Live Saving in the Two Holy Mosques, Al Masha'ir (Arafat, Mina, Muzdalifah) and the community by establishing the Public- access Automated External Defibrillator (AED) Program and the First Responder AED Program

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Abstract

Out-of-hospital cardiac arrest (OHCA) during Al Hajj represents a challenge to Saudi Arabian health authorities. There were 40 sudden cardiac arrest cases in the period of Al Hajj Season 1423/ 2002 in the Grand Mosque of Holy Makkah of which only 3 cases were revived post cardiopulmonary resuscitation (CPR). Defibrillation is the most effective treatment and should be performed within 3 minutes. However, time to first shock was delayed due to delayed arrival of the medical team owing to crowdedness and long distance and AEDs were unavailable. Holy Quran stated: {And Who Ever Saves Live, It Is As If He Saved All Mankind}, Al- Maa'idah, 5:106:32. The aim of this project is to save lives in the Two Holy Mosques, Al Masha'ir (Arafat, Mina, Muzdalifah) and the community by establishing the Public- access AED Program and the First Responder AED Program.

Methods:

The work in this scientific paper is one of the recommendations of my previous scientific papers entitled: Pilgrims Health in the 20th and 21st Centuries; Al Hajj: The Oldest and the Largest Mass Gathering; and Al Jamarat Ritual: The Emerging Critical Cornerstone of Al Hajj, These papers were published and presented at the 13th Scientific Meeting for Al Hajj, Al Omra and Al Ziarah Research, the Custodian of the Two Holy Mosques Institute for Al Hajj, Al Omra and Al Ziarah Research, Omm AL Qura University in Holy Makkah in KSA, the 14th and the 15th World Congress on Disaster and Emergency Medicine in Scotland and Netherlands, respectively. In addition, an extensive review was conducted using computerized databases Medline and PubMed for searches from 1966 through December 2014.

Islamic books, biomedical journals and the proceedings of the Lancet International Conferences on Mass Gathering Medicine (MGM) and the World Congress on Disaster and Emergency Medicine (WCDEM) were also scanned for relevant topics. Arabic/ English language articles/ topics containing information

pertinent to public- access AEDs programs and first responder AED programs were read, abstracted, analyzed and compiled.

Results:

Areas with a high incidence of cardiac arrests are defined as those with 1 cardiac arrest every 5 years. AEDs are needed to be deployed in 10.6٪ of the city area, providing coverage for 66.8٪ of all cardiac arrests. After predicted response time calculation and given the high crowd density in the Two Holy Mosques and Al Mashai'r (more than 4 persons/M2), not only strategic placement but also uninterrupted AED accessibility warrants attention if public access defibrillation is to improve survival after OHCA. Public- access AED program and first responder AED program in the Two Holy Mosques, Al Masha'ir (Arafat, Mina, Muzdalifah) and the community can be divided into 3 levels based on the type of potential first responder who is basic life support (BLS) certified and is expected to use AED. Level 1 refers to nontraditional responders (eg. police officers, scout members, firefighters, security personnel, the employees of the General Presidency for the Holy Mosque and Prophet Mosque Affairs , airport personnel, flight attendants) who have a duty to respond as part of their every day responsibilities. Level 2 refers to targeted trained "citizen responders" who may be employed by a worksite/ inland and seaport transportation means/ study places/ sport centers but who do not have an explicit duty to respond. Level 3 responders are trained family members, members of Al Hajj Missions/ Al Tuwafah / Al Adela' Establishments and friends living with or visiting a person at high risk for sudden cardiac arrest.

Conclusion:

Preventable deaths from sudden cardiac arrest in the Two Holy Holy Mosques, Al Masha'ir (Arafat, Mina, Muzdalifah) and the community can be eliminated when public- access AED program and first responder AED program are established. Given the Tawaf Arena Rradius is 50 M from the Center of Holy Ka'bah; the medical director's targeted response times (3 Min- 180 S); the Emergency Medicine goals at Mass Gatherings and the previous Hajj Experience, the number of AEDs required in the Two Holy Mosques and Al Masha'ir (Arafat, Mina, Muzdalifah) can be calculated and the public- access AED program, as well as the first responder AED programs can be established.

