

FirstAED Emergency Dispatch, Global Positioning of First Responders with Distinct Roles - A Solution to Reduce the Response Times and Ensuring Early Defibrillation in the Rural Area Langeland

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Abstract. FirstAED is a supplement to the existing emergency response systems. The aim is to shorten the first responder response times at emergency calls to below 5 minutes. FirstAED defines a way to dispatch the nearby three first responders and organize their roles in the hope of reducing response times, ensuring citizens safety and equal possibility to early defibrillation.

First aid is provided by first responders who use their smartphone (iPhone 4S/5). FirstAED Global Positioning System GPS-track the nine nearby first responders and enables the emergency dispatcher to send an organized team of three first responders with distinct roles to the scene.

During the first 21 months the FirstAED system was used 588 times. Three first responders arrived in 89 % of the cases, and they arrived before the ambulance in 95 % of the cases. FirstAED entailed a significant reduction in median response time to 4 minutes 9 seconds.

Keywords: Cardiopulmonal resuscitation, response time, first responder, dispatching, Public Access Defibrillation (PAD), Global Positioning System (GPS).

1 Introduction

Sudden out-of-hospital cardiac arrest (OHCA) is the leading cause of death in developed countries. In Denmark, approximately 3.500 people suffer an out-of-hospital cardiac arrest every year. The overall survival rate for out-of-hospital cardiac arrest is low, approximately 10 % [1]. International guidelines recommend cardiopulmonal resuscitation (CPR) within 5-6 minutes [2] and early defibrillation with an automated external defibrillator (AED) with the purpose to increase the survival rate [3]. Shortening the ambulance/paramedic response times to less than five minutes in the rural areas of Denmark including the island of Langeland, is however extremely expensive and unrealistic. Therefore dispatch of volunteer trained first responders is a good, cheap, alternative solution.

Dispatching of volunteer first responders are established in the Netherlands [4] and in the RUMBA study in Stockholm, Sweden [5]. In both studies many volunteer laypersons can be alerted at the same time by the system. The Dutch system uses CPR-AED-Alert text messages to the local (living and/or working in the area) first responders to pick up the AED or to go to the victims of suspected out-of-hospital cardiac arrest and provide early cardiopulmonary resuscitation and defibrillation.

The Dutch model of emergency pre-hospital cardiac care began around five years ago, when it was clear that standard ambulance response times around 15 minutes were too long to provide an effective cardiopulmonary resuscitation service. Some rural Dutch regions have reduced the time from first emergency call to defibrillation to 7-8 minutes and increased the overall survival rate to 23 % [4].

In the RUMBA study, when an alarm call of a suspected out-of-hospital cardiac arrest is received by the EMS dispatch operator a Mobile Positioning System (MPS) is activated. The MPS uses the mobile phone network to geographically locate all lay volunteers connected to a tailored mobile phone service called Mobile Life Saver (MLS). The MPS then locates all lay volunteers within a pre-defined radius from the suspected out-of-hospital cardiac arrest and alerts them with a computer generated voice call and a sms containing data about where the suspected out-of-hospital cardiac arrest is located. A map is also sent in order to make route finding easy.

The island of Langeland is a part of the rural Denmark. Langeland is just around 60 kilometres (km) long and around 10 km at its widest. The island is characterized by long ambulance response times and long distances to the local Svendborg Hospital approximately 20 – 50 km.

The island has a population of 13.000 inhabitants, but in the summertime the population grows, when approximately 260.000 tourists visit the holiday island.

The island has only one ambulance and one paramedic vehicle. That can cause very long response times in the case that the ambulance is reserved for another duty. The average ambulance response time is 12 minutes, but more than 33 % of the ambulances arrives after more than 15 minutes. There are additionally plans for closing the Emergency Unit at the local Svendborg Hospital and building a new common Emergency Unit at the Odense University Hospital, located approximately 85 kilometres from the distal parts of the island.

