Resuscitation 82 (2011) 1273–1278

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Clinical Paper

Early cardiopulmonary resuscitation and use of Automated External Defibrillators by laypersons in out-of-hospital cardiac arrest using an SMS alert service☆

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ARTICLE INFO

Article history:
Received 17 December 2010
Received in revised form 5 April 2011
Accepted 2 May 2011

Keywords:
Cardiopulmonary resuscitation (CPR)
Automated External Defibrillator (AED)
Defibrillation
Emergency medical service (EMS)
Out-of-hospital cardiac arrest

ABSTRACT

Aim: To evaluate an SMS service (SMS = short message service = text message) with which laypersons are alerted to go to patients with suspected out-of-hospital cardiac arrest and perform early cardiopulmonary resuscitation (CPR) and use an Automated External Defibrillator (AED). This study is the first to report on a program in which an emergency medical service (EMS) is able to alert citizens by sending them SMS messages on their mobile phone.
Methods: Web-based questionnaires were completed by laypersons who were sent an alert by the AED-Alert system between February 1, 2010 and April 30, 2010. Questions concerned the process of training, receiving alerts, actions taken and follow-up care.
Results: AED-Alert was activated for 52 patients suspected of cardiac arrest, sending 3227 alerts to 2287 laypersons. Out of 2168 eligible laypersons 1679 (77%) completed 2098 questionnaires, one for each alert. Action was taken in only 579 alerts. Laypersons were not in the patient's vicinity (41%), noticed alerts too late (35%), or other reasons (24%). In 298 alerts laypersons faced problems with retrieving AEDs (51%), finding addresses (29%), traffic (5%), or other (15%). Aid was provided in 75 alerts, involving 47 patients. Laypersons started early CPR and defibrillation (49%), assisted EMS personnel (52%), or took care of family (39%). Laypersons arrived before EMS personnel in 21 patients, started CPR and defibrillation in 18, and assisted EMS personnel in 9 patients.
Conclusion: Improvements of the SMS alert service by laypersons, the EMS, and through technical adjustments, could increase the number of laypersons who provide early aid.

1. Introduction

Sudden out-of-hospital cardiac arrest is a leading cause of death in developed countries. In the Netherlands, approximately 16,000 cases of sudden cardiac arrest occur out-of-hospital each year.[1] The overall survival rate is between 5% and 10%,[2] and depends on early recognition and call for help, cardiopulmonary resuscitation (CPR), defibrillation with an Automated External Defibrillator (AED), and advanced care.[3]

Over 40% of cardiac arrests occur due to ventricular fibrillation.[4–7] Survival rates for patients with this abnormal heart rhythm can reach up to 50–75% if early CPR and defibrillation are performed within 3–5 min after cardiac arrest.[8] However, patient's chance of survival decreases approximately 7–10% with every minute delay in defibrillation.[9,10]

Several studies report that in most communities, time from collapse to arrival of emergency medical service (EMS) personnel is 7–8 min or longer.[11,12] It is virtually impossible to reduce the delay by improving logistics and availability of EMS teams. Therefore, it is expected that further improvements can only be achieved by involving laypersons to perform CPR and defibrillation during the first minutes after cardiac arrest. Ambulance Oost, the EMS of Twente, started an early intervention program in 2008 and implemented the AED-Alert system. The program is unique in that it enables the EMS to alert laypersons by sending them an SMS message on their mobile phone requesting them to go to patients requiring emergency care in order to perform early CPR and defibrillation.

In this aspect it is essentially different from other existing programs.[11,14] Guidelines have been developed including planned

☆ A Spanish translated version of the abstract of this article appears as Appendix in the final online version at doi:10.1016/j.resuscitation.2011.05.008.

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doi:10.1016/j.resuscitation.2011.05.008

and practised response, training of anticipated rescuers in CPR and use of the AED, link with the local EMS system, and continuous audit and quality improvement.[8,14,15] This study aims to systematically collect relevant information with which to make recommendations for EMS providers who wish to adopt such a program. It is not, however, the goal to evaluate the clinical value of an SMS alert service.

Therefore, the objective of this study is to evaluate the process of alerting laypersons to go to patients with an out-of-hospital cardiac arrest and perform early CPR and defibrillation. The evaluation provides insight in the extent to which laypersons take action upon SMS alerts and provide first aid. Moreover, it identifies problems and potential solutions which may be used to improve the process. An efficient process is important since immediate resuscitation of patients with an out-of-hospital cardiac arrest is assumed to increase survival.[11]

2. Methods

2.1. Setting

This study evaluated initial consecutive emergency calls to the EMS provider from February 1, 2010 to April 30, 2010, in which an out-of-hospital cardiac arrest was suspected and laypersons had been alerted by AED-Alert. The AED-Alert system is part of a program which was started by the EMS in order to build a system that could alert citizens through SMS messages urging them to go to patients requiring emergency care in order to perform early CPR and defibrillation.