Key Words:

KSA, Holy Makkah, Al Hajj, Pilgrims, The Two Holy Mosques, Al Masha'ir (Arafat, Mina, Muzdalifah) , MGM, Emergency, Sudden cardiac arrest, CPR, AEDs, Public- access defibrillation, First responder.

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INTRODUCTION

Al Hajj is the oldest and the largest mass gathering ever known to mankind. Al Hajj is an annual, six- day, mobile, outdoor, religious event when more than 3 million Muslims from more than 180 countries including the Kingdom of Saudi Arabia (KSA), gather in the holy shrine of Holy Makkah (Earth Umbilicus) to perform this 5th cornerstone ritual of Islam.

Out-of-hospital cardiac arrest (OHCA) during Al Hajj represents a challenge to Saudi Arabian health authorities. There were 40 sudden cardiac arrest cases in the period of Al Hajj Season 1423/ 2002 in the Grand Mosque of Holy Makkah of which only 3 cases were revived post CPR. Defibrillation is the most effective treatment and should be performed within 3 minutes. However, time to first shock was delayed due to delayed arrival of the medical team owing to crowdedness and long distance and AEDs were unavailable. Holy Quran stated: {And Who Ever Saves Live, It Is As If He Saved All Mankind}, Al-Maa'idah, 5:106:32. The aim of this project is to save lives in the Two Holy Mosques, Al Masha'ir (Arafat, Mina, Muzdalifah) and the community by establishing the public- access AED program and the first responder AED Program.

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RESULTS AND DISCUSSION

Sudden cardiac arrest is an abrupt unexpected cessation of breathing and circulation and is the leading cause of death in the United States of America (USA) as well as most developed nations. Treatable pulseless ventricular tachycardia (VT) and ventricular fibrillation (VF) are the most common mechanisms of cardiac arrest (60-80٪) resulting from acute coronary syndrome, left ventricular hypertrophy, preexcitation syndromes and familiar cardiac conditions including long QT syndrome and Brugada syndrome (Seraj and Harvey 2007). Other less frequent mechanisms are brady- asystoles/ asystole and pulseless electrical activity (PEA) resulting from cardiac and extra- cardiac causes.

Defibrillation is indicated for the management of cardiac arrest due to pulseless VT and VF.

Defibrillation is non synchronized delivery of energy during any phase of cardiac cycle. The delivered shock causes the electric current to pass through the heart from the negative to the positive electrode. It causes the whole heart to depolarize and contract simultaneously interrupting and terminating the abnormal electrical rhythm and thus allowing the sinus node to resume normal pacemaker activity.

Defibrillation was first used in humans by Claude Beck, a cardiothoracic surgeon on congenitally diseased heart. Closed chest defibrillation was discovered in the 1950s in Russia.

In 1959, Bernard Lown designed the modern- day monophasic defibrillators (360 Joules). In 1980s, the safer more successful low energy less damaging (150- 200 Joules) biphasic defibrillators were discovered (Resuscitation Council UK 2014). Earlier in 1965, defibrillators have been essential part of pre hospital care since Frank Pantridge shown that defibrillation could be done in the field on the streets of Belfast, Northern Ireland (American college of Emergency Physicians ACEP 2014).

AEDs (asynchronized defibrillators) are simple and relatively inexpensive (Figure 1). They are devices that can be utilized by certified BLS providers in pre hospital or in hospital settings while the manuals have to be used by advanced cardiac life support (ACLS) providers. While CPR is in progress to maintain cerebral perfusion, AEDs will recognize the shockable rhythm and order the operator to press the shock button. AEDs cannot be overridden manually and can take 10 - 20 seconds to determine arrhythmias. AEDs are highly accurate with some modules demonstrating 100٪ specificity and 90-92٪ sensitivity for coarse VF (Bossaert L 1997). Semi AEDs are similar to AEDs but can be overridden and usually have an ECG display and also have the ability to pace. Additional critical care patient monitoring can be incorporated like noninvasive blood pressure, pulse oximetry, end- tidal Pco2 in intubated patients, as well as other physiologic parameters. The device should have recording capabilities so that the cardiac arrest can later be reviewed for medical oversight and quality assurance reasons (ACEP 2011, Alshinkity et al 2005, Alshinkity IS 2000).

Unlike AEDs, manual machine necessitates the presence of certified ACLS personnel to diagnose, interpret the rhythm and deliver shocks (asynchronized defibrillation or synchronized cardioversion) to the patients.

