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Title

Awareness of Automated Electronic Defibrillators in the community - a local study.

Authors

C Baker, Research Fellow, University of Gloucestershire, UK.

CL Loade, Faculty Administrator, University of Gloucestershire, UK.

D Crone, Professor of Exercise Science, University of Gloucestershire, UK.

Corresponding author

C Baker, Research Fellow, University of Gloucestershire, Oxstalls Campus,
Gloucester, GL2 9HW, UK. cmbaker@glos.ac.uk, 01242 715198.

Abstract

Introduction

Automated External Defibrillators (AEDs) are an important part of the Chain of Survival and provide a valuable first response to cardiac arrest. The National Defibrillator Programme instigated the installation of AEDs across England but there a need for greater local evidence concerning their installation. The aim of the study was to investigate the current status of AED provision within a single district within a county located in the South West UK.

Methods

A mixed methods study was undertaken including a quantitative survey and qualitative interviews.

Results

In total, 182 surveys were completed and seven interviews were undertaken with participants representing local organisations. Less than one third of organisations had installed AEDs and people were not clear on where the nearest AED was situated.

Conclusions

Further awareness-raising is required to develop public knowledge and confidence concerning the location, role and use of community AEDs.

Key words

Background

Limited evidence currently available concerning the provision of AEDs in community settings of limbs (Department of Health, 2013) and encompasses a range of conditions relating to the heart and blood vessels including CHD, stroke, atrial fibrillation, heart failure and cardiomyopathy (BHF, 2014b), estimating to cost the UK economy £18 billion annually by 2020 (CEBR, 2014). Despite decreases in cardiovascular deaths between 5.2% and 12.8% in some parts of the European Union (EU) (Roth et al, 2015), cardiovascular disease (CVD) remains the UK's biggest killer with Coronary Heart Disease (CHD) and stroke accounting for the majority of deaths (BHF, 2014a; Nichols et al, 2012). CHD has long been recognised as one of the leading causes of death in England (Department of Health, 2000) and cardiac arrhythmias (heart rhythm abnormalities) are consistently in the top ten results for hospital admissions (Department of Health, 2005).

Sudden cardiac arrest (SCA)

SCAs are in most instances caused by ventricular fibrillation (VF) when the heart's normal electrical rhythm becomes erratic, resulting in a disorganised electrical rhythm (BHF, 2014a). CHD is associated with a number of factors including coronary atherosclerosis and accounts for a significant proportion of SCA (Myerburg and Junttila, 2012). In the UK, approximately 30,000 people experience cardiac arrest outside hospital each year (RCUK, 2010), with electrical defibrillation being the only effective therapy for VF cardiac or pulseless ventricular tachycardia (VT). The length of time taken to administer emergency defibrillation is critical (Drennan et al, 2014),

survival rates declining by approximately 10% per minute (Valenzuela et al, 1997). Automated External Defibrillators (AEDs) provide a valuable first response to cardiac arrest and have been recommended as an important public resource due to the higher survival rate of those who receive defibrillation after suffering a cardiac arrest (Department of Health, 1999; Hallstrom et al, 2004). Prompt access to AEDs can help with maintaining neurological function (Friedman et al, 2006) and provide medical professionals with patient information following deployment. In the UK, the value of AEDs was recognised via the National Defibrillator Programme which instigated the installation of 3,000 AEDs across England including airports and shopping centres (Department of Health, 1999). Public Access Defibrillators (PADs) located onsite, rather than being transported from elsewhere, have shown better survival rates than AEDs which are largely transported by health professionals (Colquhoun et al, 2008; Eckstein, 2012; Fleischhackl et al, 2008; Nielson et al, 2013; Sanna et al, 2008). Research concerning the 681 AEDs placed in 110 public places between April 2000 and November 2002 found that of the initial 250 deployments, 182 were confirmed as cardiac arrests, with five per cent of the 177 witnessed cases surviving to hospital discharge (Whitfield et al, 2005).

