



Clinical Paper

A link between emergency dispatch and public access AEDs: Potential implications for early defibrillation[☆]Thomas Rea^{a,b,*}, Jennifer Blackwood^a, Susan Damon^a, Randi Phelps^a, Mickey Eisenberg^{a,b}^a EMS Division of Public Health, Seattle & King County, Seattle, WA, United States^b The University of Washington, Seattle, WA, United States

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ABSTRACT

Background: Public access defibrillation can improve survival but is involved in only a small fraction of out-of-hospital cardiac arrest. One approach to increase involvement is to couple emergency dispatch with mapping technology to identify public access automated external defibrillators (AEDs) that are on-site or nearby.

Methods: We conducted a retrospective observational cohort investigation of out-of-hospital cardiac arrest who received dispatch by a community dispatch center between January 1, 2007 and December 31, 2009. The dispatch system is linked to the public access AED registry. The technology enables dispatcher alert of an on-site AED and the potential to alert for an AED within 0.1 mile. We report the observed and potential frequency of AED involvement.

Results: Of the 763 cardiac arrest events, 4.2% (32/763) had an AED applied by non-EMS persons, 1.3% (10/763) by police and 2.9% (22/763) in layperson settings. Among the remaining 731 where an AED was not applied, 8.1% (59/731) had an AED identified through dispatch; 18 with an AED on-site and an additional 41 with an AED within 0.1 mile. When restricting to ventricular fibrillation arrests, 8.9% (16/179) had an AED applied by non-EMS persons, 2.8% (5/179) by police and 6.1% (11/179) in layperson settings. Among the remaining 163 where an AED was not applied, 11.7% (19/163) had an AED identified through dispatch; 9 with an AED on-site and an additional 10 with an AED within 0.1 mile.

Conclusion: A working link between emergency dispatch and an AED registry may provide an opportunity to improve resuscitation.

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1. Introduction

Out-of-hospital cardiac arrest is the cause of hundreds of thousands of deaths each year worldwide.¹ For those arrests that present with ventricular fibrillation, early defibrillation is the major predictor of successful resuscitation.² As a consequence, innovative approaches have been developed to reduce the interval from collapse to initial defibrillator shock. One such strategy is public access defibrillation, in which automated external defibrillators (AEDs) are placed where laypersons or nontraditional emergency responders may have ready access to provide defibrillation prior to arrival of emergency medical services (EMS).³ Public access defibrillation can improve survival.⁴ However, this strategy to achieve early defibrillation is involved in a small proportion of out-of-

hospital resuscitations. Although public access defibrillation may be increasing over time, the strategy is involved presently in only 1 or 2% of arrests in most communities.^{5,6}

Approaches that increase public access defibrillation represent an opportunity to improve survival. One approach is to couple the emergency dispatcher with mapping technology to identify AEDs that are on-site or nearby the location of the arrest. Under appropriate circumstances, the dispatcher could alert callers to the availability of an AED. The current investigation evaluated the potential of such a program by combining community cardiac arrest experience with a public access AED registry.

2. Methods

2.1. Study design, population, and setting

This investigation was a retrospective observational cohort study of persons >18 years of age suffering out-of-hospital cardiac arrest prior to EMS arrival who received dispatch by one of the two dispatch centers in King County, WA (excluding Seattle) between January 1, 2007 and December 31, 2009. We restricted

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* Corresponding author at: 401 5th Ave, Suite 1200, Seattle, WA 98104, United States. Tel.: +1 206 296 4693; fax: +1 206 296 4866.

E-mail address: rea123@u.washington.edu (T. Rea).

this investigation to one dispatch center because it is equipped with the mapping and alert technology necessary to evaluate the study topic. The study was approved by the University of Washington Human Subjects Review Committee and the Public Health Research Committee.

2.2. Dispatch and EMS

Emergency response is activated by calling 9-1-1. The dispatch center is staffed by civilian dispatchers who manage police, fire, and medical calls. The dispatch center provides service to approximately 500,000 persons residing in urban, suburban, and rural settings. Dispatchers use a standard set of questions to identify potential cardiac arrest.⁷ In case of suspected cardiac arrest, dispatchers provide telephone CPR instructions if CPR is not ongoing. King County is served by a two-tiered EMS system that follows the American Heart Association guidelines for management of cardiac arrest.

2.3. Community responder program

The Community Responder Program is an integrated public program that serves to register and support public access AED placement and use and comply with state law.^{5,8} The Program helps comply with state law by facilitating registration with local EMS, AED training, and medical control and supervision. The Program maintains a registry of AED locations and AED owners. AED locations are registered with the emergency dispatch center and logged into the computerized dispatch system. As part of the current program, we contacted the registered owners to determine if they would be willing to have their AED accessed from a nearby location in the case of a suspected cardiac arrest.

