Version: 9 (Final)
Updated: 26 August 2003

EARLY ACCESS TO DEFIBRILLATION IN QUEENSLAND

1. Introduction

1.1 Defibrillation is a priority in the resuscitation of a cardiac arrest victim. Cardiac arrest is characterised by sudden collapse, unconsciousness, and an absence of a palpable pulse. Sudden collapse of a cardiac origin will commonly result in a disorganised cardiac rhythm usually ventricular fibrillation (VF). Defibrillation passes a direct electrical current through a fibrillating heart to depolarise a "critical mass" of myocardial cells, allowing them to depolarise uniformly, resulting in an organised rhythm. The introduction of defibrillation in the pre-hospital setting for the treatment of sudden out-of-hospital cardiac arrest, has led to improved patient survival. Recent advancements in defibrillation technology, specifically lightweight and compact AEDs (**A**utomated **E**xternal **D**efibrillators) enable defibrillation to be more widely available in the community.

2. Aim

2.1 The aim of this statement is to establish a framework to guide the development of agency policy and implementation strategies on Early Access to Defibrillation for agencies and practitioners within the Queensland Emergency Medical System (QEMS).

3. Objective

3.1 The objective of this statement is to encourage expanded availability of defibrillation in Queensland communities through cost-effective, safe, and sustainable programs that lead to improved patient outcomes.

4. Background

4.1 Survival of the victim of cardiac arrest is time-critical. It is dependent upon the shortest possible time from onset of cardiac arrest to defibrillation.

4.2 Debate in public health circles continues as to the extent to which AEDs should be expanded within the community. One area of debate centres on the ability of a layperson without training being able to safely use an AED. Not all victims of sudden collapse need or will respond to defibrillation. In unconscious patients with peripheral pulses, or arrests suspected to be of non-cardiac causes (near drowning / overdose), airway and breathing management have higher priority.

4.3 An AED algorithm is designed to minimise risk. Voice prompts guide the actions of the user. AEDs can be operated with relatively minimal or no prior instruction.

4.4 There is a move in attitudes noted in the literature toward making AEDs available in public places so that they could be used by a layperson thereby potentially further reducing the time to defibrillation.

4.5 To date the evidence suggests that a 'First Responder' model may be the most effective way of improving the access to defibrillation. There are a number of examples in the USA, Europe and in Australia where the use of AED by first responders has achieved very high survival rates.

4.6 There is strong support amongst the medical community for expanding the availability of defibrillation in the community particularly at identified high-risk locations. The current consensus view is that the best way to expand access to early defibrillation is through organised First Responder programs that operate within an organised emergency medical system (EMS). However, such an expansion should not happen without thorough cost effectiveness modelling and evaluation.

5. Early Access to Defibrillation

5.1 Processes to expand the availability of defibrillation in the community to date include:

- All Queensland Ambulance Service response vehicles being defibrillator equipped.
- First Responder services at major events and on Queensland's beaches through St John Ambulance, Red Cross, and Surf Life Saving Queensland.
- Development of First Responder programs in public places such as casinos.
- Development of Community First Responder programs in rural and isolated communities and workplaces.

5.2 Expanding early access to defibrillation includes:

- Promotion of community knowledge, skill and application of cardiopulmonary resuscitation (CPR);
- An integrated emergency medical system (EMS) approach; and
- Rapid First Responder and paramedic response.

5.3 Advances in AED design have significantly reduced the complexity of defibrillation. With this in mind the public health priority for response to out-of-hospital cardiac arrest focuses on cost-effective ways of expanding early access to defibrillation in the community.

6. Systems Approach to Cardiac Arrest

6.1 Early Access to Defibrillation has the highest probability of success if it is addressed within the concept of a ***"chain of survival"***. This concept involves a series of independent actions that together provide the best chance of survival for victims of cardiac arrest. It is frequently reported that if one action in the chain is not undertaken effectively, or is missed, the strength of the process is weakened and survival of the victim is less likely. An AED linked to an organised First Responder program is considered most effective in supporting the chain-of-survival concept.

6.2 Recognition of the arrest is critical, and then the steps in responding to the victim are:

- Early Access to the ambulance service by calling '000'.
- Early CPR;
- Early Defibrillation; and
- Early Advanced Life Support.

