Prepared for sudden cardiac arrest? A cross-sectional study of automated external defibrillators in amateur sport

Owen Cronin,1 Joseph Jordan,1 Fionnuala Quigley,2 Michael G Molloy1,3

ABSTRACT

Introduction Sudden cardiac arrest (SCA) is a rare but tragic part of professional and amateur sport. Following multiple high profile deaths in professional sport over the past two decades, there has been a significant trend towards the widespread availability of automated external defibrillators (AEDs) at amateur sports grounds.

Objectives To examine the availability of AEDs in amateur sports clubs in Cork, Ireland, and to investigate club practices with respect to the purchase, accessibility, maintenance and use of AEDs.

Design A cross-sectional survey of 218 amateur Gaelic Athletic Association (GAA), soccer and rugby clubs was conducted between July and September 2012. Club committee representatives answered a 22-point questionnaire.

Results 126 GAA clubs and 28 soccer and 17 rugby (n=171) clubs were enrolled in this study. A total of 81.3% of amateur clubs own an AED. We estimate an AED-use rate of one AED use for every 54.5 years an AED is available. Almost 50% of club representatives thought the location of their club AED could be improved while 12.9% of clubs admitted to not maintaining their club AED on a regular basis.

Conclusions A large proportion of amateur clubs in Cork City and County own an AED. Many clubs engage in regular maintenance and storage of AEDs. However, this study identifies several areas for improvement in facilitating a secure chain of survival for players in the event of an SCA.

INTRODUCTION

Sudden cardiac arrest (SCA) is a rare but tragic part of professional and amateur sport. However, within large populations such as the USA, it is estimated that a sports-related sudden cardiac death occurs every 3 days (approximately 110 deaths per year).1 In the Veneto region in Northern Italy, Corrado et al2 using a mandatory screening and reporting system, found the incidence of sudden cardiac death in athletes participating in competitive sport to be 1.9/100 000 person-years.

Out-of-hospital cardiac arrest offers a poor prognosis.3 This is also true when SCA occurs during sport. In France, Marijon et al4 found survival to discharge rates of 15.7% (95% CI 13.2% to 18.2%) for victims of SCA during sport. However, with prompt and effective cardiopulmonary resuscitation (CPR) and defibrillation with an automated external defibrillators (AED), the survival rates improve significantly.5,6 There is a temporal relationship between time to AED use and victim survival. It is estimated that survival rates decline by 7–10% for every minute defibrillation is delayed.6

Over the past two decades, multiple high profile cases of SCA in sport in Ireland, the UK and Europe have heightened awareness as to the need to provide accessible treatment for players in the event of an SCA. This has led to a rise in the availability of AEDs in amateur sports clubs. Many sporting organisations including the Gaelic Athletic Association (GAA) and the Irish Rugby Football Union (IRFU) offer subsidised AEDs for their member clubs.

In the Republic of Ireland, no large-scale study has examined AED availability at amateur sports grounds. This study aims to determine the prevalence of AEDs at amateur sports grounds in Cork City and County and to estimate their AED use rate. Second, club practices regarding the placement and maintenance of AEDs and training in AED use will be explored.

METHODS

Study design/participants

The investigators conducted a cross-sectional study between July and September 2012. The study examined AED availability, use and practices in amateur clubs across three different sporting codes. Adult soccer, rugby and GAA clubs in Cork City and County were eligible for inclusion. Gaelic football and hurling clubs were included. Professional, semiprofessional clubs or clubs solely with under-age teams were excluded.

At the beginning of the study period, 158 GAA clubs were registered for competition. Three clubs were listed as separate hurling and football clubs, but as they competed at the same venue under the same name, these clubs were combined to avoid duplication of data pertaining to the same arena. Forty-four soccer clubs from two rural and urban soccer leagues were available for enrolment. Nineteen amateur rugby clubs, based in Cork City and County, were available for inclusion. In total, 218 clubs were eligible for inclusion.

