Will shorter distance between dispatched lay-rescuer and out-of-hospital cardiac arrest increase cardiopulmonary resuscitation and early defibrillation rates?

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Aim: To increase early defibrillation in out-of-hospital cardiac arrests (OHCAs), the Capital Region of Denmark has implemented a smartphone application-based first-responder system which activates registered volunteers (heart runners) to participate in OHCA resuscitation (Heart Runner-app). We investigated whether shorter distances between heart runners and OHCAs increased the cardiopulmonary resuscitation (CPR) and early defibrillation rates.

Methods: We identified all consecutive cases of OHCA from February 12 to August 12, 2018. The Heart Runner-app included 21,673 registered heart runners (=1,204 heart runners/100,000 inhabitants) and was linked to the Danish AED Network, holding a total of 5,416 automated external defibrillators (AEDs) (117 AEDs/100,000 inhabitants/1,000 km²). Heart runner and OHCA locations at the time of the alarm were provided by the Heart Runner server as coordinates. Heart runners were stratified according to straight line distance to OHCA in three groups (<3 minutes, 3-9 minutes, and >9 minutes from OHCA). For Figure 2, an OHCA was classified as a group 1 if at least one heart runner < three minutes arrived prior to Emergency Medical Services (EMS), and group 2 and 3 if at least one heart runner 3-9 and >9 minutes from OHCA arrived prior to EMS, respectively. We estimated an average speed for heart runners to 2 m/s. All heart runners received an electronic survey after being alerted which collected information on arrival prior to EMS and if a heart runner applied an AED.

Results: In 236 OHCAs, 4,315 heart runners were alerted and 1,085 (25%) accepted the alarms. Of those, 610 (56%) answered the survey and 209 (34%) reported they arrived prior to EMS. Distribution over groups shown in Figure 1. At least one heart runner arrived prior to EMS in 98/236 (42%) of all the OHCA cases. One case was excluded due to missing data. In cases where at least one heart runner < three minutes from OHCA arrived prior to EMS (group 1), 88% of all the cases got bystander CPR and 35% was bystander defibrillated, Figure 2.

Figure 1.

Figure 2.

	Group 1, No. (%)	Group 2, No. (%)	Group 3, No. (%)	Total, No. (%)	P
Lay-rescuers accepting the alarm	342 (32)	620 (57)	123 (11)	1,085 (100)	
Answered the survey	174 (29)	370 (61)	66 (11)	610 (56)	
Arrived prior to EMS	76 (44)	108 (29)	25 (38)	209 (34)	
OHCAs with bystander CPR	43 (88)	34 (85)	5 (56)	82 (85)	<0.05
AED applied by a bystander	34 (69)	16 (41)	4 (44)	54 (56)	<0.05
OHCAs with bystander defibrillation	17 (35)	4 (10)	1 (11)	22 (22)	<0.05

Conclusion: One-third of all heart runners were < three minutes from OHCA when accepting the alarm. Shorter distances between OHCA and heart runner were associated with higher rates of bystander HLR, bystander AED application, and bystander defibrillation.