**Emergency Response Facilities Including Primary and Secondary Prevention Strategies Across 79 Professional Football Clubs in England**

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**ABSTRACT**

**Aim**

To assess the emergency response planning and prevention strategies for sudden cardiac arrest (SCA) across a wide range of professional football clubs in England.

**Methods**

A written survey was sent to all professional clubs in the English football league, namely the Premiership, Championship, League 1 and League 2. Outcomes included: 1) number of clubs performing cardiac screening and frequency of screening; 2) emergency planning and documentation; 3) automated external defibrillation (AED) training and availability; and 4) provision of emergency services at sporting venues.

**Results**

79 clubs (86%) responded to the survey. 100% clubs participated in cardiac screening. All clubs had AEDs available on match days and during training sessions. 100% Premiership clubs provided AED training to designated staff. In contrast, 30% of lower division clubs with AEDs available did not provide formal training. Most clubs (n= 66; 83%) reported the existence of an emergency action plan for SCA but formal documentation was variable. All clubs in the Premiership and League 1 provided an ambulance equipped for medical emergencies on match days compared with 75% of clubs in the Championship and 66% in League 2.

**Conclusions**

The majority of football clubs in England have satisfactory prevention strategies and emergency response planning in line with European recommendations. Additional improvements such as increasing awareness of European guidelines for emergency planning, AED training and mentorship with financial support to lower division clubs, are necessary to further enhance cardiovascular safety of athletes and spectators and close the gap between the highest and lower divisions.

**Keywords:** emergency response planning, automated external defibrillator, sudden cardiac death, medical action plan, safety in sport.

**INTRODUCTION**

Athletes harbouring inherited cardiac conditions are at risk of exercise-related sudden cardiac death (SCD).(1,2) Although SCD in young athletes is a relative rare event(1,3–5), its impact in the wider community has prompted many scientific bodies and sporting organizations worldwide to adopt pre-participation cardiac screening (PPS) for primary prevention.(6–8) Some athletes however, still suffer sudden cardiac arrest (SCA) from conditions associated with false negative ECG screening results, such as premature atherosclerotic coronary disease, anomalous coronary arteries, incomplete expression of cardiomyopathy or ion channel disease and acquired conditions such as *commotio cordis,* myocarditis and electrolyte disorders.(9,10) In such cases, effective secondary strategies including prompt bystander cardiopulmonary resuscitation (CPR) and early defibrillation can significantly improve survival rates.(11–15)

Adequate emergency provisions should be in place to overcome logistical barriers to medical treatment in crowded areas for both athletes and spectators. Previous experience reveals that spectators are at increased risk of SCA during football matches from emotional stimuli that trigger catecholaminergic surges promoting coronary plaque rupture.(16–18)

Automated external defibrillators (AED) are effecting in preventing SCD in large public settings,(19,20) including high-schools, with up to 64% survival rate to hospital discharge.(4) High-school AED programmes in the US demonstrate a high survival rate for students and adults who suffer SCA on school campus.(21) The major determinant for survival is the time to defibrillation. The critical interval from the onset of a lethal arrhythmia to shock is 3–5 min,(22) with success rates decreasing by 7-10% for every minute delay to defibrillation(22) thus highlighting the need for a comprehensive, well-rehearsed emergency response plan.

The 2010 ARENA Study(23) outlined inadequacies in emergency response planning in top-flight European football clubs, which necessitated the European Association of Cardiovascular Prevention and Rehabilitation (EACPR) to issue consensus recommendations for minimum standards for emergency cardiovascular care at sports arenas in Europe to ensure a coordinated and timely response to SCA.(24) Principal elements of the recommendations were the provision of AEDs, existence and documentation of an emergency medical action plan (MAP), sufficient personnel resources and collaboration with local emergency medical services.

To date, there are no studies evaluating existing protocols for preventing SCD in English football, a sport that encompasses over 4,500 professional players and more than 30 million spectators each season.(25) We aimed to evaluate existing primary prevention strategies and emergency response planning across professional football clubs in England to identify potential areas of improvement and further optimise SCD prevention.

**METHODOLOGY**

A cross-sectional study among English professional football clubs was conducted between June and October 2014, to assess the awareness and implementation of cardiac screening, AED training and availability, the existence and documentation of a medical action plan and emergency medical service provision (Supplementary file 1)). All clubs were affiliated and registered with The English Football Association (FA), which is the governing body for professional football clubs in England. This study was organised in collaboration with the Football Association and the Professional Footballers’ Association (PFA) as part of an initiative to monitor availability and quality of preventative strategies across professional football clubs.