7. Quality, Data, and Systems Control

7.1 The community has the right to expect that help in an emergency will be available in a reasonable time under given circumstances, and that the care will be provided in a safe and effective way. Systems should ensure the safety of patients, bystanders, and carers. Systems of care should also be accountable, and contribute to the body of knowledge on out-of-hospital cardiac arrest.

7.2 The goal is to provide the highest probability that AED programs will be operated effectively and with safety. AED programs must be part of a coordinated system, which is medically supervised. Therefore AED programs must:

- Be integrated with community medical and EMS authorities;
- Ensure that all first responders have acquired appropriate knowledge and skills through assessment.
- Have a system to document, review, and collect data on each 'incident'.
- Have a system to provide post incident support to the responder.
- Ensure that the AED will be serviceable whenever needed e.g. battery charged, pads not old and dry.

7.3 Training of persons in the operation of an AED must include:

- Development and testing of on-site action plans for response to cardiac arrest, including: calling for an ambulance; Basic Life Support; and Safe use of an AED.
- Access to re-certification training.
- Correct measures to minimise risk of cross infection during skills training and rescue procedures;
- Incident recording, data collection and notification of each incident requiring deployment of an AED.
- How to access debriefing and counselling services.
- AED storage and maintenance.

10. Indications for the use of AED

8.1 A person suffering a cardiac arrest is unconscious, not breathing and has no signs of circulation. An AED is used to reverse the effect of cardiac arrest. An AED will identify a convertible rhythm and advise the rescuer to shock the victim.

8.2 As there will almost always be a delay between arrest and the availability of a defibrillator, even if an AED is located in the vicinity of the arrest, the priority of care remains as calling for an ambulance and immediate CPR. CPR must not be delayed by attempts to locate an AED.

11. Location of AED in Public Places

9.1 Decisions about the location of AEDs in public places should follow a risk assessment, and cost-effectiveness modelling and evaluation. According to recent Queensland data, apart from the victim's residence (75%), the most likely location for a out-of-hospital cardiac arrest is a road or public place (12%). Other locations include nursing homes (3%), recreation /sport facilities (2.5%), medical or paramedical centres (2.4%), and workplaces (1.5%). Indicators that may influence a risk assessment include:

- Age profile of populous
- Isolation from emergency services response
- Public gatherings of high-risk people, which includes age and activity levels.

9.2 Priority locations considered appropriate for review include populous public places and buildings, airports, sporting and entertainment venues, nursing homes and the like. Guiding principles for the deployment of AED in public places is shown at Annexure A.

10. Maintenance and Security of AED

10.1 An AED is to be maintained in accordance with the manufactures specifications with due regard to the requirements of the Workplace Health and Safety Code of Practice for Plant. Equipment should be secured in such a way as to minimise risk of machine theft, and in such a place as to ensure that persons will have immediate access to the machine, and where practicable, have a mechanism or system to immediately notify the ambulance service.

11. Auditing

11.1 A reporting system is to be established by the owner (accountable person) to document each incident requiring AED deployment. Owners are to ensure that incidents are evaluated as part of local EMS quality processes.

12. AEDs only are to be used in First Responder Programs.

12.1 Under no circumstance should a manual external defibrillator, or automated external defibrillator with a capacity to be converted to manual operation, be used in a first responder program. Only AEDs are to be used in First Responder programs or placed in public sites.

13. Conclusion

13.1 Increased availability of defibrillation in the community, when linked to wide spread community knowledge, skill and application of CPR, as well as rapid response by the ambulance service, has a high probability of reducing mortality from out-of-hospital cardiac arrest. To provide the greatest public health benefit, expansion of AED in the community should focus on identification of high-risk locations through a process of risk assessment and cost-effectiveness evaluation, and the development of First Responder programs.

Definitions:

1. Advanced Life Support
   The provision of effective airway management, ventilation of the lungs and production of a circulation by means other than basic life support.
2. AED (Automated External Defibrillator)
   An external defibrillator in which rhythm analysis and recognition are undertaken by the defibrillator which charges up automatically if a shockable rhythm (ventricular fibrillation or ventricular tachycardia) is recognised.
3. Basic Life Support
   The preservation of life by the establishment of and/or maintenance of airway, breathing and circulation and related emergency care without the use of equipment. Note Ancillary devices such as a resuscitation facemask, face shield or gloves may be used to minimise cross-infection.
4. Cardiopulmonary Resuscitation (CPR)
   The technique of inflation of the lungs and compression of the heart, used in an attempt to revive a person who has suffered a cardiac arrest.
5. Defibrillation
   The process of passing direct electrical current through a fibrillating heart to depolarise a “critical mass” of myocardial cells, allowing them to depolarise uniformly, resulting in an organised rhythm.
6. Early Defibrillation
   A concept base on evidence that the period of time between the onset of ventricular fibrillation and defibrillation is a critical variable in the probability of a successful outcome i.e. the shorter the time to defibrillation the greater the chance of the victim’s survival
7. External Defibrillation
   Defibrillation by the use of a automated (shock advisory) defibrillator through electrodes, which are applied to the chest wall.
8. Emergency Medical System (EMS)
   An integrated and coordinated response to pre-hospital emergency patient care involving community preparedness, pre-hospital emergency response providers, and definitive medical care.
9. First Responder
   A first responder is a person who has been trained in Basic Life Support including the use of an Automated External Defibrillator.
10. First Responder Program
    A coordinated group of First Responders, either volunteers or at a workplace, who are integrated with the local EMS response, and who are available to respond in an emergency at specific locations.
11. Layperson
    A layperson is someone who is not a health care professional or first responder.

Relevant Legislation

Legislation which is relevant to a discussion on Early Access Defibrillation include:

- The Ambulance Service Act (Qld) 1991; (The act requires providers of first aid training to be authorised by the Commissioner Queensland Ambulance Service. For the purpose of this policy, training in the safe use of an AED within a first responder program will constitute first aid training.)
- Health Services Act (1991)
- The Health Act (1937); and
- The Workplace Health and Safety Act 1995
- The Workplace Health and Safety Regulations 1997

Bibliography

1. Australian Resuscitation Council;(1997) *Early Defibrillation; policy statement # 11.7*.
2. Australian Resuscitation Council; (2000) *First Responder, policy statement #11.7.2*.
3. Becker, L., Eisenberg, M., Fahrenbruch, C., Cobb, L. 1998, 'Public locations of cardiac arrest. Implications for public access defibrillation.' *Circulation,* Vol. 97(21), pp. 2106-9.
4. Caffrey, S.L., Willoughby, P.J., Pepe, P.E., & Becker, L.B. (2002) 'Public use of automated external defibrillators.' *The New England Journal of Medicine*.
5. Capucci, A., Aschieri, D., Piepoli, M.F., Bardy, G.H., Iconomu, E., & Arvedi, M. (2002) Tripling survival from sudden cardiac arrest via early defibrillation without traditional education in cardiopulmonary resuscitation. *Circulation*.
6. Frank, R.L., Rausch, M.A., Menegazzi, J.J., & Rickens, M. (2001) The locations of non-residential out-of-hospital cardiac arrests in the City of Pittsburgh over a three-year period: Implications for automated external defibrillator placement. *Pre-hospital Emergency Care*.
7. Harrison, G.A., (1998) Manual of Skills in Semiautomatic External Defibrillation for Learners who are not Health Professionals.
8. Keane, G., Wassertheil, J., Fisher, N., & Leditschke, F. (St John Ambulance Australia), (1998) Outcome of cardiac arrest managed at or in the vicinity of the Melbourne Cricket Ground utilizing an Early Access to Defibrillation Strategy – A forerunner to public access *Resuscitation*.
9. Marenco, J.P., Wang, P.J., Link, M.S., Homoud, M.K., & Estes, N.A.M. (2001) Improving survival from sudden cardiac arrest: The role of the automated external defibrillator. (Journal of American Medical Association.
10. Martens, P., Calle, P., Vanhaute, O., (1998) Theoretical calculation of maximum attainable benefit of public access defibrillation in Belgium. *Resuscitation*, Mar; 36(3): pp.161-3.
11. MacDonald, R.D., Mottley, J.L., Weinstein, C. (2002) Impact of prompt defibrillation on cardiac arrest at a major international airport. *Pre-hospital Emergency Care*.
12. Myerburg, R.J., Fenster, J., Velez, M., Rosenburg, D., Lai, S., Kurlanskuy, P., Newton, S., Knox, M., & Castellanos, A. (2002) Impact of community-wide police car deployment of automated external defibrillators on survival from out-of-hospital cardiac arrest. *Circulation*.
13. Nichol G. et.al. (1998) Potential cost-effectiveness of public access defibrillation in the United States. *Circulation* 97(13): pp.1315-20.
14. Page, R.L., Joglar, J.A., Kowal, R.C., Zagrodszky, J.D., Nelson, L.L., Ramaswamy, K., Barbera, S.J., Hamdan, M.H., & McKenas, D.K. (2000) Use of automated external defibrillator by a U.S. airline. *The New England Journal of Medicine.*
15. Pell, J.P., Sirel, J.M., Marsden, A.K., Ford, I., Walker, N.L., & Cobbe, S.M. (2002) Potential Impact of public access defibrillators on survival after out of hospital cardiopulmonary arrest: Retrospective cohort study *BMJ*.
16. Queensland Ambulance Service (2002) *Clinical Practice Manual, Cardiac Arrest*. Version 2.1 A4-2.
17. Queensland Ambulance Service (2002) *Out-of-hospital Cardiac Arrest Data*.
18. Riegel, B., (1998) Training non-traditional responders to use automated external defibrillators. *American Journal of Critical Care*, 7(6): pp.402-10.
19. Smith, K.L., Peeters, A., & McNeil, J.J. (2001) Results from first 12 months of a fire first-responder program in Australia. *Resuscitation*.