Provision of AEDs in community settings

Although the provision of AEDs as a means of first response to SCAs has been a legal requirement for many organisations in both Canada and the United States, particularly fitness clubs and sports facilities (Larkin, 2007), in the UK no legislation requiring premises to provide AEDs currently exists. Consequently, while some organisations, for example National Governing Bodies of Sport (NGBs), have begun to offer subsidies for the purchase of AEDs (Cronin et al, 2013; Football Association, 2014), their

provision within community settings remains variable. Although AED programmes are widespread in Europe (Bahr et al, 2010), there is a continuing need to assess local conditions to inform planning and training and training processes (Priori et al, 2004). Further, while training in the use of AEDs is recommended (Priori et al, 2004) and can improve skills in deployment, speed of shock delivery and electrode pad placement (Yeung et al, 2011), refresher training is often overlooked (Cronin et al, 2013), leading to potential deficiencies in knowledge and confidence.

Aims and objectives

In light of the limited evidence currently available concerning the provision of AEDs in community settings the rationale for the study was based on the need to establish evidence concerning factors that might inform current and future practice. The aim of the study was to conduct a local survey to investigate the current status of AED provision within a single district within a county located in the South West UK. Three objectives were established including to: undertake a quantitative investigation to ascertain the number, type of location and type of AED available; undertake a qualitative investigation to compare training, number of staff and volunteers trained and their training needs, and to assess factors influencing the provision of AEDs.

Research design

A parallel mixed methods approach was adopted which included a quantitative and qualitative component based on the rationale of developing a greater understanding of the current status of AED provision, potentially providing the most complete and useful results (Johnson et al, 2007). The approach allowed flexibility in data collection and analysis (Tashakkori and Creswell, 2008) and provided a more sophisticated and

complete study (Bryman, 2006). Firstly, a quantitative component was used to assess numbers, locations and other aspects of AEDs via an online questionnaire administered to representatives of local organisations with public facilities located within the study area. Secondly, a parallel qualitative component investigated the perceptions of those trained in and responsible for AEDs to explore contextual factors and wider issues influencing the provision of AEDs in community settings.

Methods

Study sample

A broad inclusion criterion was established to identify participants that worked within, or were responsible for, local facilities i.e. buildings frequented by the public including sports clubs, schools, commercial businesses, and local government from across the district. Potential participants (n = 237) were identified through purposive sampling via website searches and were categorised by organisational type.

Procedure

For the quantitative questionnaire, participants' contact details were collected via telephone directories and websites. The questionnaire was administered online via the Bristol Online Surveys platform (BOS, 2015) and via paper-based questionnaires where email addresses were unobtainable (n = 44) between June and September, 2014. Online questionnaire were accessible via a secure URL link included emailed directly to participants. A pilot questionnaire was reviewed by lay people (a teacher at a local school and a local business person) to ensure its structure and content were acceptable and appropriate. For the qualitative component, semi-structured interviews

were conducted with seven participants identified via a convenience sampling approach (Gray, 2009) to provide contrast between organisational types.

Data collection and analysis

The quantitative questionnaire assessed a broad range of factors and included dichotomous questions for example; do you have an AED on the premises, continuous questions for example, how many members of the public attend the premises each day, and open ended questions for example, what demonstration/training was provided for the AED? Quantitative data were collected via the BOS survey platform for safe storage and exported into an Excel database for cleaning to remove text from numeric fields and entering blank values where necessary (Randall et al, 2013) prior to analysis in SPSS v20 (IBM Corp, 2011). All variables were assessed for accuracy and missing values following which descriptive statistics were calculated.

Qualitative data were collected via face-to-face and telephone interviews lasting between 20 and 35 minutes. A semi-structured interview schedule was that allowed for flexibility during the interview process established (Robson, 2011) following a review of the data from the questionnaire data which was supplemented with topics identified as being potentially relevant by the study team. Questions explored issues related to the local provision of AEDs for example, level of training and issues putting people off purchasing AEDs. Interviews were recorded and transcribed verbatim and downloaded into NVivo 10 (QSR International Pty Ltd, 2012) for data storage and management. Inductive thematic analysis was used to provide a detailed account of data (Braun and Clarke, 2006) involving a single researcher systematically coding

sections of text into descriptive themes. Themes were reviewed by three researchers to confirm or amend the coding to ensure the data were represented accurately and to minimise researcher bias (Creswell, 2013). The creation of a coded matrix facilitated the renaming of participants as soon as they were included in the research process and allowed for the inclusion of participants' quotations in the text via a code according to their role and sequence in the interview process for example, CG/1 where CG denotes community group representative, the number indicating that they were the first participant community group representative interviewed.