**The League System**

The 92 clubs are organised into four leagues, the highest of which is the Premiership which consists of the top 20 clubs. This is followed by the Championship (n= 24 clubs), League 1 (n =24) and League 2 (n= 24). The system is bound together by the principle of promotion and relegation. At the end of each season, a certain number of the most successful clubs in each league can be promoted to a higher league. Conversely, those that finish at or towards the bottom of their league at the end of the season are relegated to a lower division. Although based on sporting achievement and results, promotion is usually contingent on meeting criteria set by the higher league, especially concerning appropriate facilities and finances.

**Survey**

A quantitative written survey (supplementary file 1) was distributed to the head medical doctor or physiotherapist of all 92 professional football clubs in the four English leagues during the 2014-2015 season. The survey comprised of two sections: A) primary prevention measures in terms of cardiac screening and details of implementation; B) secondary prevention measures in terms of CPR training and AED provisions, emergency medical action plan documentation and ambulance provisions.

**Cardiac Screening**

The Football Association mandates that all academy players aged 16 undergo pre-participation cardiac screening with a health questionnaire, physical examination, 12 lead ECG and echocardiogram. The survey enquired if the club adhered to the Football Association mandate, who implemented the screening and how often screening was performed. Clubs were also asked if they undertook regular screening of senior players and if so how frequently (supplementary file 1). All screenings are overseen by the club doctor or senior physiotherapist in liaison with a regional expert cardiologist.

**Secondary Prevention Measures**

In line with EACPR recommendations, this survey enquired about which members of the medical team had training in basic and advanced CPR (supplementary file 1). There were also questions regarding the awareness of Football Association guidelines on AEDs, availability of AEDs both at match day and training ground venues, and which staff ware trained to use the equipment.

**Medical Action Plan**

This section focused on an emergency medical action plan for SCA and if one existed whether it was documented, whether it was in place for training and for match day games, the personnel required for implementation and the review process.

**Ambulance Provision**

EACPR recommendations state that an ambulance should be provided at gatherings of >10,000 spectators. All clubs in the study were asked whether an ambulance was present on training days and on match days and how far the nearest hospital was in terms of distance (km) and estimated time of arrival (minutes). The nearest hospital was one deemed to have sufficient facilities to deal with SCA and have the necessary staffing skills set required for the sequelae of such an event such as intensive care support.

Incomplete questionnaires were not eligible for further analysis and treated as a non-response. All clubs were assured that anonymity of the data would be maintained throughout.

**Patient Involvement**

There was no patient involvement in the design or recruitment of this study and therefore development of outcome measures were not informed by patient preference.

**Statistical Analysis**

Descriptive statistical tests were performed using SPSS version 20.0 (SPSS, Chicago, Illinois, USA). Ethical approval was not required for this study.

**RESULTS**

The response rate for the survey was 86% (n= 79), ranging from 80% (n= 16 of 20) in Premiership clubs to 88% in each of the Championship clubs (n= 21 of 24), League 1 clubs (n= 21 of 24) and League 2 clubs (n= 21 of 24). Figure 1 demonstrates the overall percentage of positive responses to the survey questions.

**Primary Prevention Strategies**

All (n= 79; 100%) clubs across the four professional leagues participated in the Football Association cardiac screening programme. 100% (n= 16) of the Premiership clubs and 57% (n= 12) of the Championship clubs reported a regular cardiac screening programme for senior players on an annual basis. All Premiership clubs performed a health questionnaire, ECG and echocardiogram as did 4 of the 12 (37%) Championship clubs. The remaining 8 Championship clubs performed screening with health questionnaire and ECG only. None of the clubs in League 1 or League 2 reported any further cardiac screening programme beyond the Football Association requirements.

**Secondary Prevention Strategies**

All clubs (n= 79; 100%) had provisions for AEDs on match days and during training sessions (figure 1). Awareness of the Football Association‘s AED guidelines was highest among League 1 medical staff (n= 17; 81%), followed by Premiership (n= 12; 75%), Championship (n= 15; 71%) and League 2 staff (n=13; 62%).

Resuscitation training comprising of basic life support (BLS) and AED guidance was provided to medical staff by all Premiership clubs (n= 16; 100%) and most Championship clubs (n=19; 90%). 76% (n= 16) League 2 clubs provided such training compared with 67% (n= 14) League 1 clubs.

All medical doctors were trained in advanced life support (ALS) with variable rates of BLS training among physiotherapists across all leagues.

**Medical Action Plan**

The majority of clubs (n= 65; 82%) reported the existence of a medical action plan for SCA (figure 2) which ranged from 94% in the Premiership to 71% in the Championship clubs.

There was considerable variation in the documentation of the medical action plan. A similar proportion of Premiership clubs (n= 14; 88%) and League 2 clubs (n= 18; 86%) reported full documentation. However, fewer clubs in League 1 (n= 14; 67%) and the Championship (n= 11; 52%) reported a documented medical action plan.