The most frequent cause of cardiac arrest in children is respiratory in origin. However, children 8 years or older may have life- threatening arrhythmias due to structural heart diseases and AEDs can be used (Vetter VL and Haley DM 2014, Nishiuchi et al 2014). An AED with pediatric attenuator is ideal for children, as this feature allows the delivery of a lower dose of energy in pediatric patients. In the event of VF, a weight related dose of 2 J/Kg can be used initially, followed by 4J/Kg subsequently. If an AED with a pediatric attenuator is not available, then standard AED may be used.

The aim of defibrillation is termination of abnormal rhythm and restoration of normal perfusing rhythm. Step- by- step technique of AED use includes the followings:

1. While CPR is ongoing, open the package containing the defibrillation pads with attached cable and connector. With the chest prepared (hair shaving, wiping dry, jewelry removal, medication patches removal) carefully pull off the protective backing from the pads. Attach the pads to chest wall (Antero- Apical, Anteroposterior or Apex- posterior position).
2. Turn on the device and follow the voice prompts.
3. Initiate the analysis of the rhythm and ensure there is no movement during the analysis. If the shock is indicated, the device will automatically charge up to a preset level.
4. Check that no one is in contact with the patient or trolley and call out "Stand clear".
5. Discharge the shock (note that fully automated defibrillators do not require the operator's input to discharge a shock).
6. Continue CPR and manage according to the universal resuscitation protocols.

Possible complications include skin burns, inadvertent electric shock to others and defibrillation induced myocardial damage. Patients requiring defibrillation will need intensive monitoring and close post resuscitation care (ACEP 2011, WADEM 2014).

Figure 1: AEDs Models.

OHCA accounts for 250.000 - 350.000 sudden cardiac deaths per year in the USA. OHCA is a leading cause of death (70٪) and only 3-8٪ of patients survive to leave the hospital neurologically intact (Sanna et al 2008). Defibrillation is the most effective treatment and should be performed within 3 minutes. Unless treated promptly, VF becomes less coarse and eventually converts to less treatable rhythm of fine VF or asystole.

The AED represents an efficient method of delivering defibrillation to persons experiencing OHCA and its use by both traditional (healthcare professional) and nontraditional (non-healthcare professionals) first responders appears to be safe and effective (Marenco et al 2011). Early defibrillation is the use of AEDs by trained public-safety personnel (Alshinkity IS 2013, Kassanoff et al 1972). First responder AED programs may increase the number of people experiencing sudden cardiac arrest who receive bystander CPR; can reduce time to defibrillation; and may improve survival from sudden cardiac arrest. The survival rate is up to 90٪ in the first minute. However, defibrillation effectiveness diminishes with each passing minute (Kassanoff et al 1972, Seraj and Harvey 2007).

Community- based studies show increased cardiac arrest survival when first responders are equipped with AEDs rather than waiting for paramedics to defibrillate. Prompt application of an AED shows a greater number of patients in VF compared with initial rhythms documented by late -arriving emergency medical services (EMS) personnel (Winkle RA 2010). Survival of OHCA treated by police officers equipped with AEDs in Rochester, USA, has averaged 50٪ resuscitation, with median time from collapse to defibrillation of about 5 minutes (ACEP 2014).

A meta-analysis by Sanna et al evidenced a risk ratio (RR) of 1.22 (95٪ C.I.: 1.04-1.43) of surviving to hospital discharge for people treated with CPR+AED as compared to CPR- only. The second meta-analysis showed a RR of 1.39 (95٪ C.I.: 1.06-1.83) of surviving to hospital discharge for people treated with CPR+AED as compared to CPR- only. The results of this meta-analysis demonstrate that programs based on CPR plus early defibrillation with AEDs by trained non- healthcare professionals (trained layrescuers/ bystanders) offer a survival advantage over CPR -only in OHCA (Sanna et al 2008). Laypersons trained and equipped to use AEDs in public places can double survival to hospital discharge compared with that which can be achieved by laypersons rescuers who can only perform CPR while awaiting EMS arrival (Hallstorm et al 2004).

