

Time for action regarding cardiovascular emergency care at sports arenas: a lesson from the Arena study

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Sudden cardiac arrest (SCA) is a common cause of death worldwide, most often triggered by ventricular fibrillation or asystole.¹ The estimated prevalence in adult individuals (>35 years) is about 1 in 1000 per year in the USA.² The major determinant for survival in such instances is the time to defibrillation,¹ with the critical interval from the onset of a lethal arrhythmia to subsequent shock, to restore sinus rhythm, being 3–5 min.² The efficacy of automated external defibrillators (AEDs) to prevent SCAs has been demonstrated in large public settings, such as airports and casinos^{3,4} and their implementation in other crowded venues has also been advocated.⁵

Large sports arenas typically gather several thousands of spectators, including adult and senior individuals with risk factor for cardiac events, repeatedly exposed to intense emotion.⁶ Although much attention is put on the athletes on the field, most cases of SCA in this setting will occur among spectators, and simply watching (emotional) sports events has been demonstrated to trigger cardiac events.⁷

The National Association of Emergency Medical Services Physicians (NAEMSP) recommends a medical action plan (MAP), including AEDs, as a blue-print for delivering emergency medical care at mass gathering events (e.g. more than 1000 persons).⁸ In the USA, moreover, AEDs are recommended in large sports facilities and gyms, and also in the school setting when the time to defibrillation exceeds the critical threshold of 5 min.^{9,10} On the contrary, no recommendations regarding acute cardiovascular care at sports arenas exist at present in Europe, and the current implementation of medical action plans (including AEDs) in major continental sports arenas is largely unknown.

The Arena study

We sought to investigate the existing cardiovascular safety procedures of major sports arenas in Europe, with special attention to the availability of AEDs, using a written survey. The survey was distributed to elite soccer clubs in 10 European countries, willing to participate in the study, and collected by national representatives of the Sports Cardiology Section of the European Association of Cardiovascular Prevention and Rehabilitation, within the European Society of Cardiology (see Acknowledgements).

The survey comprised of 12 questions concerning the cardiovascular safety programme for the season 2005–2006, including the average number of spectators at the clubs arena for the season; the existence of a documented MAP; the number of emergency personnel present; the availability of AEDs in the arena; the mean distance (in km) and time (in min) to reach the nearest hospital; the level of training of emergency personnel and training programmes offered to the emergency staff, as well as the number of SCAs registered during the particular season.

The study included 190 clubs from 10 countries, namely England ($n = 37$), France ($n = 29$), Holland ($n = 25$), Spain ($n = 24$), Sweden ($n = 21$), Greece ($n = 16$), Norway ($n = 14$ clubs), Serbia ($n = 9$), Austria ($n = 8$), and Italy ($n = 5$). Three clubs used the same arena, and two other clubs also shared an arena, making the total number of arenas as 187. Eventually, 135 teams were recruited from the top leagues and 55 teams from the second or lower leagues. The response rate for the survey was 87% for the 153 top division clubs being asked to participate (100% in all countries, except 80% in Austria and 55% in Serbia and England).

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Cardiovascular safety programmes

Of the 190 clubs, 137 (72%) reported the presence of an AED in their arena, with a broad range in different countries (0–100%; Table 1). Only 122 of 190 clubs (64%) reported the existence of a written MAP for sports events, again with a broad range (19–100%). The medical personnel present at arenas was commonly comprised of medical doctors (90%) and, to a lesser extent, of nurses and paramedics (37 and 58%, respectively). The majority of clubs reported an existing communication system (97%). Moreover, only 123 of 190 clubs (65%) reported having a basic cardio-pulmonary resuscitation (CPR) training programme, and even fewer clubs, i.e. 48 of 190 (26%) had an advanced CPR training programme implemented at the club/arena.

The distance from the soccer arena to nearest hospital is summarized in Figure 1. The mean distance from the stadium to the nearest hospital was 4.2 km (range 0–36 km). The mean time for transportation was ≤ 5 min for most soccer grounds/arenas (59%); however, in a few instances (two clubs) was up to 20 min. Indeed, of the 79 clubs who reported a time longer than 5 min to reach the nearest hospital, 20 (25%) did not report having an AED present at the arena. As outlined in Figure 1, the presence of AEDs at arenas is not related to the time to the nearest hospital.

Incidence of sudden cardiac arrest

The number of spectators was calculated by multiplying the average number of home spectators in each arena times the total number of home games for each club in the 2005–2006 season ($n - 1$, where n = the number of clubs in the league). In total, for the 190 participating clubs, a total of 39.4 million spectators were estimated during the study season. We subsequently adjusted these figures (by arbitrary adding 15% of spectators, according to the information derived from the clubs) to estimate the total number of spectators, including also those present at cup games and friendly games. The total number of SCAs reported was 77 in one season,

making the estimated adjusted incidence of SCA per total number of spectators 1 in 589 000 spectators. No SCA occurred among soccer players or officials during the observed season. Owing to our study design, finally, it was not possible to achieve any further detailed analysis of the SCAs and their causes.