**Ambulance Provision**

The Premiership clubs had the highest average stadium capacity and match day attendance followed by the Championship, League 1 and League 2 clubs (figure 3). This has implications on ambulance transportation to local hospitals with more logistical barriers posed by larger stadiums with a greater number of spectators (figure 3). 87% (n= 69) clubs across all four leagues provided an ambulance on-site on match days for players and spectators, including 100% Premiership and League 1 clubs, 83% Championship clubs and 67% League 2 clubs. In all cases, the ambulance staff were trained to BLS level. The mean distance to the nearest hospital in each league was under 7km and the average time estimated was highest in Premiership clubs (figure 3). Of note, only a minority of clubs provided on-site ambulance cover during training sessions with BLS measures and the practice was confined only to the Premiership (figure 1).

**DISCUSSION**

This study of 79 professional football clubs is the first to have evaluated emergency response planning provisions based on the recommendations of the EACPR in England and Wales. Similar to the ARENA study, our cohort includes professional football clubs across the top four divisions of English football, allowing for direct comparisons between the two studies, and in particular with the subset of 39 English clubs that participated in the ARENA study.

All 79 clubs undertook cardiac screening of their academy players in line with Football Association mandate. Moreover, all the Premiership clubs and over half (57%) of the Championship clubs undertook regular screening for other players on an annual basis. In contrast, none of the clubs from the lower two divisions reported cardiac screening programme beyond the Football Association requirements. The frequency and extent of cardiac screening was highest in the Premier League, with all clubs reporting annual assessment of their senior players with a health questionnaire, ECG and echocardiogram. In contrast just 4 of 12 Championship clubs used a similar screening strategy and the remaining 8 clubs used a health questionnaire and ECG only. None of the League 1 and League 2 clubs conducted regular screening for senior players. This may be reflective of the financial constraints but raises concerns relating to limited access to screening of young players at grassroots or amateur level, who may be at greater risk of SCD.(26)

Premiership football clubs were better prepared to maintain the cardiovascular safety of their players than clubs in the lower divisions. 94% of Premiership clubs had a documented medical action plan and all clubs offered training to their staff and provided ambulance support on match days (figure 2). This may partly reflect the ability of more affluent clubs to fund more comprehensive emergency response planning provisions. The Football Association and Professional Footballers’ Association fund an initial cardiac screening for all 16 year-old scholars in every club. However, further preventative measures are dependent on the individual club thereafter. The available resources for Premiership clubs are vastly greater than the lower divisions due to greater attendance revenue, television rights deals, overseas investors and global commercial appeal. Given, however, that the majority of exercise-related SCA occur in those who are competing at lower levels and in greater numbers, emergency response facilities should be readily available to all athletes.

All clubs participating in our study provided AED equipment. This was significantly better than the European average of 72% in the ARENA study and an improvement to the 87% of the subset of English clubs participating in the ARENA study.(23) Of concern, almost 30% of clubs in the lower divisions with available devices had no formal training for the staff. The location and maintenance of AEDs were not specifically assessed though the importance of these aspects have been highlighted in a previous study of 171 Irish amateur football and rugby clubs highlighted the importance of AED storage and maintenance in the survival change for athletes who suffer SCA.(27)

Almost three-quarters (72%) of clubs reported the existence of a documented medical action plan, compared with 64% of European counterparts.(23) There were significant differences between divisions with 88% of Premiership and 86% League 2 clubs having a documented medical action plan compared to only 67% of the League 1 and 52% of Championship clubs. Lack of documentation in a significant proportion of clubs raises concern, as it is likely to indicate informal arrangements and the absence of a standardised protocol which is practiced and audited on a regular basis. Moreover, our result is notably lower compared to the 85% of English clubs, which reported the existence of a written medical action plan as part of the ARENA study. Although this may be a chance finding, depending on the divisions included in the ARENA study, at the very least indicates no improvement since the publication of the EACPR recommendations.

All Premiership and League 1 clubs provided an ambulance on match days, compared to a quarter of Championship clubs and a third of League 2 clubs. However, the vast majority (87%) of clubs in all divisions complied with the EACPR recommendation for an ambulance to be present at sporting venues when >10,000 spectators are present. All clubs were less than 7km from their nearest hospital, the journey to which ranged from 7.9 minutes (Championship) to 12.5 minutes (Premiership) (figure 3). The Premiership clubs had larger stadiums for ambulances to navigate through with the highest number of match day spectators, which may contribute to an increased time to the nearest hospital.

Ongoing Initiatives

Simply providing an AED may not be sufficient as there may be practical barriers involved due to accessibility and maintenance. Similarly, ongoing BLS and ALS training is important to maintain the skills required to deal with SCA. Open communication with emergency services is also important to be informed of contemporary developments that may enhance coordination of emergency responses.