The author (OC) designed a 22-point questionnaire examining the areas of AED availability, purchase, time-since purchase, usage, storage, placement, number of club members trained in AED-use and maintenance (see appendix through web-only access). Close-ended, open-ended and grouped-answer questions were included in the questionnaire. Likert scales were applied where appropriate to assist the respondent and to ensure a presentable format for subjective responses.
The investigators (OC and JJ) contacted the club secretaries or public relation officers by telephone. The nature and purpose of the study were explained and the club committee member was offered to participate in the anonymous questionnaire. Telephone contact details were obtained either from online club directories or directly through the supervising sporting organisation. A maximum of four telephone calls to each club were attempted and if no response was obtained, the club was omitted from the study. The Clinical Research Ethics Committee of the Cork Teaching Hospitals approved the study protocol.

Statistical methods
Statistical analysis was performed using programs available in V18.0.3 of the statistical package for the Social Sciences (SPSS, PASW Chicago, Illinois, USA). Clubs were studied as an overall group as well as compared by sport. When examining the three different sports, the Kruskal-Wallis and χ² tests were applied to compare the proportions. The significance level was set at 0.05 and all comparisons were two-tailed.

RESULTS
AED availability in amateur clubs
In total, 171 of the 218 (78.44%) eligible clubs participated in this study. The remaining 47 clubs either declined to participate or were not contactable following four attempts to do so. In total 126 GAA clubs, 28 soccer clubs and 17 rugby clubs participated. Of the 171 amateur sports clubs enrolled, 81.3% (n=139) had a club AED available at their home ground. In total 18.7% (n=32) did not. Several clubs owned more than one AED. When comparing sporting codes, 25% (n=34) of the AEDs provided by sporting organisations were soccer clubs, 36.7% (n=51) were rugby clubs and 36.7% (n=51) were GAA clubs. Of those who did not have defibrillators, the club representatives identified expense as the reason why in 37.5% (n=12) of cases. Additional reasons are outlined in box 1.

Acquisition and use of AEDs
The majority of clubs acquired their AEDs through fundraising efforts (36.7%, n=51), followed by donation (20.9%, n=29). Relatively few clubs (12.9%, n=18) chose to purchase subsidised AEDs offered by sporting organisations. The median number of years that a club owned an AED was 4 years (IQR=2—5 years). The oldest AEDs were approximately 10 years old (figure 1). In total 6.5% (n=9) of clubs that owned an AED had it used in an emergency situation. We estimate a ‘use rate’ of one AED-use for every 54.5 years an AED is present (the cumulative number of years each club AED was available divided by the total number of AED uses). Victims included players in three cases, spectators in three cases and other individuals in three cases (eg, passers-by). Four out of the nine individuals requiring defibrillation survived, to the best knowledge of the club representative.

Placement and accessibility of AEDs
Almost all the club officials surveyed (n=136, 97.8%) knew where their club AED was kept. Seventy-five per cent (n=102) of clubs stored their AED indoors, while 25% (n=34) stored their AED outdoors. AEDs were stored in a variety of locations. No clear pattern for AED placement existed, and the pattern varied from club to club. Examples of such instances are shown in table 1. In total 59.7% of clubs (n=83) kept their AED under lock and key, 51.1% of club officials (n=69) considered their AED to be ‘very accessible’ in the event of a cardiac arrest while 8.9% (n=12) of club officials thought their AED to be ‘not very accessible’ in the event of a cardiac arrest.

Maintenance of AEDs
In total 76.3% (n=106) of clubs who owned an AED maintained it regularly, 12.9% (n=18) admitted to not maintaining their AED and 10.8% (n=15) of the club officials contacted did not know whether their AED was maintained regularly or not. In total 25.8% (n=36) of clubs had maintained their AED within the last month prior to the survey (figure 2). One club had not checked their AED in 2 years. In total 36.7% (n=51) of club officials did not know the last time it was checked.

A total of 10.3% of clubs (n=14) did not have anybody assigned to AED maintenance, 44.1% of clubs (n=60) assigned this task to a single individual and among multiple people in 40.4% of cases (n=55). Most often a club committee member (62.1% of clubs, n=72, eg, a club chairman/secretary) was

Box 1 Barriers to acquiring a club automated external defibrillator (AED)

| High expense of purchasing an AED |
| Nobody trained to use an AED |
| Not a priority; never discussed at committee level |
| Inability to ensure maintenance |
| AED located nearby in local community |
| Expense of training individuals |
| Medicolegal fears |

Table 1 Examples of AED storage locations used by amateur clubs

<table>
<thead>
<tr>
<th>Indoor locations</th>
<th>Outdoor locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside clubhouse</td>
<td>At main gate to pitch</td>
</tr>
<tr>
<td>Meeting room</td>
<td>On wall of clubhouse</td>
</tr>
<tr>
<td>Inside front door of dressing room</td>
<td>On wall of dressing rooms</td>
</tr>
<tr>
<td>Groundsmans shed</td>
<td>With medical bag</td>
</tr>
</tbody>
</table>

AED, automated external defibrillators.
assigned to do so, followed by a club member, such as a player or a manager in 18.1% (n=31). An individual from outside the club was responsible for AED maintenance in 7.6% of clubs (n=13) (box 2).