Lessons from the Arena study

Our investigation demonstrates a surprisingly high proportion of inadequacies regarding cardiovascular safety programmes in major European soccer arenas. As many as 28% of the participating clubs did not have an AED available in their arena, and 36% did not have a written MAP describing cardiovascular safety procedures. Furthermore, 41% of clubs reported a transportation time from the arena to the nearest hospital in excess of 5 min, and a substantial proportion of these clubs (25%) did not report the availability of an AED.

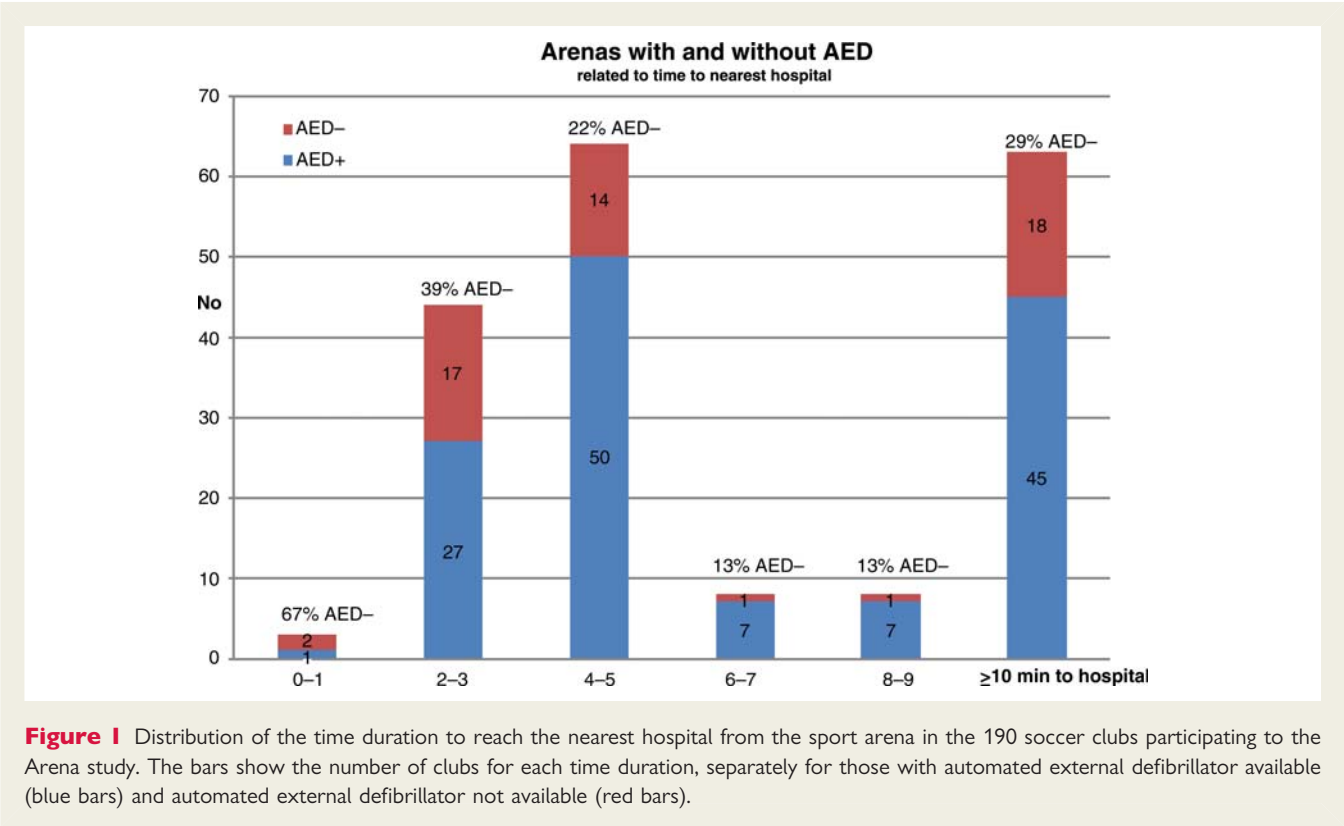
Automated external defibrillators and transportation times

Availability of AEDs in health and fitness facilities, when the anticipated time to defibrillation by the local emergency medical system exceeds 5 min, is currently recommended by the American Heart Association (AHA) and American College of Sports Medicine (ACSM).⁹ The AEDs are considered to play a pivotal role in the emergency-preparedness also in the school setting.^{10,11} Despite these recommendations and the current attention devoted to implementation of AEDs, the actual availability of defibrillators in large sport facilities, such as the soccer arenas, appears to be sub-optimal in Europe. This is particularly disappointing since the European Society of Cardiology and the European Resuscitation Council, since 2004, have been supporting specific AED programmes.¹² In consideration of the inadequacies regarding the provision of AEDs, we believe that further efforts should be instigated on behalf of the scientific societies and sport organizations by