The messages about the long ambulance response times and closing down the local Emergency Unit were very essential for the inhabitants 6 years ago, when the idea about founding the Langeland AED association was born. The inhabitants understood that they could not expect the Public Emergency Services to save their lives in a case of an acute emergency or cardiac arrest. They needed to take part in the first aid, the cardiopulmonary resuscitation and to establish Public Access Defibrillation (PAD).

The Langeland AED association was established in March 2008 and the members collected money, raised funds for buying AEDs, AED cabinets and resuscitation kits. They also established small local AED associations and provided first aid training to the volunteer first responders. Today there are 32 local AED associations in the Langeland AED association. The population purchased 96 AEDs which are available around the clock and placed less than two kilometres apart. Some of the AED's are placed in a temperature regulated, GPS controlled AED cabinets, which are localized

and activated (emergency light and siren) by the new FirstAED alert system. The total fundraising amounted to approximately 340.000 €.

Adverts in the local newspaper, posters in the town and streamers on the cars were the media used to encourage the citizens to become first responders. Two hundred and fifteen volunteer first responders in the age 18-72 years were recruited in 2011 and they all received a 12 hours basic first aid training course (Airway, Breath, Circulation, Disability protocol) including cardiopulmonary resuscitation and how to use an AED. Every year all the first responders receive a 3 hours back up training course including a new theme like basic pediatric life support, basic trauma life support (assess injuries, stabilization of cervical spine, seal wounds etc.).

In the beginning of the project, various models for calling the first responders were tried. At first, a model with information cards/posters with the AED owner contact details in combination with local telephone calls was tried, but very soon, this model proved not to be effective. Next an emergency telephone call to the first responder registered in the Danish AED registry (www.hjertestarter.dk) was tried, again without major improvement in response times. At last a model with emergency text messages sent to the local first responders was tested. But it became obvious that none of the models were effective enough in a rural area like the island of Langeland to shorten the response time for first responders to less than 5 minutes.

Often the first volunteer first responder was too far away to help, and the next volunteer first responder on the list had to be called losing valuable seconds or even minutes in the resuscitation process. Generally the first responder arrived to the emergency scene after 8-10 minutes. They were often alone helping the patient, providing comfort to the relatives and sometimes giving cardiopulmonary resuscitation or basic trauma support, which could be a very dramatic and stressful experience – especially since the outcome was often dubious.

The Langeland AED association experienced that they needed to develop a more optimal dispatching system to the volunteers on the island. The smartphone application FirstAED was developed. The FirstAED solution GPS track the first responders smartphones. FirstAED is an auxiliary to the public services and it enables the emergency dispatcher to send an organized team of first responders with distinct roles to the scene.

All the 200 first responders were asked to buy their own rescuer smartphone (iPhone 4S/5). Some of the first responders were too old to use smartphones or too poor to buy the smartphone for the price 530 €, but a lot of new younger people were attracted by the smartphone solution.

2 Aim

2.1 Reduction in First Responder Response Time and AED on Site Time

The smartphone application FirstAED was developed with the target to reduce the first responder response time at emergency calls to below 5 minutes and to secure arrival of an AED within 6 minutes in a rural part of Denmark.

2.2 Organization of First Responders in a Rescue Team Structure

The project defines a new way to dispatch the nearby first responders and organize their roles in a rescue team structure in the hope of reducing response times, establishing early Public Access Defibrillation (PAD) and improving survival rates.

2.3 Assessment of the Cowork between First Responders and Paramedics/ Ambulance Staff

The project assess the extent to which volunteer first responders can help the paramedics and the ambulance staff in the rescue missions.

3 Methods

3.1 Setting

This study evaluate (preevaluate) all initial calls to EMS Ambulance Funen from April 1, 2012 to December 31, 2013 in which an emergency situation or out-of-hospital cardiac arrest was suspected and first responders had been alerted by the FirstAED Alert on the island of Langeland.

The project was designed in collaboration between the department of Cardiology at the Odense University Hospital, the Region of Southern Denmark and the Langeland AED association.

