Saving Lives

Schools and School Sports

The facts about Automated External Defibrillators (AEDs) in schools in NSW

The Australian Resuscitation Advisory Network
Dedicated to improving resuscitation (as it is taught and practiced)
www.aran.org.au

Introduction

At the Australian Resuscitation Advisory Network (ARAN), we are dedicated to improving the survival rates from cardiac arrest, a condition that strikes suddenly and can occur at any age. Over the years in NSW there has been reluctance by Government to the installation of AEDs in schools, and NSW still remains the only state in Australia where schools are not actually encouraged to purchase an AED.

The official policy from the NSW DoE relies on "formal advice" received from the Ministry of Health suggesting that AEDs are "not necessary" as Sudden Cardiac Arrest (SCA) among school age children and youths is, fortunately, infrequent. While statistically this is true, the fact that they occur at all (and result in death) for the sake of a simple piece of equipment - is tragic. Strangely, in our investigation into AEDs in NSW schools, the Ministry of Health denies giving such advice to the NSW Department of Education that AEDs in schools are "unnecessary". Sadly, in Australia there is also no WHS legislation or codes of practice that require employers/workplaces to have AED(s) dependent on staff size, location or nature of their work, even if they have significant customer traffic (e.g. fast food chains).

So why have a defibrillator in your school? Firstly, Sudden Cardiac Arrest (SCA) must be treated quickly (< 3 minutes) for a successful outcome and survival rates of 43—75% compared to the usual 5-6% in Australia. Regardless of the proximity of medical services to a school, this target time to defibrillation cannot b**e** met without an AED located at the school. As of July 2016 only 25% of general practices in Australia have AEDs, hospitals do not loan out defibrillators in an emergency, and Ambulance response times in NSW average 9.3 minutes to the door (not the casualty).

Secondly, the presence of AEDs in schools, and AED programs, improve public awareness of what SCA is, what AEDs are, and the importance of immediate bystander action; particularly for the next generation. This occurs through the transfer of knowledge from students and staff to family and friends and by direct observation of parents and visitors who see and learn about AEDs when they visit the school. While most cardiac arrests in schools occur in adults—both staff and visitors - many, if not most schools serve as community meeting centers, and so sustain adult traffic during school and non-school hours.

Sadly, we know there are a significant number of young athletes with undetected, underlying heart disease that predisposes them to SCA, which is exacerbated at times of exertion. As no routine screening is done in Australia for these heart defects, the level of this risk is largely hidden until an event.

Unfortunately in NSW, AEDs are not a central focus in schools by government (as it is in other countries around the world) and NSW guidelines currently advise that they are *"not a requirement for schools"*. This advice is repeated no less than 4 times in bolded text in the Department of Education guidelines, and is extremely disappointing. However the document also demonstrates a lack of understanding of the importance of a community response to a very serious epidemic and the role and operation of modern defibrillators.

This document from ARAN provides easy-to-understand descriptions of how an AED works and the fundamental principles of an effective public access defibrillation (PAD) program in schools. Apart from the internal regulatory obligations imposed by the Department of Education, installing and maintaining an AED in a school is not the onerous task suggested in the school AED guidelines.

It is now time that we all work together to eliminate preventable deaths from SCA (33,000+ each year in Australia) that continue to occur all too often. Establishing emergency action plans in schools (and school sports programs) that include response planning, training in CPR, and deployment of AEDs and providing CPR and AED training to all students will greatly reduce the risk that we and our children will face from sudden cardiac arrest. This has been well proven in countries such as Ireland and Scotland where schools and community, local, state and federal Government work together on this issue.

Sudden Cardiac Arrest (SCA) Facts

No school principal, teacher, or sports coach wants to think about the prospect of the injury or death of a child who is under their supervision. Certainly no one working with young people would knowingly let them play on unsafe playground equipment, sit in a classroom that did not meet building codes, or participate in sports without the proper protective gear. The school first aid kit is expected to be stocked with bandages, cold packs, and other standard first aid supplies. Yet, every day in schools and on sports fields, many of our youth are left unprotected from sudden cardiac arrest – for which there is a simple-to-use device that is becoming a standard of care in public facilities, offices, health clubs, shopping centers, and even many schools.

Unfortunately, without widespread screening of young people for underlying heart conditions, there is always a risk of SCA amongst school age children. Studies have identified a 2.5 times relative risk for SCA attributable to sports activity in adolescent and young adult

athletes versus an age-matched non-athletic population, related to underlying cardiac disorders.