Ethics

The study complied with the University of Gloucestershire Research Guidelines including providing anonymity by data coding and the use of pseudonyms to protect confidentiality. All questionnaires made clear that participation was entirely voluntary and that participants could withdraw at any point. Participants were informed that only the location of the AED would be disclosed and that all other responses would be anonymised. Interview participants were provided with a written copy of the study information and informed consent form, and were ascribed a pseudonym via a participant coding sheet to which only the principal investigator had access. All paper-based information was stored in a locked filing cabinet in a secure office and all computer-based information was stored on a password-protected computer

Results

Participant profile

In total, 182 responses were received to the 237 paper and online questionnaires representing a response rate of 76.8%. The majority of participants were female (57.1%, n = 101), with a mean age of 49.6 years ($SD = 13.32$), and White British or White Other. The most represented organisational type was primary and secondary education (27.5%, n = 50), followed by community sports club (14.8%, n = 27), and commercial business (14.8%, n = 27), with sports and leisure clubs (5.5%, n = 10) and local government services (2.2%, n = 4) being the least represented.

Quantitative findings

Table 1 presents descriptive data for the main quantitative findings according to organisational type. A total of 53 (29.1%) organisations identified having at least one AED and of these 24 (45.2%) were available at all times, of which 50% (n = 12) were in locked cabinets. Less than half (47.3%, n = 86) of participants knew the location of the nearest AED and eight of the 27 (30.0%) wards (local level geographic areas) within the district assessed in this study did not have access to an AED. Overall, 47.2% (n = 25) of those organisations with an AED had notified the Ambulance Service of this and 17.0% (n = 9) were unsure. With respect to access to AEDs, 26.4% (n = 14) were generally available to the public and 60.4% (n = 32) were available to all staff in facilities at which AEDs were located. Health Services accounted for the majority of organisational types possessing AEDs (28%, n = 15) and half of facilities with AEDs gave access only when the premises were open or in use (50.9%, n = 27). Reasons given for the purchase of AEDs were that they were considered to be an essential First Aid item (n = 17) and as a response to someone in the organisation/community having had a cardiac arrest (n = 6). The majority (71.5%, n = 93) of the 130 respondents who did not have an AED were unable to identify where their nearest AED was located

although 24 (18.5%) were considering purchasing a device. The majority (60.0%, n = 32) of organisations with an AED had been provided with a training manual and 15.1% (n = 8) had received training delivered by St John's Ambulance. A small proportion (13.2%, n = 7) were still awaiting training, while in house training accounted for 9.4% (n = 5).

[Table 1 here].

Table 2 highlights four equal groups based upon the 25th, 50th and 75th percentiles to establish low (0-30 people per day), medium (31-60 people per day), high (64-137 people per day), and very high (\geq 138 people per day) groups for daily footfall as perceived by the respondents. It was clear that community sports clubs (29.2%, n = 14) and community facilities (29.2%, n = 14) represented organisations with low average footfall, while primary and secondary education organisations were those with generally high (46.5%, n = 20) and very high average footfall. We noted that only a small number (14%, n = 7) of primary and secondary education organisations had AEDs at their facilities, health services representing the group with the highest proportion of AEDs (100%, n = 14), and religious organisations the lowest (0%).

[Table 2 here].

Qualitative findings

Interviews (n = 7) were conducted with representatives of community groups (CG, n = 2), a General Practitioner (GP, n = 1), a charity (CH, n = 1), a sports club (SC, n = 1), an ambulance service representative (AS, n = 1), and a manufacturer of AEDs (MA, n

= 1). A number of themes emerged through data analysis relating to the provision of AEDs the community. The first theme, geographical situation, related to the perceived diversity of the area which, while characterised by three large urban areas with populations of approximately 10,000 people each, was essentially a rural area with many isolated villages, valleys, and dense woodland. Hence, access to immediate first aid was critical; *'...every minute it takes you longer to get the defibrillator to patient, the less chance that defibrillator being used successfully'* [CG/1].

