figure 1 shows the flow of eligible and randomized patients. A total of 947 individuals with out-of-hospital cardiac arrests were included in the final analysis. Of these, 461 were allocated to the intervention group (median [IQR] age of patients, 73 [61-81] years; 295 male patients [65.3%]) and 486 to the control group (median [IQR] age of patients, 73 [63-82] years; 312 male patients [65.3%]). Baseline characteristics of all patients with out-of-hospital cardiac arrest included in the outcome analysis are shown in **Table 1**. No safety issues were reported during the study.

Outcomes

In patients allocated to intervention, 13.2% (n = 61) had an AED attached before arrival of EMS or first responders (primary outcome) vs 9.5% (n = 46) among patients allocated to the control group (difference, 3.8% [95% CI, −0.3% to 7.9%]; P = .08; **Table 2**). The majority of AEDs were attached by lay volunteers who were not volunteer responders using the smartphone application (37 in intervention arm, 28 in the control arm). Regarding the secondary outcome of bystander CPR, the proportion was 69.0% (n = 318) in patients allocated to intervention vs 71.6% (n = 348) in patients allocated to the control group (difference, −2.6% [95% CI, −8.4% to 3.2%]; P = .42). Concerning the secondary outcome of defibrillation before arrival of EMS, the proportions of patients were 3.7% (n = 17) in those allocated to intervention vs 3.9% (n = 19) in control patients (difference, −0.2% [95% CI, −2.7% to 2.3%]; P = .99).

Actions of Volunteer Responders

Survey answering rate was 72% (3500 of 4590) by volunteer responders who accepted an alert. In 24 of 61 patients of AED placement (39%), volunteer responders stated that they were first on the scene to provide attachment of AED in the intervention group (Table 2 and **Figure 2**). In patients allocated to the control group, the corresponding proportion was 37% (18 of 46). Volunteer responders provided defibrillation in 7 patients in the intervention group and in 8 patients in the control group. Volunteer responders were first to provide bystander CPR in 138 of 318 patients (43%) allocated to intervention vs 155 of 348 (45%) allocated to the control group.

As seen in **Figure 3**, 519 of 1681 volunteer responders (30.9%) who were assigned to fetch an AED stated that they attempted to do so. In the control group, 206 of 1807 volunteer responders (11.4%) stated that they tried to fetch an AED despite instructions to go directly to perform CPR.

Per patient, at least 1 volunteer responder stated that they tried to fetch an AED in 277 of 461 patients in the intervention group (60.1%), compared with 202 of 486 (41.6%) among the controls (eTable and eFigure 4 in Supplement 2).

Observational Outcomes

In observational outcome analysis in both study groups combined, volunteer responders were first to attach an AED in 41 of 107 patients (38%) of all bystander-attached AEDs. Defibrillation was carried out by volunteer responders in 16 of 36 patients (45%) of all instances of bystander defibrillation, and volunteer responders provided CPR in 293 of 666 patients (44%) of all instances of bystander CPR (eFigure 2 and eAppendix in Supplement 2).

In cases where volunteer responders arrived first on the scene, the odds ratio of bystander CPR was 2.5 (95% CI, 1.6-4.2), 5.2 (95% CI, 3.1-8.8) for attachment of an AED, and 10.5 (95% CI, 4.1-30.2) for bystander defibrillation vs no volunteer responder arriving first at the scene (eFigure 3 and eAppendix in Supplement 2).

Discussion

In this randomized clinical trial covering a population of 4 million individuals, we hypothesized that a system (Heartrunner) for smartphone dispatch of volunteer responders (Heartrunners) to nearby AEDs and out-of-hospital cardiac arrests could increase the use of AEDs compared with dispatch for CPR only. A difference of nearly 4% in the primary outcome in favor of intervention was observed. The main reason why the difference is not statistically significant may be the result of the large degree AED placement by volunteers who were not volunteer responders and well as crossover and low compliance to the given instructions among the volunteer responders. The proportion of patients who met the primary outcome in the control group owing to the actions of the volunteer responders was about one-third, being about the same proportion as in the intervention group, even though no volunteer responder in the control group received instructions to fetch an AED, hence creating a dilutional effect.