In Australia, sudden cardiac arrest (SCA) strikes more than 33,000 people annually (more than 500 per week) and is the leading cause of death each year, killing more than stroke, breast cancer, lung cancer, and HIV/AIDS and motor vehicle accidents combined. While most SCA deaths occur in adults, SCA is also the leading cause of death in young athletes and can also strike children participating in normal school or sports activity. Even the most healthy-appearing competitive athletes and students may harbour unsuspected cardiovascular disease with the potential to cause sudden death. This unfortunately can happen without warning and in 25% of SCA cases the first sign is death.

SCA results from a disruption in the heart's electrical system, which generally causes the heart to beat very rapidly and irregularly (ventricular fibrillation), a heart rhythm that does not pump blood to the brain, heart and other vital organs. Victims typically lose consciousness in a matter of seconds. Without immediate CPR compressions to help the heart continue to transport blood to and maintain the supply of oxygen to vital organs, and the shock of an AED to enable the heart's natural rhythm, victims usually die. By the time an ambulance has arrived, it is often too late.

The good news is that the simplicity of AEDs makes rapid, public response possible. In Australia we are sadly lagging behind the rest of the world in preparing schools for these emergencies. Scotland has a nationally focused campaign to ensure all school children receive training in CPR (including AEDs) and in the US, more than 20 states and hundreds of school districts now require AEDs to be standard equipment.

ARAN

HEART ATTACK

Many people (including the media) confused the term “heart attack” and “cardiac arrest”. A heart attack, or acute myocardial infarction (AMI), is caused by a circulation or plumbing problem of the heart, when one (or more) of the arteries delivering blood to the heart is severely restricted or blocked. Oxygen in the blood cannot reach the heart muscle, and the heart muscle becomes damaged.

- This damage to the heart muscle can lead to a malfunction of the heart’s electrical system, causing dangerously fast or slow heart rhythms that can cause a cardiac arrest, however most heart attack victims do not have cardiac arrests at the same time.
- Many SCAs occur in patients with coronary heart disease (70-80%). If the patient suffers a heart attack, there is a higher risk for SCA.
- Symptoms of heart attack can include chest pain, radiating pain (left arm, between shoulder blades, jaw), difficulty breathing, dizziness, nausea and vomiting, and profuse sweating or may be completely symptom free (silent).

CARDIAC ARREST

Cardiac Arrest on the other hand is the cessation of effective heart function. In most cases of cardiac arrest, the heart initially does not stop but goes into a chaotic rhythm that does not result in blood being pumped to the brain and heart. The result is the same, in that death will shortly follow unless resuscitation (including the use of an AED) is started quickly. Cardiac arrest can also result from a lack of oxygen e.g. drowning, choking, asthma, where the heart slows to a stop. This is the most common form of cardiac arrest in younger children.

Why kids are at risk from sudden cardiac arrest?

There are several conditions and events that can be causes of sudden cardiac arrest. Some conditions are congenital, (present at birth). Among these conditions are Long QT Syndrome, Hypertrophic Cardiomyopathy (HCM), Brugada Syndrome, Wolff– Parkinson-White Syndrome, and Marfan Syndrome. It is estimated that 1 out of every 128 infants is born with congenital heart disease each year in Australia. Around 3000 babies are born each year with heart defects ranging from holes in the heart, leaky valves, or abnormalities in the heart chambers.

Some of these heart defects can prevent the heart from pumping a sufficient amount of blood to the lungs and other body organs, which can cause congestive heart failure. Other affected children may have rapid or irregular heartbeats and rhythms, and it may be difficult to breathe, especially during physical activity. The good news is that there are treatment options for these conditions if detected and diagnosed in time. However these children are at higher risk of SCA.

Hypertrophic Cardiomyopathy

Hypertrophic cardiomyopathy, or HCM, is a genetic cardiac condition affecting one in 200 people. HCM causes the heart to become thick and the anatomy to be abnormal from the cellular level. HCM is the most common cardiac cause of sudden cardiac arrest in the young (under 35).

Long QT (and related syndromes)

Long QT is a disturbance of the heart's electrical system, causing an abnormality of the heart's rhythm. Because of this abnormality, those who are affected are susceptible to sudden fainting (syncope) and in some cases, death from SCA. Although most episodes occur during periods of physical exertion, they can occur during emotional stress or even sleep. Death from long QT syndrome is preventable through proper diagnosis and treatment.

Commotio Cordis

Commotio cordis is a rare but potentially fatal phenomenon that can result in sudden cardiac arrest. It can occur when a blunt, (but often mild) blow to the area of the chest directly over the heart occurs during a precise moment of the heart's cycle, leading to sudden cardiac arrest. It can occur both in contact sports and non-contact ball games.