Table 1 Cardiovascular safety programmes available at major soccer arena in Europe (shown as proportion of the interviewed soccer clubs)

Country	AED	MAP	Physicians	Nurses	Paramedics	Communication	CPR training	
							Basic	Advanced
Austria ($n = 8$)	75	75	63	13	38	100	38	50
England ($n = 39$)	87	85	87	13	59	100	87	26
France ($n = 29$)	93	62	100	31	97	100	62	48
Greece ($n = 16$)	25	19	94	19	0	100	31	0
Holland ($n = 25$)	68	68	64	72	4	100	68	24
Italy ($n = 5$)	100	80	100	0	0	100	100	40
Norway ($n = 14$)	100	43	100	7	93	100	57	29
Serbia ($n = 9$)	0	100	100	11	100	100	22	0
Spain ($n = 24$)	92	67	100	88	88	96	83	25
Sweden ($n = 21$)	38	48	95	57	62	81	57	14
Total ($n = 190$)	72	64	90	37	58	97	65	26

AED, automated external defibrillator; MAP, medical action plan; CPR, cardio-pulmonary resuscitation.



providing appropriate initiatives and directions specifically focused on major public sports venues.

A similar scenario is also evident regarding the transportation time. A large proportion of clubs (42%) reported a time from arena to the nearest hospital (and subsequent defibrillation) exceeding the critical threshold of 5 min (Figure 1). The presence of AEDs at these arenas was not related to the time to reach the nearest hospital, as might have been expected and, even more importantly, a large proportion (25%) of those clubs with an exceedingly longer transportation time did not have an AED present at the arena, making it impossible to provide an efficient defibrillation. Of notice, the lack of AED associated with a prolonged transportation time was not restricted to the lower divisions. This observation suggests that lack of adequate safety procedures and tools was not largely imputable to economic reasons, but likely reflects inadequate attention to the cardiovascular safety procedures.

Medical action plans

The availability of an AED in the arena does not automatically guarantee the proper use of the device, should an emergency occur. It has been demonstrated that AED (in terms of number and location) should be part of a documented medical action plan,¹³ which should also include the medical oversight for the venue/event, the level of care to be provided, the human resources, the medical equipment and treatment facilities, the transportation and communication systems, together with central control of and repeated training of cardiovascular safety procedures.^{8,14}

In spite of the above recommendations, the current situation in Europe appears far from optimal, considering that only two-thirds of the interviewed clubs reported having a documented MAP. To underline just some of the discrepancies, as many as 35% of the examined clubs do not offer their medical staff any basic training in CPR. In addition, a substantial proportion of clubs (12%) completely lacked not only AEDs, but also MAP as well as training of personnel. Our figures are in sharp contrast to the findings of a US survey, which showed that all National Football League (NFL)-stadiums offered advanced cardiac life support, communication, and designated personnel providing emergency medical care for spectators.¹⁵

Incidence of sudden cardiac arrest

Viewing and being emotionally engaged in a soccer game increases the incidence of cardiac events,^{7,16} particularly in adult and senior individuals with a high cardiovascular risk profile.⁷ Our study show that the incidence of SCAs may be as large as 1/5–600 000 for spectators in major European soccer arenas. The calculated incidence of SCAs in our study was as high as previously reported;¹⁷ a similar figure were also reported by Luiz (1 SCA/400 000 spectators) from one major German soccer arena during 6 years of observation.¹⁸ A recent study showed an even higher incidence of SCA (3/800 000) in a new stadium, while also demonstrating successful on-site resuscitations with AEDs.¹⁹ Accordingly, our study confirms that spectators, even more than the athletes themselves,²⁰ deserve medical attention and, indeed, represent the primary target of cardiovascular safety programs in the sports arenas.

Future perspectives

This study, by demonstrating the inadequacies concerning written MAP, availability of external defibrillators, as well as basic CPR training procedures in a substantial number of sports arenas, emphasizes the urgency for action to ensure an appropriate level of future cardiovascular safety. The need for action is even more plausible, when we consider that our findings, derived from the major sport arenas, likely depicts the best scenario in Europe. In a real emergency situation, some of the determinants we described here, such as the transportation time to the nearest hospital, may be increased, due to traffic, re-routing, and other logistical issues on the match days.

In our opinion, this inadequacy represents the expression of a scarce attention to safety procedures, more than the expression of tight financial limitations. Therefore, our findings should raise the attention of scientists and medical staff operating in sports arenas, by urging the timely release of specific recommendations concerning the cardiovascular safety strategies at major sports arenas.

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