Club members trained in AED use
In total 48.3% of clubs (n=67) who owned an AED had 10 or more club members trained to use an AED, 50.3% (n=70) of clubs had between 1 and 9 club members trained in AED use, 1.4% (n=2) of clubs had no club members trained in AED use despite having an AED. Club officials were also asked to rate, on a 4-point scale (None, some, most or all), the proportion of competitive matches and training sessions at which an AED-trained individual was present (figure 3).

DISCUSSION
To our knowledge, this study represents the first study of AED practices and availability in amateur sports clubs in Europe. Our results display the widespread availability of AEDs across amateur sports clubs in Cork City and County. With 81.3% of the responding amateur clubs owning an AED, it is clear that considerable effort and expense have been invested in AEDs. What is more encouraging is the fact that the majority of clubs have acquired their AED in the past 5 years despite the economic downturn (figure 1). However, it is worth noting that almost a fifth of clubs do not own an AED and require further assistance. Our study shows that surprisingly few clubs (13% of all clubs with an AED) chose to avail of subsidised AED schemes. Sporting organisations, such as the GAA, provide a means to purchase subsidised AEDs. These schemes appear to be an under-utilised resource and may represent an effective tactic for increasing the availability of AEDs, in regions where they are infrequent.

The majority of clubs which do not own an AED cite expense as the reason why they do not invest in an AED. This is consistent with international studies. Rothmier et al7 surveyed 118 Washington state high schools and found that 65% of schools identified monetary resources as the main obstacle to obtaining an AED. This study also revealed several important secondary findings that represent difficulties for AED provision in the future. While a significant proportion of the practices recorded were exemplary, several gaps and potential liabilities were identified especially in the areas of AED training, storage and maintenance. Almost a quarter of the club officials either reported not maintaining their AED or not knowing if it was maintained on a regular basis. The GAA, through its recent ‘ACT’ campaign, is alerting clubs as to the need to maintain club AEDs.8 What is striking is the fact that 44.1% of clubs designate a single committee member to maintain their club’s AED (ie, battery checks and defibrillator pad replacement). In the event of emigration or illness affecting this individual, the responsibility of AED maintenance may be lost or neglected.

When asked directly to state the last time their club AED had been maintained, club representatives responded with a large variety of answers (figure 2). Just over 40% of club representatives stated that their AED had been maintained within the last month. This is likely to be an overestimation due to the response bias. Accurate answers are difficult to achieve here also as the club representative responding to the questionnaire may not be aware of these details. However, even allowing for these facts, a substantial proportion of clubs do not maintain their AEDs frequently.

Box 2 Examples of resources and individuals external to the main club structure that are utilised by amateur clubs to maintain club automated external defibrillators

Local fireman
Local volunteer—for example, Nurse
Member of local community association
Club physical therapist
Local General Practitioner

Figure 2 Time since amateur clubs last maintained their club automated external defibrillators (AED). **Categories expressed as number of clubs who maintained or knew when their AED was last maintained, n=88.

Figure 3 Chart comparing coverage of competitive matches and training sessions with an automated external defibrillators (AED)-trained individual. Almost 50% of clubs thought that ‘all’ of their club matches would have an AED-trained individual present. Percentage proportions of overall number of clubs with AEDs are used (n=138).
The optimal positioning of AEDs remains controversial. The American Heart Association’s guidelines recommend that AEDs are visible and secured in an unlocked cabinet.\(^9\) To properly prepare for an SCA, clubs should evaluate their own playing fields, training facilities and club grounds to ensure the fastest emergency response in the event of an SCA. Depending on the geographical layout of a club, this may require more than one AED per club. Strategic positioning of AED(s) should ensure that an AED is retrievable for use within 3 min.