There are three levels of public- access AED programs based on the type of potential first responder who is basic life support (BLS) certified and is expected to use AED. Level 1 refers to nontraditional responders (eg. police officers, scout members, firefighters, security personnel, the employees of the General Presidency for the Holy Mosque and the Prophet Mosque Affairs, airport personnel, flight attendants) who have a duty to respond as part of their every day responsibilities. There has been considerable experience demonstrating benefit with minimal risk for this group (Riegel et al 2006). Level 2 refers to targeted trained "citizen responders" who may be employed by a worksite/ inland and seaport

transportation means/ study place/ sport centers but who do not have an explicit duty to respond. There has been good experience with level 2 AED workplace use in British rail stations, oil platforms in North Sea, electricity plants, passenger cruise ships, and merchant marine vessels (Hallstorm et al 2004). Level 3 responders are trained family members, members of Al Hajj Missions/ Al Tuwafah/ Al Adela' Establishments and friends living with or visiting a person at high risk for sudden cardiac arrest (prior acute myocardial infarction, left ventricular ejection fraction less than or equal to 35٪, prolonged QTc, sustained inducible VT) (SCAA 2014).

Millions of people attend mass gathering events every year. The common feature of all mass gatherings is that the injury, illness rate and sudden cardiac arrest incidence of those attending are greater than the average non- gathered population and that they may be the subject to a catastrophic accident or attack with large numbers of injured or dead persons.

The collapse and death of two un- resuscitated spectators in the Nebraska University Football Stadium in 1965 was a stimulus for the modern era of MGM. The incidence of sudden cardiac arrest in mass gatherings ranges from 0.3 to 4 per 1,000,000 spectators with high survival- to- discharge rate of 20 ٪ - 100 ٪ (ACEP 2013). The incidence of sudden cardiac arrest and the efficiency of AED application in the Grand Mosque of Holy Makkah were studied by Dr. Al Dosari. There were 40 sudden cardiac arrest cases in the period of Al Hajj season 1423/ 2002 (Table 1). CPR was initiated in 26 of them, another 14 were labeled as dead on arrival of the medical team based on clinical examination and only 3 cases were revived post CPR. Asystole was the initial rhythm in 11 cases with delayed time to first shock. AEDs were unavailable. He concluded that many deaths were potentially preventable and that the utilization of AEDs as well as mobile emergency medical technicians (EMTs) units is highly recommended (Alshinkity IS 2007).

Table 1: Cardiac arrest patients in the Holy Grand Mosque of Holy Makkah, Al Hajj Season 1423/ 2002.

Number of cardiac arrest patients	40
Number of resuscitated patients	26 (65٪)
Number of unresuscitated patients	14 (35٪)
Number of resuscitated patients with asystole as initial rhythm	11 (42.3٪)
Number of patients revived post CPR	3 (11.5٪)
Neurological status of patients revived post CPR	Unknown
Time to first shock	Delayed
AEDs	Unavailable
EMTs	Unavailable

Strategic placement of AEDs is pivotal for public-access defibrillation. Public-access AEDs are being implemented in many countries worldwide (Winkle RA 2010). Regardless the financial implications, areas with a high incidence of cardiac arrests were defined as those with 1 cardiac arrest every 5 years. AEDs are needed to be deployed in 10.6٪ of the city area, providing coverage for 66.8٪ of all cardiac arrests (Hazinski et al 2005, Zakaria et al 2010).

Given a medical director's targeted response times (3 Min- 180 S) and the goals at mass gatherings, the number of AEDs required can be calculated (Crocco et al 2004). Studies from the University of North Carolina Hospitals found that the predicted emergency EMTs response times were 363 S for the longest football stadium distance, and 187 S for the basketball arena (Motyka et al 2005, Khodari AE 2013). AEDs are cost effective at sites where there is a high density of both potential victims and resuscitators (Ho et al 2014). Placement at residential units such as private homes / apartment complexes, golf courses, health clubs, and similar venues is less cost effective; however, the visible devices are good for public awareness of the problem of sudden cardiac arrest and provide reassurance to patrons (Winkle RA 2010). Limited AED accessibility at the time of cardiac arrest decreased AED coverage by 53.4٪ during the evening, nighttime and weekends, when 61.8٪ of all cardiac arrests in public locations occurred. (Alshinkity et al 2004, Alshinkity IS 2007, Al Turki M 2010, Z Al Abideen H 2010, Hansen et al 2013). Given the high crowd density in the Two Holy Mosques and Al Mashai'r (more than 4 persons/M2), not only strategic placement but also uninterrupted AED accessibility warrants attention if public access defibrillation is to improve survival after OHCA (Alshinkity et al 2005, Alshinkity IS 2007, Al Turki M 2010, Z Al Abideen H 2010, Hansen et al 2013).