3.2 Emergency Medical System and FirstAED

Emergency Medical System (EMS) Ambulance Rudkoebing serves the island of Langeland in Denmark. Like all EMS's in Denmark, a national emergency telephone number, 112, is connected to the regional dispatch centre of the EMS. The dispatch centre is manned by experienced nurses who instruct different ambulance services with ambulance posts spread over the Region of Southern Denmark. When the nurse at the dispatch centre suspect an emergency situation or a cardiac arrest in the initial call (Danish Category A duty), one ambulance is dispatched. Immediately after dispatching the ambulance, the health care assistant manager at the dispatch centre activate the FirstAED GPS Alert system to dispatch three GPS tracked first responders. When the health care assistant manager activates the FirstAED GPS Alert system, the system GPS track all available first responders and the EMS FirstAED iPad shows the position of all the first responders and AEDs (Fig 1).

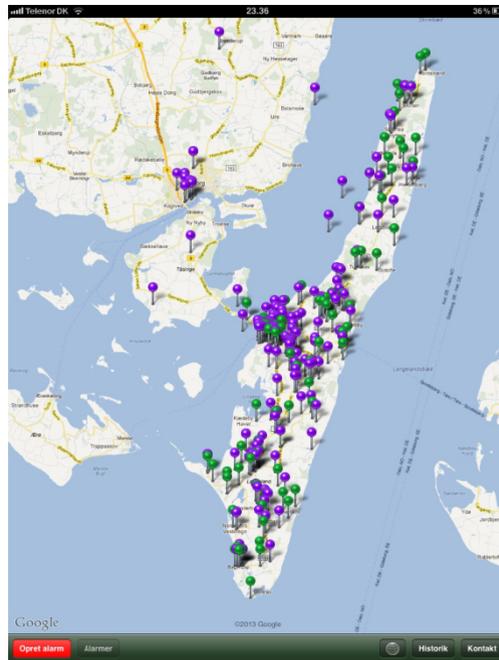


Fig. 1. Photo from EMS iPad showing the position of anonymised first responders (purple pushpins) and the 96 AEDs (green pushpins) a random day at the island of Langeland

The nurses uses following dispatching categories: Disease, Accident, Cardiac Arrest, Traffic Accident, Others (hanging, birth, diver with decompression sickness).

3.3 FirstAED-GPS-Alert Process

The FirstAED technology deployed on Langeland uses the Global Positioning System (GPS). GPS is a space-based satellite navigation system that provides location and time information anywhere on the Earth.

FirstAED is activated by the nurses at the central dispatch centre either on an iPad or by automatic signal from the Computer Aided Dispatch System. FirstAED Alert starts an automated communication sequence, GPS-track and send a push-message to the nine nearby first responders who can choose to accept or reject the alarm (Fig. 2).

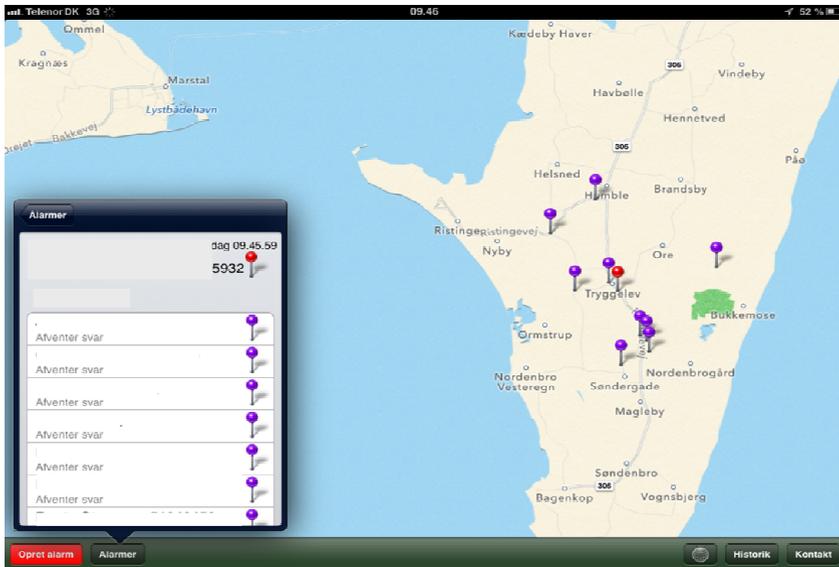


Fig. 2. Dispatch category Cardiac Arrest – 20 seconds after activation of the system. Photo from the EMS iPad showing the location of the geographically nearest nine first responders (purple pushpins) which were alerted via their iPhone. The place of the cardiac arrest is marked with the red pushpin.