2.4. AED site alert and radius search

Dispatch technology enables an on-site AED alert and the potential for a radius search to identify locations of public access AEDs that are entered into the computerized dispatch system. As part of a 9-1-1 call, the dispatcher enters a condition code during call receipt. If a dispatcher enters cardiac arrest as the condition code for an incident address where an AED has been registered, the dispatcher receives a secondary visual prompt alerting the dispatcher of an on-site AED. Dispatch technology also enables a search for (nearby) AEDs not located at the incident address. The AED radius search was not actively employed during the study period. This system uses a distance-limited circumferential search from a given address. For the purposes of this investigation, we used 0.1 mile (0.16 km) as the search radius. We entered the location of each treated cardiac arrest to determine if the AED radius search technology would identify an AED on-site or within 0.1 mile.

2.5. Data collection and definitions

King County EMS maintains an ongoing registry of treated cardiac arrest since 1976.⁹ The EMS system reviews EMS reports and dispatch recordings to determine patient demographics, event circumstances (i.e. time of arrest), clinical care including the use of a public access AED, and outcome of prehospital care. For the purposes of this study, we defined public access AED as any application of an AED by a responder outside of the EMS system. Although police responders may or may not be a traditional part of the formal response system, the purpose of the current study was to determine if dispatch mapping of community AEDs in fixed locations had the potential to influence early defibrillation. Thus we report police AED application but exclude this group from the primary public access experience. We reviewed dispatch recordings to determine

whether cardiac arrest was recognized, if dispatcher-assisted CPR was initiated, the number of responders, and if either dispatcher or responder mentioned the availability of an AED.

2.6. Statistical analysis

We used descriptive statistics to describe the frequency of public access AED involvement and availability for cardiac arrest. We first evaluated how often public access AED was actually applied. Among cases where public access AED was not applied, we first determined if the computerized dispatch identified an AED on-site. We then determined if the AED radius search technology identified an AED within 0.1 mile of the arrest incident. We conducted an analysis among all arrests, and then restricted the analysis to ventricular fibrillation arrests, the group for whom early AED application can be lifesaving. Analyses were conducted with SPSS 14.0.

3. Results

During the 3-year study period, there were 763 cardiac arrest events that occurred prior to EMS arrival and received dispatch through the study dispatch center. Overall 85% (649/763) of arrests occurred in residential locations. However, an AED was more likely to be applied by non-EMS in the public setting (18% (20/114)) compared to the residential setting (2% (12/649)). Of the 763, 4.2% (32/763) had an AED applied by non-EMS persons, 1.3% (10/763) by police and 2.9% (22/763) in layperson settings (Fig. 1). Of the 22 arrests where a public access AED was applied in a layperson setting, 41% (9/22) were registered in the computerized dispatch corresponding with the address of the incident while 59% (13/22) did not have an AED registered with dispatch. Among the remaining 731 arrests where a non-EMS AED was not applied, 59 incidents registered an AED in the computerized dispatch; 18 with an AED registered at the incident location (on-site) and an additional 41 with an AED within 0.1 mile of the incident location. Collectively, 10.6% (81 (22+59)/763) of all arrests had actual or potential for public access AED use.

When restricting to arrests presenting with ventricular fibrillation ($n=179$), 8.9% (16/179) had an AED applied by non-EMS persons, 2.8% (5/179) by police and 6.1% (11/179) in layperson settings (Fig. 2). Of the 11 arrests where a public access AED was applied in a layperson setting, 36% (4/11) were registered in the computerized dispatch corresponding with the address of the incident while 64% (7/11) did not have an AED registered with dispatch. Among the remaining 163 ventricular fibrillation arrests where a non-EMS AED was not applied, 19 incidents registered an AED in the computerized dispatch; 9 with an AED registered at the incident location (on-site) and an additional 10 with an AED within 0.1 mile of the incident location. Collectively, 16.8% (30 (11+19)/179) of all ventricular fibrillation arrests had actual or potential for public access AED use.

We also evaluated dispatch and scene characteristics among all-rhythm arrests where the non-EMS AED was registered on-site but not applied or identified via the radius search application to better understand the potential barriers to more comprehensive non-EMS AED use. Of the 18 events where an AED was registered on-site but not applied, the majority occurred in a residential setting (72% (13/18)). Most (89% (16/18)) were correctly identified as a cardiac arrest by the dispatcher so would have triggered a secondary alert of on-site AED. Based on tape review, the dispatcher was able to notify the caller in only 3 of these calls, none of which had AED application. Among the 41 arrests where an AED was identified within 0.1 mile (but not at the arrest address) using the radius search application, 61% were initially identified by the dispatcher as cardiac arrest condition. The average distance from the incident

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