CONCLUSION AND RECOMMENDATIONS

Preventable deaths from sudden cardiac arrest in the Two Holy Holy Mosques, Al Masha'ir (Arafat, Mina, Muzdalifah) and the community can be eliminated when public- access AED program and first responder AED program are established. Given the Tawaf Arena Rradius is 50 M from the Center of the Holy Ka'bah; the medical director's targeted response times (3 Min - 180 S); the Emergency Medicine goals at Mass Gatherings and the previous Hajj Experience, the number of AEDs required in the Two Holy Mosques and Al Masha'ir (Arafat, Mina, Muzdalifah) can be calculated and public- access AED program, as well as first responder AED program can be established.

Special attention should be given to uninterrupted AED accessibility during the evening, nighttime and weekends as well as other high risk times/ locations. Follow up of patients revived post CPR to learn their neurological status on Cerebral Performance Category scale (CPC scale) and Glasgow Coma Scale (GCS) is mandatory. This is to be performed inside and outside the KSA before and after pilgrim's departure for research outcomes and quality assurance purposes. This experience of public- access

AED program and first responder AED program can then be nationalized to Holy Makkah city/ state and to other cities and states in the KSA.

REFERENCE

١. القرآن العظيم

٢. الحديث النبوي الشريف

٣. الدكتور إبراهيم بن سيدي محمد بن محمد الأمين الشنقيطي: كتاب الطبيب والمريض بين يدي اللّه، الطبعة الثانية ١٤٢١، ردمك ٩٩٦٠٣٦٨٦٠٢ مكة المكرمة، المملكة العربية السعودية.

٤. الدكتور إبراهيم بن سيدي محمد بن محمد الأمين الشنقيطي: صحة حجاج بيت اللّه الحرام في القرنين العشرين والواحد والعشرين، الملتقى العلمي الثالث عشر لأبحاث الحج والعمرة والزيارة معهد خادم الحرمين الشريفين لأبحاث الحج والعمرة والزيارة جامعة أم القرى١٤٣٤، مكة المكرمة، المملكة العربية السعودية.

٥. أ.د. أحمد عماد الدين بن محمد خضري: مقترح لتغطية متحركة للمطاف حول الكعبة المشرفة بأوقات القيلولة هيئة تطوير مكة المكرمة والمشاعر المقدسة الملتقى العلمي الثالث عشر لأبحاث الحج والعمرة والزيارة معهد خادم الحرمين الشريفين لأبحاث الحج والعمرة والزيارة جامعة أم القرى١٤٣٤، مكة المكرمة، المملكة العربية السعودية.

6. Kassanoff I, Whaley W, Walter W, Burge D, Harrison C, Hurst J: Stadium coronary care: A concept in emergency health care delivery. JAMA 1972; 221: 397– 399.

7. Bossaert LL: Fibrillation and defibrillation of the heart. British Journal of Anesthesia 1997; 79: 172-177.

8. Marenco JP, Wang PJ, Link MS, Homoud MK, Estes NA 3rd: Improving survival from sudden cardiac arrest: the role of the automated external defibrillator. JAMA 2001; 7;285(9):1193-200.

9. Alshinkity IS, Alsolami S, Taylor D, Maimani O, Cameron P: Undifferentiated abdominal pain: The dark third of the moon, Emerg Med Australas 2004; vol. 16, supp. 1, p.A86.

10. Crocco TJ, Sayre MR, Liu T, Davis SM, Cannon C, Potluri J: Mathematical determination of external defibrillators needed at mass gatherings. J.Prehosp Emerg Care 2004; 8(3):292-7.

11. Hallstorm AP, Ornato JP, Weisfeldt M, Travers A, Christenson J, McBurnie MA, Zalenski R, Becker LB, Schron FB, Proschan M: Public- access defibrillation and survival after out-of-hospital cardiac arrest. N Eng J M 2004; 351: 637.

12. Hazinski MF, Idris AH, Kerber RE, Epstein A, Atkins D, Tang W, Lurie K: Lay rescuer automated external defibrillator ("public access defibrillation") programs: Lessons learned from an international multicenter trial. Circulation 2005; 111(24):3336-40.