The second theme, reluctance, related to factors which potentially discouraged the purchase of AEDs by local organisations. These issues included costs and maintenance, registration, replacement of accessories, after-care and support following deployment. While cost was not an unexpected finding, it was interesting that one respondent identified that organisations might be dissuaded by a degree of trepidation concerning AEDs; *'people have grown up thinking defibrillators are used on TV programmes and it looks very dramatic'* [GP/1]. The importance of introducing quality control measures was recognised and initiatives to support local organisations were welcomed; *'...the Ambulance service are going to be launching an initiative in 2015 where defibrillators are going to be accredited [to make sure] it has been checked and it is appropriately able to be used [on] the patient'* [AS/1]. Such approaches were perceived as useful for promoting good practice; *'...if you buy a defib on the internet it may not be appropriate, they don't understand data protection issues, patient confidentiality, things like that'* [CH/1].

The third theme, knowledge and training, related to concerns regarding awareness of AEDs in the community; *'I think the majority of people, they wouldn't have a clue where*

they are...it is great to have them at the shop, but if I am a GP and I don't know the shops that have got them...then how much do the public know? [GP/1]. With respect to training, it was interesting to find an apparent high level of public interest in AEDs; *'we have been oversubscribed for them...we're really surprised how many people have come along and got involved'* [CG/1]. Thus, a critical aspect of training was to not overly complicate the delivery style with technical detail, the focus being toward increasing user confidence; *'the training needs to be more about people's confidence to use [it] in an appropriate situation'* [GP/1].

Discussion

The findings in this local study suggested that less than one third of organisations who responded to the questionnaire provided AEDs and that people were not generally clear on where the nearest AED was situated. While we were not able to make meaningful comparisons between local wards given the distribution of the sample, that the majority of AEDs were located in the south of the district highlighted that some areas might experience a disproportionate lack of access, particularly in rural or more remote areas. While the provision of AEDs in schools is understood to be widespread in Europe (Bahr et al, 2010), the lack of provision of AEDs within primary and secondary schools noted in this study was concerning given the high footfall in these areas. Although infrequently required, AEDs in schools have proved successful (Swor et al, 2013), and statutory guidance has recommended schools purchase AEDS and that training in CPR should be promoted amongst staff and students (Department for Education, 2014). Furthermore, given their locations within often densely populated urban settings, access to AEDs within schools and other education settings has the potential to help pupils, staff and the wider public. Hence, while the recent Call Push

Rescue campaign providing CPR training to all school children (BHF, 2014a) is a positive step it was clear that the potential of these settings as locations for AEDs was not yet fully realised at a local level.

Across the organisations that responded to the survey, many (42.5%) of those providing an AED had not notified the Ambulance Service of its details, including schools, local government services and health services. While we were unable to fully assess the differences between organisations due to missing data, this finding suggested that certain practices could be improved with respect to communication between local organisations and the Ambulance Service. Existing recommendations advise that organisations should notify the local NHS ambulance service of AED locations (Department for Education, 2014) and is likely to provide critical information for governance procedures that support the buying, storing and upkeep of AEDs in community setting. Hence, this finding might also have pointed to a general need for greater awareness raising and communication of the fact that AEDs were available onsite in order to maximise the potential of AEDs in an emergency (Leung et al, 2012). Of further concern was the relatively low number of AEDs identified as being available at all times (57.5%). It is recommended that there should be no restrictions to AED access as any delay can affect the successful deployment of the device rate (BHF, 2014a). Hansen et al. (2014) found a decrease of 53.4% in AED coverage at night-time and weekends when 61.8% of cardiac arrest in the public locations studied had taken place. While we were not able to ascertain the nature of coverage according to time of day the findings in this study suggested that 24-hour access was not consistently guaranteed across the local area. This was a concern given that limited access may compound a lack of AEDs within certain settings, specifically sports and

leisure settings where it is recognised that AEDs are important for spectators and participants (Hodgson, 2012), as the number of people, their age, and range of health conditions likely influence the potential for a cardiac arrest to occur.