The reasons for crossover could be several, one being that an owner of an AED, or a volunteer responder close to one, will bring it, regardless of the instructions they received. Low compliance to instructions could also be explained by longer distances to collect the nearest AED, as reported in a previous study.[21] A solution to contamination of the control arm could be not to activate the system in patients with out-of-hospital cardiac arrests allocated to controls. However, this study was conducted in a setting with an existing system for dispatch of volunteer responders that has been shown to increase bystander CPR rates.[8] Since CPR is associated with increased survival, and the fact that the volunteer responder system is considered to be standard care in the study regions, we believed it unethical to remove an existing treatment system.

Due to crossover and low compliance, we also provide observational data and outcome for both study groups combined as 1 cohort. Altogether, there was a substantial proportion of patients who met the primary and secondary observational outcomes owing to the actions of the volunteer responders. We also observed that the overall chances of bystander CPR, AED attachment, and defibrillation increased substantially when 1 or more volunteer responder arrived first at the scene. This result is in line with that in a previous article from Copenhagen, Denmark.[14]

It is challenging to commit research in a prehospital environment at the level of the emergency medical dispatch center since a large number of randomized patients have suspected arrest and not true arrest treated by the EMS. We used postrandomization exclusion to exclude non-out-of-hospital cardiac arrests that were randomized since they were not participants for study intervention. It cannot be ruled out that this might have introduced some selection bias. However, the baseline characteristics and the even distribution of randomized patients in intervention vs control imply that the groups are balanced.

Volunteer responder systems are becoming widely implemented[22] and advocated in both US and European guidelines, being a strong recommendation based on observational studies carried out in both Europe and Asia.[23,24] The majority of these studies report an association between system activation and an increase in various outcomes such as bystander CPR or defibrillation and survival.[9,10,14,25] However, these studies show great heterogeneity in the selection of study groups and outcomes. The most recent, and so far, the largest study was carried out in the Netherlands. It involved stepped-wedge cluster analysis to show an association between system activation and increased survival to discharge among patients with ventricular fibrillation as the first registered rhythm.[26]

After the current analysis and adjustment of sample size for the primary outcome of 30-day survival, the aim was that the trial would continue into a second phase. As the results suggest crossover and poor compliance, we conclude that it will not be feasible to evaluate the effect on 30-day survival by using the current study design. Additionally, the County Council Assembly decided to pause the system in the spring 2021 because of the COVID-19 pandemic.

Table 1. Baseline Characteristics of Allocated Out-of-Hospital Cardiac Arrests by Treatment Group[a]

Characteristic	No./total No. (%)	
	Intervention	Control
No.	461	486
Region		
Västra Götaland	170/461 (36.9)	182/486 (37.4)
Stockholm	291/461 (63.1)	304/486 (62.6)
Age		
No.	402	419
Median (IQR)	73 (61-81)	73 (63-82)
Sex		
Male	295/452 (65.3)	312/478 (65.3)
Female	157/452 (34.7)	166/478 (34.7)
Witnessed		
Yes	211/406 (52.0)	233/424 (55.0)
No	195/406 (48.0)	191/424 (45.0)
Location		
Public	107/449 (23.8)	113/472 (23.9)
At home	342/449 (76.2)	359/472 (76.1)
Initial rhythm		
Shockable	88/457 (19.3)	83/483 (17.2)
Nonshockable	369/457 (80.7)	400/483 (82.8)
Etiology		
Medical	340/457 (90.0)	363/397 (91.4)
Other	38/379 (10.0)	34/397 (8.6)
Time		
7-11 AM	190/461 (41.2)	185/486 (38.1)
12-5 PM	156/461 (33.8)	166/486 (34.2)
6-11 PM	115/461 (24.9)	135/486 (27.8)
Time to dispatch, min		
EMS		
No.	458	484
Median (IQR)	1.75 (1.25-2.43)	1.8 (1.27-2.65)
Firefighter		
No.	457	476
Median (IQR)	2.93 (2.07-4.53)	3.1 (2.1-4.66)
Police		
No.	457	476
Median (IQR)	3 (2.07-4.53)	3.1 (2.1-4.66)
Volunteer responder		
No.	461	486
Median (IQR)	3 (2.17-4.92)	3.18 (2.23-4.8)
Call to arrival of EMS		
No.	451	473
Median (IQR)	10.83 (7.78-16)	11.42 (7.83-17.1)
Call to arrival of firefighters		
No.	406	432
Median (IQR)	10.47 (8.3-14.74)	11.31 (8.62-15.96)
Dispatch to arrival EMS		
No.	451	473
Median (IQR)	8.77 (5.72-13.81)	9.25 (5.92-14.42)

Abbreviation: EMS, emergency medical services.