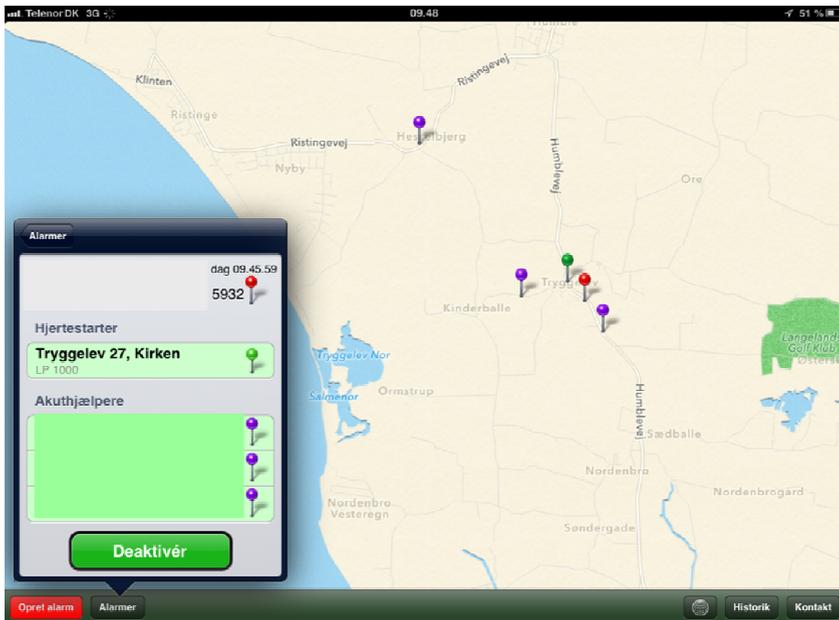


Fig. 3. Dispatch category Cardiac Arrest – 35 seconds after activation of the system. Photo from the EMS iPad showing the location of the three first responders (purple pushpins) who received distinct resuscitation tasks on their iPhone. The place of the cardiac arrest is marked with red pushpin and the place of the nearest AED is marked with the green pushpin.