Participant perceptions concerning a reluctance to acquire AEDs were not surprising. The fear of harming people experiencing a SCA, particularly with regard to the legal ramifications, has been highlighted as reason for not using AEDs (Schober et al, 2011). While education in legal and safety issues around AEDs increases the general public's willingness to use them (Lubin et al, 2004), the findings in this study would appear to support the notion that it is how training is delivered that is important for people's willingness to acquire and deploy AEDs. As such, this training might usefully be linked to the respective professional accreditation processes that organisations and individuals undergo including issues of personal, patient and bystander safety (Jorgenson et al, 2013), in addition to ensuring good practice with respect to the upkeep and testing of AEDs to avoid the danger of devices becoming inoperable through neglect (Huig et al, 2014).

Limitations

The generalisability and applicability of the findings are limited by the local nature of the study, the sample size and type, and the inability to compare data with other studies. Despite the comprehensive search strategy used to identify participants we were unable to make meaningful comparisons between wards and organisations and it is not possible to state with confidence that all relevant participants were identified or included in the sample. Footfall estimates were based on respondent perceptions and cannot be assumed to be accurate and not all relevant variables may have been

included in the study. Caution should be exercised when interpreting the quantitative data due to self-reporting. As a cross-sectional study the results represent only one moment in time and fail to capture changes in the longer term.

Conclusion and recommendations

The provision of AEDs in community settings can provide a useful means of first aid in response to SCAs. On the basis of the findings in this study it is likely that further awareness-raising is required to develop public knowledge and confidence concerning the role and location of community AEDs, particularly with respect to their deployment and related legal issues. The provision of additional AEDs in a wider variety of organisations may provide greater coverage and access to critical life-saving equipment, particularly for rural or isolated areas. Local audits of AEDs to establish further evidence with respect to location, coverage, servicing and replacement, training and education are recommended.

Key Points

- Automated External Defibrillators (AEDs) provide a valuable first response to cardiac arrest due to the higher survival rate of those who receive defibrillation after suffering a cardiac arrest.
- While there is increasing provision of AEDs in the UK their installation within community settings remains variable.
- It is important to investigate the current status of AEDs in order to establish local evidence concerning location, coverage, training and education.

- Further awareness-raising is required to develop public knowledge and confidence concerning the role and location of community AEDs.
- The provision of additional AEDs in a wider variety of organisations may provide greater coverage and access to critical life-saving equipment, particularly in rural or isolated areas.

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Table 1: Organisations with AEDs installed

Organisation type	Within sample		With AED	
	%	n	%	n
Community sports club	14.8	27	11.1	3
Sports & Leisure facility ^a	5.5	10	80.0	8
Primary / Secondary Education	27.5	50	14.0	7
Religious organisation	13.7	25	0.0	0
Community facility ^b	13.7	25	20.0	5
Commercial business ^c	14.8	27	40.7	11
Local government service	2.2	4	75.0	3
Health service ^d	7.7	14	100	14

Notes: ^a Including outdoor sports and recreation facilities. ^b Including halls, parish buildings. ^c Including shops and local businesses. ^d Including GPs, dentists, opticians.