[a] An out-of-hospital cardiac arrest is defined by the Swedish register of cardiopulmonary resuscitation, as treated by EMS personnel. Cases witnessed by EMS were not included in the analysis.

Finally, we do not interpret the lack of statistical differences between treatment groups to reflect the fact that the volunteer responder system does not have an effect. Instead, we

Table 2. Primary and Secondary Outcomes

Outcome	No./total No. (%)		P value	Difference (95% CI)	Risk ratio (95% CI)
	Intervention (n = 461)	Control (n = 486)			
Primary outcome					
Bystander-attached AED[a]	61/461 (13.2)	46/486 (9.5)	.08	3.8 (−0.3 to 7.9)	1.40 (0.97-2.01)
Secondary outcome					
Bystander CPR[a]	318/461 (69.0)	348/486 (71.6)	.42	−2.6 (−8.4 to 3.2)	0.96 (0.89-1.05)
Bystander defibrillated[a]	17/461 (3.7)	19/486 (3.9)	.99	−0.2 (−2.7 to 2.3)	0.94 (0.50-1.79)
Actions by volunteer responder using the smartphone application, No.					
Volunteer responder-attached AED[b]	24	18	NA	NA	NA
CPR by volunteer responder[c]	138	155	NA	NA	NA
Defibrillation by volunteer responder[b]	7	9	NA	NA	NA
Actions by volunteers not using smartphone application, No.					
Volunteer-attached AED	37	28	NA	NA	NA
CPR by volunteers	180	193	NA	NA	NA
Defibrillation by volunteers	10	10	NA	NA	NA

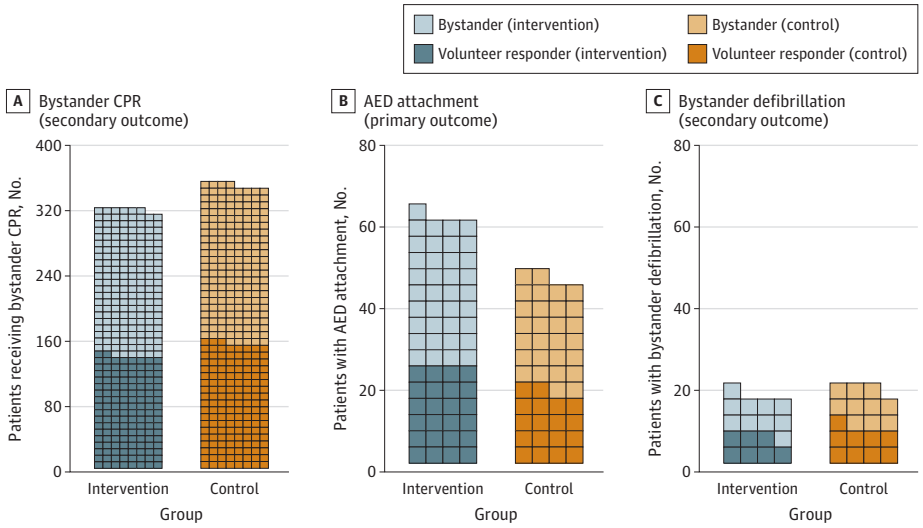
Abbreviations: AED, automated external defibrillator; CPR, cardiopulmonary resuscitation; NA, not applicable.

[a] Bystanders are all lay volunteers, including those using and not using the smartphone application.

[b] Data from web survey. Each case was subsequently validated through structured telephone interview.

[c] Data from web survey.

Figure 2. Outcomes and Actions Performed by Bystanders and by Dispatched Volunteer Responders



Bystander cardiopulmonary resuscitation (CPR) (A), automated external defibrillator (AED) (B), and bystander defibrillation (C) outcomes are shown. Each square indicates 1 patient with out-of-hospital cardiac arrest. Volunteer responder actions are validated by online survey and a telephone interview.