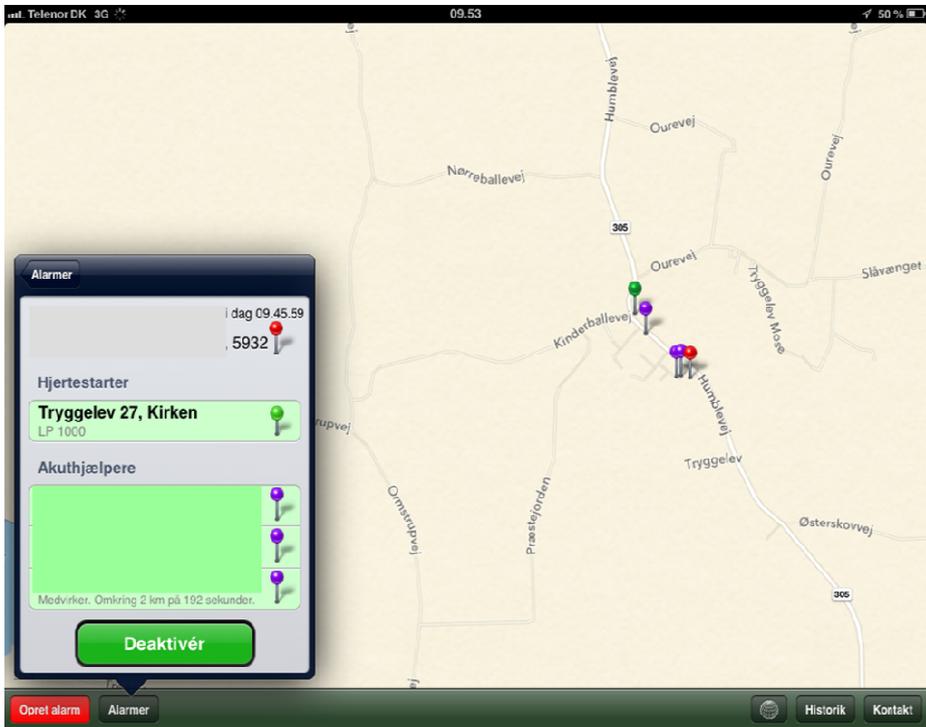


Fig. 4. Dispatch category Cardiac Arrest – 275 seconds after activation of the system. Photo from the EMS iPad showing the location of the three first responders (purple pushpins). Two first responders including the AED have arrived at the cardiac arrest site.

FirstAED chooses the three most optimally located first responders who have accepted the alarm. FirstAED organizes the three first responders in a team with distinct roles: no. 1 reaches the patient to give first aid/cardiopulmonary resuscitation; no. 2 brings the AED; and no. 3 is the onsite coordinator (Fig 3 and 4).

When the call-out is completed, the first responders have the opportunity to fill in a case report on their smartphones, and in the case they wish to discuss the life-saving activities with a supervisor they have the possibility to request debriefing.

3.4 Study Population and Data Collection

This study uses preliminary information from dispatching 215 trained volunteer first responders, including 15 nurses and 3 doctors.

FirstAED exchanges data between many different units and ties it all together, in a unified infrastructure-based communication (Fig 5).

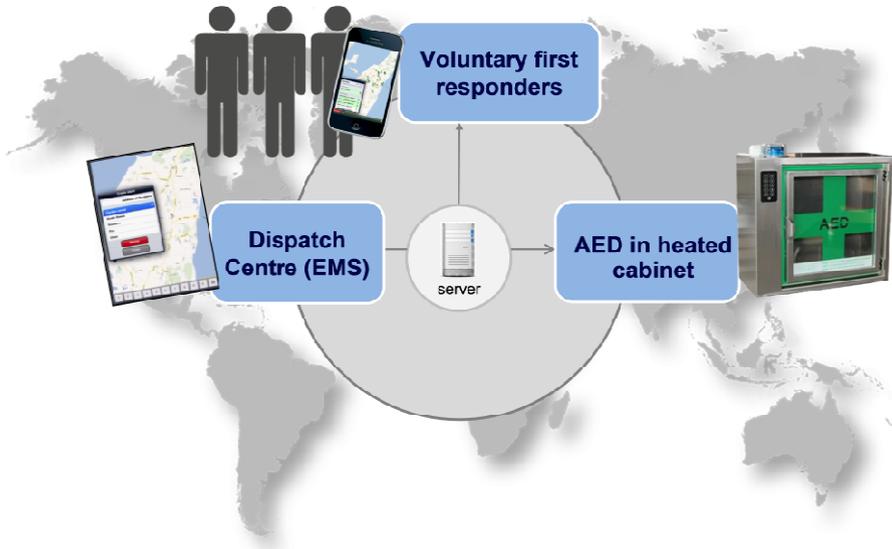


Fig. 5. FirstAED modern IT technology connects the healthcare assistant manager at the EMS dispatch centre, first responders and AEDs located in GPS controlled AED cabinets

The FirstAED IT-system collect dispatching data about the dispatching category, the emergency place location, the nine first responders involved in the alarm, the three first responders in the rescue team and their tasks, the GPS tracked first responder arrival time and the first responder case report.

Another part of the study compare the dispatching data with the Regional and University Hospital database, Cosmic. This part of the study will in the future look upon patient diagnoses, professional versus first responder response times, and evaluate 30 days and 12 months survival rates.

3.5 Statistical Analysis

Summary statistics (percentages, median value and range). All statistical analyses were performed with the use of the Excel statistical package.