On April 30, 2010 almost 6000 volunteer citizens and about 475 AEDs were registered in the program. Recruitment and registration of these volunteers took place through training, the website of the program, and various advertisements and campaigns. Most AEDs registered in the program were privately owned, or owned by communities or companies that distributed them in industrial areas and public places such as shopping malls, neighbourhoods, and businesses.

2.2. Emergency medical system and AED-Alert

EMS Ambulance Oost serves a specific region, Twente, in the Netherlands. This region has a population of about 620,000 inhabitants, and encompasses 1504 km^2, of mainly rural areas, with some urban and suburban areas. Half of the population consists of men, and overall 16% is over the age of 65.[13]

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 direct ambulances that are placed throughout the region. If in the initial call a cardiac arrest is suspected, two ambulances are dispatched. Immediately thereafter, nurses activate the AED-Alert system. This system automatically selects registered laypersons that live or work on an address within 1000 m of the patient, and sends them an SMS message on their mobile phone to go to the patient and perform early CPR and defibrillation. This SMS message contains the location of the patient and if applicable the location of the nearest AED.

2.3. AED-Alert process

Fig. 1 gives an overview of the process of alerting laypersons. Only volunteer citizens who are qualified to perform basic life support, preferably supplemented by a valid certificate of AED training, are able to enrol in the program. After enrolment, laypersons may receive alerts on their mobile phone in case of a suspected out-of-hospital cardiac arrest near their registered home or work address. Laypersons who are trained in using an AED may receive a message

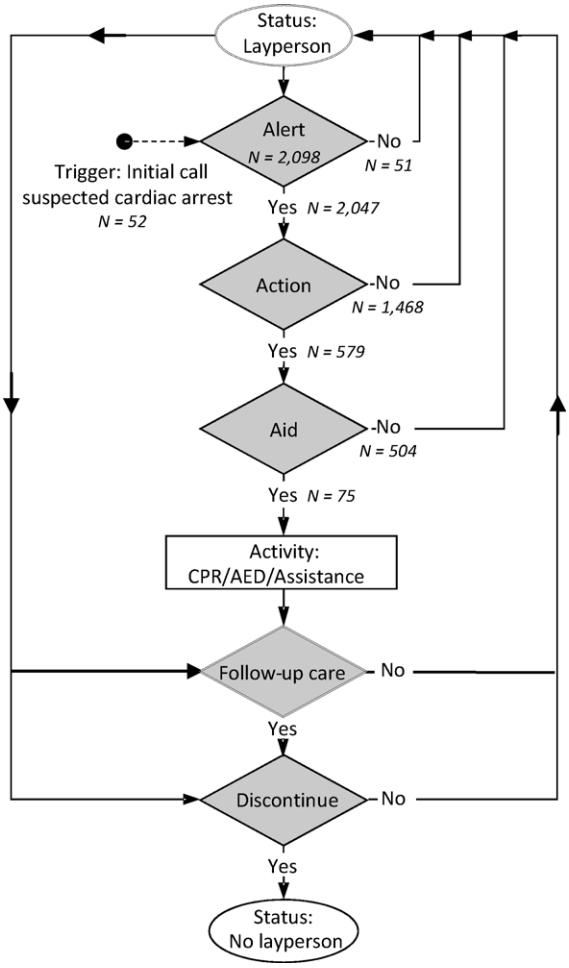

Fig. 1. AED-Alert process.

to retrieve an AED on their way to the patient. If there is no AED in the vicinity, all laypersons are alerted to start CPR. Laypersons who are able to go to the patient, take action. They perform early CPR and use the AED. Others assist laypersons or EMS personnel, or take care of family and bystanders. After the alert, the EMS offers laypersons the opportunity to receive follow-up care. Laypersons have the opportunity to discontinue enrolment in the program.

2.4. Study population and data collection

This study used information from EMS administrative databases. Information gathered from these databases included the time of the initial emergency call to the EMS reporting a suspected out-of-hospital cardiac arrest, the localisation of the patient, the time alerts were sent, laypersons who were alerted, the AEDs registered in the patient's area, and AEDs mentioned in the alert. The study included laypersons in Twente with an email address and to whom AED-Alert sent SMS messages between February 1, 2010 and April 30, 2010. These laypersons were requested to complete a web-based questionnaire.

The web-based questionnaire focused on the recent AED alert and process that followed. The questionnaire was constructed on the basis of results from a pilot study that explored layperson experiences with the AED-Alert system based on 11 interviews and 138 surveys. The questionnaire was pre-tested by three laypersons and revised to generate the final edition, which consisted of multiple choice questions with the opportunity to give an alternative answer.