In our study, almost 60% of amateur clubs chose to protect their AED by storing it under lock and key. It is obvious that amateur sports clubs are conscious of the risk of vandalism and theft. When choosing the optimal position to place an AED, clubs are faced with several dilemmas. Is it better to consistently store the club AED in the same position or to use it as a mobile unit and to bring it pitch-side with the remainder of the medical equipment? We feel that emphasis should be placed on storing club AEDs in highly visible locations that are well signposted, preferably outdoors, and therefore easily accessible by anyone at the point of care (ie, adjacent to the playing fields). The use of an alarmed storage cabinet may deter vandalism and theft. Certainly some of the storage locations recorded in our study are not ideal and awareness should be increased to save time in the event of an SCA (table 1). It is recommended that clubs and sporting organisations practice and review their response to an SCA at least annually.\(^10\)

An encouraging finding was that almost half of the amateur clubs surveyed (48.3%) had 10 or more club members trained in AED-use. The training of new members proficient in AED-use must be encouraged. During the conduct of the study, it was clear that some clubs organise regular AED training courses at specific intervals. Other clubs appear to have organised initial training on purchase of their AED but none since. Many of the original individuals trained in AED use may no longer be club members. The issue of periodic refresher training is another obstacle with the American Heart Association recommending refresher training to occur every 2 years.\(^11\)

Thankfully, SCA in sport is a rare event.\(^12\) When it occurs, it is unexpected, distressing and sudden. Survival depends on the time to CPR and the time to defibrillation with an AED.\(^13\) To facilitate this it is crucial to have individuals who are regularly trained in these components. While almost 50% of club officials expressed confidence in all of their competitive matches being covered by an AED-trained individual, many clubs admitted to falling short of this. This study displayed a visible drop in coverage of training sessions (figure 3). It is perhaps most beneficial to train players and coaches as they are most likely to be present at both competition and training. Another potential option would be to train all referees in basic life support and AED use, but obviously this does not ensure coverage at training sessions.

Our study is limited by its cross-sectional survey design; however, a high response rate across a large and diverse cohort of amateur sports clubs was achieved. Club committee members were targeted to participate as they represent a reliable and knowledgeable source central to club structure. However, this group was certainly at risk of responder bias. Despite this, many clubs provided honest critiques of their own AED practices. To overcome response bias, an independent audit of AED storage and mandatory maintenance records would be beneficial. The establishment of a mandatory nationwide AED registry would facilitate this.

The onus of implementing, encouraging and facilitating the continual retraining, maintenance and correct usage of club AEDs is a large responsibility. Government departments, healthcare groups, sporting associations and the governing bodies of individual leagues all have an important role to play to ensure player safety. This study examined AED availability, use and practices across a large cohort of amateur sports clubs in Cork, Ireland. Cork is the largest geographical county in Ireland and most likely offers a real-world reflection of emergency planning for SCA in amateur clubs countrywide. This study examined urban and rural clubs, and in this respect, reflects practices in both populated counties as well as metropolitan cities.

In conclusion, our study provided information on the widespread availability of club AEDs, the reasons why they are not acquired by some clubs, an estimation of their use-rate and outlined improper practices in terms of AED maintenance and storage. These results identify several key areas for improvement and to raise awareness among amateur sports clubs to ensure an intact chain of survival in the event of an SCA on the field of play.

What are the new findings?

- In total 81.3% of amateur sports clubs surveyed own a portable automated external defibrillator (AED). While many clubs engage in appropriate training, maintaining and storage of AEDs, many clubs do not.
- This represents a potential flaw in the chain of survival in the event of a sudden cardiac arrest in sport.

How might it impact on clinical practice in the near future?

- Healthcare, government and sporting authorities need to further encourage and assist amateur clubs in the purchase, maintenance and training of automated external defibrillators (AED)-use.
- Particular focus needs to be placed on storing AEDs in accessible locations and ensuring multiple and appropriate individuals are assigned to AED maintenance.
- Regular retraining and training of new club members in AED use is a priority and needs to be facilitated.

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Contributors OC and FF planned and designed the study. OC designed the study questionnaire, wrote the study with assistance from JJ and MGM, and was responsible for the overall content of the study. OC and JJ conducted the survey.

Competing interests None.

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