4 Results

April 2012 the FirstAED system was implemented. During the first 21 months the FirstAED alarm system was used 588 times (table 1).

Table 1. Distribution of dispatch categories

<i>Dispatch category</i>	Number of dispatches
Disease	484
Accident	45
Cardiac Arrest	26
Traffic accident/ fire	21
Others	12
Total april 2012- december 2013	588

Three first responders arrived in 89 % and two first responders in 7 % of the cases (table 2).

Table 2. Number of activated first responders on site

<i>Number of first responders on site (n = 588)</i>	Percentage distribution
3 first responders	89,1 % (n = 523)
2 first responders	7,1 % (n = 42)
1 first responder	3,1 % (n = 18)
0 first responder	0,7 % (n = 5)

The first first responder arrived before the paramedic/ambulance staff in 90 % or at the same time as the paramedic/ambulance staff in 8 % of the cases.

FirstAED entailed a significant reduction in first responder median response time from more than 8-10 minutes before to 4 minutes 9 seconds after (table 3). The first responder was on site in less than 5 minutes in more than 60 % of the cases.

Table 3. First first responder response time (median response time + range)

<i>Response time – First first responder</i>	Time
Median	249 sek.
Range	[1 – 1200 sek.]

The AED was on site within a median time of 5 minutes and 58 seconds (table 4).

Table 4. AED on site (median response time + range)

<i>Response time – AED on site</i>	Time
Median	358 sek.
Range	[1 – 1813 sek.]

During the first 21 months, the first responders were involved in 8 cardiac arrests (3 patients survived, 1 more than 30 days), 3 hangings (1 patient survived more than 30 days), 6 patients with serious respiratory insufficiency (5 patients survived more than 30 days), 25 patients with acute myocardial infarction (all survived more than 30 days), 1 patient with subarachnoid haemorrhage (complete restituted), 5 children with febrile seizures, two divers with decompression sickness (complete restituted) and positioning of more than 10 traffic accidents.

5 Conclusions

The new FirstAED solution has reduced the time to first responder and AED on site remarkably. It is ensured that in 98 % of the cases help from more than one person is quickly on-site. Peer support and feedback is provided to the first responders.

The FirstAED technology implement strategic location of the AEDs, development of a team with responsibility for monitoring and maintaining the devices, training and retraining programmes for the volunteer first responders. FirstAED GPS-tracking reduces the first responder response times, and the quality of the effort improves as all the first responders who accept the FirstAED alarm have distinct roles. FirstAED localize and activate all the GPS activated AED cabinets, which makes it easy to collect the AED from the AED cabinet in foggy weather and dark nights. FirstAED is a logistic solution to reduce response times to below 5 minutes for first responder programmes. FirstAED defines a way to dispatch the nearby first responders and organize their roles in the hope of reducing response times, ensuring citizens safety and equal possibility to early defibrillation.

References

1. Wissenberg, M., Lippert, F.K., Folke, F., et al.: Association of National Initiatives to Improve Cardiac Arrest Management With Rates of Bystander Intervention and Patient Survival After Out-of-Hospital Cardiac Arrest. *JAMA* 310(13), 1377–1384 (2013)
2. Deakin, C.D., Nolan, J.P., Soar, J., et al.: European Resuscitation Council Guidelines for Resuscitation 2010. Section 4. Adult advanced life support. *Resuscitation* 81, 1305–1352 (2010)
3. Koster, R.W., Baubin, M.A., Bossaert, L.L., et al.: European Resuscitation Council Guidelines for Resuscitation 2010. Section 2. Adult basic life support and use of automated external defibrillators. *Resuscitation* 81, 1277–1292 (2010)
4. Dutch emergency care a global model - Response time down to eight minutes when locals gets involved. *ESC Congress News 2013 - Amsterdam* (2013)
5. Ringh, M., Fredman, D., Nordberg, P., et al.: Mobil phone technology identifies and recruits trained citizens to perform CPR on out-of-hospital cardiac arrest victims prior to ambulance arrival. *Resuscitation* 82, 1514–1518 (2011)