13. Motyka TM, Winslow JE, Newton K, Brice JH: Method for determining automatic external defibrillator need at mass gatherings. Resuscitation 2005; 65(3):309-14.
14. Alshinkity IS: Al Hajj: the oldest and the largest mass gathering. Prehosp Disaster Med 2005; vol 20, supp 1, s40.
15. Alshinkity IS, Taylor D, Maimani O, EL Khalifa E, Felemban H, Cameron P: Standardized approach for assessment and investigation of undifferentiated abdominal pain: A clinical intervention trial. Ann Emerg Med 2005 vol. 46, issue 3, September, p. S121.
16. Riegel B, Nafziger SD, McBurnie MA,Powell J, Ledingham R, Sehra R, Mango L, Henry MC: How well are Cardiopulmonary Resuscitation and automated external defibrillator skills retained over time? Results from the Public Access Defibrillation (PAD) Trial. Acad Emerg Med 2006; 13:254.
17. Alshinkity IS: Al Jamarat ritual: The corner stone of Hajj. Prehosp Disaster Med 2007; vol. 22, supp.1, s64.
18. Seraj MA, Harvey PJ: The new technical aspects of basic life support policy and procedures of CPR for hospitals; Cardio Pulmonary Resuscitation (CPR) New 2005 Guidelines, 2007.
19. Sanna T, La Torre G, de Waure C, Scapigliati A, Ricciardi W, Dello Russo A, Pelargonio G, Casella M, Bellocci F: Cardiopulmonary resuscitation alone vs. cardiopulmonary resuscitation plus automated external defibrillator use by non-healthcare professionals: a meta-analysis on 1583 cases of out-of-hospital cardiac arrest. Resuscitation 2008; 76(2):226-32.
20. Z Al Abideen H: A future model for mass gatherings. The LANCET conferences, Mass Gathering Medicine: Implications and opportunities for global health security October 23- 25, 2010, Jeddah, Kingdom of Saudi Arabia.
21. Al Turki MS: Managing the crowds: the Saudi Hajj Experience. The LANCET conferences, Mass Gathering Medicine: Implications and opportunities for global health security October 23- 25, 2010, Jeddah, Kingdom of Saudi Arabia.
22. Winkle RA: The effectiveness and cost effectiveness of public-access defibrillation. Clin Cardiol 2010; 33(7):396-9.
23. Hansen CM, Wissenberg M, Weeke P, Ruwald MH, Lamberts M, Lippert F, Gislason GH, Nielsen SL, Køber L, Torp-Pedersen C, Folke F: Automated External Defibrillators Inaccessible to More than Half of Nearby Cardiac Arrests in Public Locations during Evening, Nighttime and Weekends. Circulation 2013; 128(20):2224-31.
24. Ho CL, Lui CT, Tsui KL, Kam CW: Investigation of availability and accessibility of community automated external defibrillators in a territory in Hong Kong. Hong Kong Med J 2014; 20(5):371-8.
25. Zakaria ND, Ong ME, Gan HN, Foo D, Doctor N, Leong BS, Goh ES, Ng YY, Tham LP, Charles R, Shahidah N, Sultana P, Anantharaman V; PAROS study group: Implications for public access

defibrillation placement by non-traumatic out-of-hospital cardiac arrest occurrence in Singapore. Emerg Med Australas 2014;26(3):229-36.

26. Vetter VL, Haley DM: Secondary prevention of sudden cardiac death: does it work in children? urr Opin Cardiol 2014 ;29(1):68-75.
27. Nishiuchi T, Hayashino Y, Iwami T, Kitamura T, Nishiyama C, Kajino K, Nitta M, Hayashi Y, Hiraide A; Utstein Osaka Project Investigators: Epidemiological characteristics of sudden cardiac arrest in schools. Resuscitation 2014 Aug;85(8):1001-6.
28. WEBSITES
29. The World Association for Disaster and Emergency Medicine (WADEM) http://www.wadem.org
30. Resuscitation Council (UK) http/ www. resus.org.uk
31. The American College of Emergency Physicians (ACEP) http://www. acep.org
32. Sudden Cardiac Arrest Association (SCAA) http://www.suddencardiacarrest.org