In keeping with this, a major factor in the improved rates of AED provision and emergency care in England compared to European counterparts may be largely attributable to educational courses run by the governing body such as The Football Association Advanced Resuscitation and Emergency Aid (AREA) course. This is a training programme for doctors and physiotherapists designed to address issues such as cardiac arrest, BLS and ALS, and AED use. It is mandatory of the Premier League doctors to attend this course. Another Football Association initiative for the lower leagues is the Intermediate First Aid for Sport (IFAS) course primarily for healthcare and allied professionals who may be working in the lower leagues and are responsible for the pre-hospital management of the individuals in sports environments and particularly for practitioners who may be working in isolation without immediate access to medical support and first aid provision.

**Areas for Improvement**

Our study has identified specific areas of the emergency response planning where intervention would enhance the club’s preparedness, ensuring a coordinated and timely response to life-threatening cardiovascular emergencies: 1. Educational activities to enhance the awareness and understanding of the EACPR and Football Association guidelines across all clubs for both AEDs and emergency planning. Such educational activities should provide a practical approach to organising an emergency response plan. Mentorship and financial support of lower division clubs would further enhance the implementation of such programmes. 2. Training of staff in AED usage, especially in lower divisions, which will facilitate prompt defibrillation if required and aid confidence when involved in a SCA. In order to enhance the chain of survival, it is crucial to ensure ease of AED accessibility and AED maintenance should also be ensured. 3. Although the existence of an emergency medical action plan was widely reported, documentation should be improved for use at both the training ground and the match day stadium. 4. Each club should ensure that their medical action plan is well-written, comprehensive and addresses the logistical challenges posed to that particular club in terms of ambulance access and local hospital facilities.

**LIMITATIONS**

Our results may be affected by response bias as clubs with more stringent emergency response planning culture may have been more likely to respond. Though not all football clubs were included, a response rate of 86% represents the majority of the clubs with proportional representation from all four leagues. The suitability and quality of the medical action plan for each club was assumed to be of a sufficient standard though the authors did not have direct access to the plans. The data from the study should not be extrapolated to emergency response planning across other sporting disciplines in England.

**CONCLUSION**

Improvements in a number of areas, including AED staff training and the documentation of an emergency plan is likely to enhance the ‘chain of survival’ of early recognition of an emergency, early activation of a response team, early bystander CPR, early defibrillation and advanced cardiac life support with post-resuscitation care. Programmes dealing with emergency preparedness need to ensure that the provision of an AED alone is insufficient; ease of access and regular maintenance are important factors. The rehearsal and coordination of medical action plans is also imperative and these areas of emergency planning should be assessed in future studies. Such initiatives should be readily available to all athletes, not just those at the highest echelons of sport.

**What are the new findings?**

* English football clubs outperform European football clubs by providing AEDs at all training and match grounds.
* The existence of a medical action plan is variable among clubs; , documentation should be improved for use at both the training ground and the match day stadium
* Training of staff in AED usage, especially in lower divisions, which will facilitate prompt defibrillation if required and aid confidence when involved in a sudden cardiac arrest.

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

* Highlight the need for ongoing training for AED usage, BLS and ALS skills and emergency response coordination.
* Encourage sports clinicians and administrators to review their medical action plans and response facilities in line with current recommendations.

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Competing interests statement

No support was received from any organisation for the submitted work; no financial relationships exist with any organisations that might have an interest in the submitted work in the previous three years; and no other relationships or activities exist that could appear to have influenced the submitted work.

Author Contributions

AM designed data collection tools, monitored data collection, cleaned and analysed the data, and drafted and revised the manuscript. HD, SG and GF designed data collection tools and drafted the manuscript. TY, TR and LR monitored data collection and analysed the data. MW, RB and DS liaised with the healthcare professionals at the 92 clubs to facilitate data collection. IB supported the study with endorsement on behalf of the Football Association, liaised with the healthcare professionals at the clubs and revised the paper. MT revised the manuscript and MP initiated the project. SS monitored data collection for the whole study, analysed the data and drafted and revised the paper. SS is the guarantor.

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Conflict of interest

None declared.

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**SUPPLEMENTARY FILE AND FIGURE LEGENDS**

**Supplementary File 1: Survey sent to all Professional Soccer Clubs**

**Figure 1: Response rate of all Professional Clubs to Primary and Secondary Prevention Survey**

**Figure 2: Bar Chart Demonstrating Emergency Response Planning Across all four English Professional Leagues**

**Figure 3: Characteristics of Clubs from all the four Leagues in terms of Spectator Numbers and Proximity to Hospital Care**