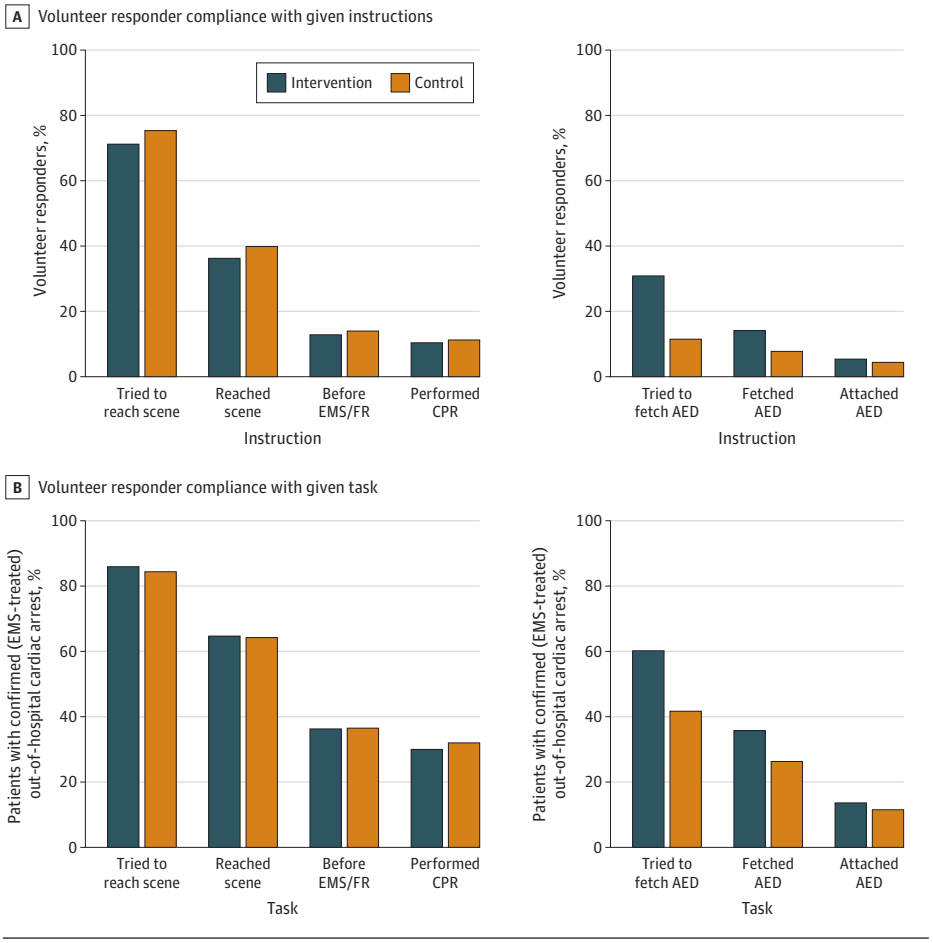
conclude that the control group grew strong as a result of methodological issues. Therefore, our overall conclusion is that the volunteer responder system contributes to an increase in the overall use of AEDs and bystander CPR and may represent an important complement to the efforts of standard EMS and first responders.

Strengths and Limitations

The present study has strengths. First, it is one of the first randomized clinical trials carried out to evaluate the effects of a lay responder system, including nearly 1000 patients with out-of-hospital cardiac arrest in 2 metropolitan areas. Second, allocation was blinded to the researchers and dispatchers until final analysis. Third, we collected data on primary outcome by way of firsthand information from the dispatched volunteer responders, medical records, and telephone follow-up. Fourth, this study was carried out in a setting with an existing first responder system and a high bystander CPR baseline. We believe that the results from our study can be generalized to other settings with similar high-performance EMS and first responder systems as in Sweden.

There are also several limitations. First, only proxy clinical outcomes are reported. Second, there was poor compliance to instructions and contamination of study groups by crossover. Third, because of cultural and/or legal differences, the results of our study might not be relevant in other settings and might not be applicable for cases occurring at nighttime and those resulting from trauma, intoxication, or suicide attempts.

Figure 3. Volunteer Responder Compliance



AED indicates automated external defibrillator; CPR, cardiopulmonary resuscitation; EMS/FR, emergency medical services and first responders (police, fire department).

Conclusions

Smartphone dispatch of volunteer responders (Heartrunners) to out-of-hospital cardiac arrests with instructions to retrieve nearby AEDs, compared with instructions to perform CPR directly, did not significantly increase the bystander attachment rate. In addition to many AEDs applied by volunteer responders outside of this smartphone application, volunteer responders who did use this application in both treatment groups attached AEDs in a large proportion of cases, which may explain why the difference was not significant.

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Concept and design: Berglund, Hollenberg, Svensson, Claesson, Nordberg, Forsberg, Rosenqvist, Högstedt, Ringh.
Acquisition, analysis, or interpretation of data: Berglund, Hollenberg, Jonsson, Svensson, Nord, Nordberg, Lundgren, Riva, Ringh.
Drafting of the manuscript: Berglund, Jonsson, Svensson, Ringh.
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Other: Nord.

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