20. Valenzuela, T.D., Roe, D.J., Nichol, G., Clark, L.L., Spaite, D.W., & Hardman, R.G. (2000) Outcomes of rapid defibrillation by security officers after cardiac arrest in casinos *The New England Journal of Medicine*.

Review Working Group

Title	First Name	Last Name	Job Title	Company
Dr	Peter	Abernethy	Director of Health Promotion	Heart Foundation of Australia
Dr	Richard	Bonham	Medical Director	Queensland Ambulance Service
Prof.	Vic	Callanan	Director Intensive Care	The Townsville Hospital
Mr	Noel	Gillard	Chairman (Queensland Branch)	Aust. College of Ambulance Professionals
Dr	J (Fred)	Leditschke	Queensland Commissioner	St John Australia
Ms	Molly	McCarthy	Research Assistant	Australian Centre for Pre-hospital Research
Dr	Karen	Theobald	Schools of Nursing	QUT
Ms	Vivienne	Tippett	Research Fellow	Australian Centre for Pre-hospital Research

Annexure A.

Guiding Principles for the deployment of AED in public places

1. There is no legislation or regulation in Queensland requiring the availability of an AED in public places or workplaces.
2. The decision to have an AED available in a public place or workplace is the responsibility of the entity.
3. Proper and timely use of an AED can save lives in the case of cardiac arrest.
4. The risk/likelihood of a cardiac arrest occurring in a public place is low. Recent Queensland data, in the table below, show the occurrence of out-of-hospital cardiac arrest:

75% in the home	2.5% in recreation/sport facilities
12% on a road or **public place**	2.4% in medical/paramedical centres
3% in nursing homes	1.5% in the workplace

5. The annual risk of cardiac arrest from cardiovascular disease in different age groups and sexes is shown in the following table (Rate per 100,000 of population.)

Age group (yrs)	**Males**	**Females**
<20	**	**
25-34	4.1	1.0
35-44	19.0	4.3
45-54	62.5	13.9
55-64	203.7	60.7
65-74	634.7	262.4
75+	2,193.5	1,703.0

**Rates not shown as relative standard errors are greater than 50%.
Source: AIHW National Mortality rates.

6. Due to the relatively low risk/likelihood of cardiac arrest in public places, the following risk assessment is recommended to help determine the benefits of having an AED available in a particular location/facility.

	Risk Assessment Criteria	Yes	No
1	(a) >50,000 visitors per year; and/or (b) Major public gathering where on-site fist aid is provided; and /or (d) Specific locations/events of high risk due to age (>50) or activity levels.		
2	Identifiable persons able to: (a) Undertake appropriate first aid training including AED. (b) Be available for response to the victim within four minutes. (c) Be available during operational / opening hours		
3	Isolation from emergency services response due to distance or potential access delays (e.g. large crowds) (>10 minutes).		

Yes to all three above would support AED deployment.

7. AED Check List

Once an AED is deployed, the following criteria should apply.

	AED Check List Criteria	Yes	No
1	Program is integrated with community medical and EMS authorities response.		
2	Responders have CPR, first aid and AED knowledge and skills through assessment.		
3	Systems to document, review, and collect data on each 'incident'.		
4	A system to provide post-incident support to the responder.		
5	On-site action plans for response to cardiac arrest.		
6	A system for on-site AED storage and maintenance.		