Table 2: Summary of findings according to type of organisation

Criteria	Organisation type																
	Community sports club		Sports & Leisure facilities		Primary / Secondary Education		Religious organisation ^f		Community facilities		Commercial business		Local government services		Health services		
	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	
Approximate footfall (per day) ^a																	
0 - 30	29.2	14	-	-	-	-	20.8	10	29.2	14	20.8	10	-	-	-	-	
31 - 63	19.5	8	-	-	19.5	8	26.8	11	19.5	8	4.9	2	-	-	9.8	4	
64 - 137	2.3	1	7.0	3	46.5	20	9.3	4	4.7	2	11.6	5	2.3	1	16.3	7	
≥ 138	4.7	2	16.3	7	51.2	22	-	-	-	-	18.6	8	2.3	1	7.0	3	
Location of nearest AED known																	
Yes	40.7	11	80.0	8	44.0	22	12.0	3	48.0	12	55.6	15	75.0	3	100	14	
No	59.3	16	20.0	2	56.0	28	88.0	22	52.0	13	44.4	12	25.0	1	0.0	0	
AED located on premises																	
Yes	11.1	3	80.0	8	14.0	7	0.0	0	20.0	5	40.7	11	75.0	3	100	14	
No	88.9	24	20.0	2	86.0	43	100	25	80.0	20	59.3	16	25.0	1	0.0	0	
Professional Accreditation ^b																	
Yes	37.0	10	40.0	4	63.2	24	5.6	1	0.0	0	12.5	3	0.0	0	30.0	3	
No	51.9	14	60.0	6	23.7	9	88.9	16	95.5	21	62.5	15	75.0	3	60.0	6	
Don't know	11.1	3	0.0	0	13.2	5	5.6	1	4.5	1	25.0	6	25.0	1	10.0	1	
Cardiac rehabilitation classes ^c																	
Yes	3.7	1	50.0	5	1.0	2	0.0	0	4.0	4	11.1	3	0.0	0	28.6	4	
No	92.6	25	50.0	5	47.0	94	100	25	20.0	20	88.9	24	100	4	71.4	10	
Don't know	3.7	1	0.0	0	2.0	4	0.0	0	1.0	1	0.0	0	0.0	0	0.0	0	
Grant / subsidy for AED ^d																	
Yes	25.0	1	12.5	1	11.1	1	-	-	40.0	2	9.1	1	66.7	2	38.5	5	

No	25.0	1	12.5	1	55.6	5	-	-	60.0	3	54.5	6	0.0	0	53.8	7
Don't know	50.0	2	75.0	6	33.3	3	-	-	100	5	36.4	4	33.3	1	7.7	1
AED deployed in emergency																
Yes	0.0	0	75.0	6	0.0	0	-	-	0.0	0	22.2	2	0.0	0	14.3	2
No	50.0	2	25.0	2	71.4	5	-	-	100	5	66.7	6.0	100	3	71.4	10
Don't know	50.0	2	0.0	0	28.6	2	-	-	0.0	0	11.1	1.0	0.0	0	14.3	2
Access restrictions ^e																
Yes	60.0	3	25.0	2	85.7	6	-	-	20.0	1	40.0	4	33.3	1	78.6	11
No	20.0	1	75.0	6	0.0	0	-	-	80.0	4	60.0	6	66.7	2	14.3	2
Don't know	20.0	1	0.0	0	14.3	1	-	-	0.0	0	0.0	0	0.0	0	0.0	0
Notified local ambulance service																
Yes	50.0	1	75.0	6	42.9	3	-	-	100	5	20.0	2	33.3	1	38.5	5
No	0.0	0	25.0	2	42.9	3	-	-	0.0	0	30.0	3	66.7	2	38.5	5
Don't know	50.0	1	0.0	0	14.3	1	-	-	0.0	0	50.0	5	0.0	0	23.1	3
Considering AED purchase																
Yes	32.0	8	0.0	0	9.3	4	8.0	2	36.8	7	25.0	4	0.0	0	-	-
No	60.0	15	100	2	69.8	30	84.0	21	47.4	9	62.5	10	100	1	-	-
Don't know	8.0	2	0.0	0	20.9	9	8.0	2	15.8	3	12.5	2	0.0	0	-	-
Looked into AED prices																
Yes	0.0	0	50.0	1	8.8	3	12.5	3	25.0	5	40.7	16	25.0	1	-	-
No	0.0	0	50.0	1	91.2	31	87.5	21	75.0	15	59.3	11	75.0	2	-	-

Notes: ^a Based on respondent estimates. ^b Where applicable e.g. Football Association (FA) Charter Standard. ^c Classes run at respondents' premises. ^d For example, British Heart Foundation. ^e For example, when premises are closed. ^f Some data missing / unavailable.