Commotio cordis is sometimes referred to as a "concussion of the heart" and is only treatable with CPR compressions and defibrillation to reverse ventricular fibrillation (a chaotic, life threatening heart rhythm) .

Other Causes

Electrolyte imbalances caused by eating disorders, rapid weight loss or dehydration e.g. distance running in a hot environment.

What is the difference between defibrillators (AEDs)?

Automatic vs Semi-Automatic

An Automated External Defibrillator (AED) comes in two basic configurations, Automatic and Semi-Automatic. Automatic defibrillators tell the rescuers it is about to shock, however if you don't hear this message i.e. noisy environment or inattention, it shocks anyway. A Semi-Automatic defibrillator provides an additional safety step in that someone has to push the shock button when prompted i.e. visual check everyone is clear of the casualty. An inadvertent shock has the potential to cause a cardiac arrest in another person (other than the casualty).

Age range for defibrillators

AEDs are not designed to be used on a casualty under 12 months of age. In defibrillation terms an Adult is defined as a person > 8 years and a Child is defined as >1 year ≤ 8 years. Different defibrillation pads are usually needed for children < 8 years old.

Ongoing Costs

- **Maintenance**— Modern AEDs do not require ongoing maintenance. The machines are self-monitoring and reporting. The AED will indicate when it need attention and most will tell you the problem. A weekly check that there are no warning lights present and that the pads are in date is all that is required.
- **Warranty** - Most AEDs have an expected service life of up to 10 years so the warranty should meet or exceed this.
- **Battery Life -** battery life can range between models and manufactures from around 2 years up to 7 years.
- **Cost of Consumables -** specialised battery packs can cost from $90.00 to $280.00 . Replacement adult pads range from $90.00 to $150.00, while paediatric pads are more expensive with costs ranging from $92.00 to around $200.00. All pads have a maximum of a 4 year shelf life (usually up to 2 1/2 years).

CPR Feedback - as good compressions are crucial in resuscitation, AEDs have a range of measures that can help maintain this. The simplest feedback measure is a metronome. Some defibrillators have patented compression feedback systems that use either an accelerometer or an algorithm that detects impedance changes.

Security

The guidelines from the DoE require schools to place an AED in a cabinet with a security alarm, however a standard cabinet with a security tag has proved to be an adequate measure with defibrillators placed in schools and other public places to discourage theft and/or vandalism.

Unfortunately the AED guidelines for schools restrict the purchase of AEDs from a limited list and provide no actual recommended specification or rationale for one AED feature over another. This list does not contain newer AEDs that are equally or more suitable for a school situation.

Other benefits of introducing a defibrillator to your school

Apart from purchasing a defibrillator for your school, there is great value in educating students about the role and use of an AED with CPR. The education of school children in CPR (including defibrillation) has been shown in many countries around the world to not only to improve outcomes in the community today, but also to have improved the willingness and capability of the individuals as they move from school into the community. In other words, education about AEDs and CPR supports a generational change in cardiac arrest outcomes through an increased willingness and ability to respond. There are numerous examples of children using the resuscitation life skills learned at school to save friends and relatives.

In one study researchers used a mock simulation of cardiac arrest to familiarize sixth-grade students who had no previous training with the use of an AED. They compared time to defibrillation, pad placement, and compliance with AED prompts to stand clear of the patient during shock delivery between the sixth year students and paramedics.

The mean time to defibrillation was 90 seconds for the year six students and 67 seconds for the professionals. Both the year six students and professionals placed the pads correctly and stood clear of the patient during shock delivery. In another study, Lawson et al assessed year three students use of an AED after explaining only the mechanics of peeling off the backing from the pads. Those students successfully used the AED on a manikin but, after a 2-minute, one-on-one orientation, their performance was significantly faster in a second trial. These studies prove the ease of AED use by even the very young and, in the latter instance, minimally trained users. High school AED programmes demonstrate a high

survival rate (71%) for students and adults who suffer SCA on school grounds. School-based

AED programmes are therefore strongly encouraged in current research.

Risk Factors to Consider in Your School

Issue	Risk Factors
Location of school	Isolation is not a city vs rural issue. In relation to SCA, even metropolitan ambulance response times are not sufficient to provide increased survival. Average Ambulance response time in NSW is 9.3 minutes to the door (not the casualty) and AED target time is < 3minutes.
Number of Students/Staff/Visitors	The DoE uses visitor numbers of over 1000 p.a. as an indication of risk in deciding on the purchase of an AED, however this number has no basis and is unmeasurable when all the functions (including hall rental and voting functions, canteen, etc.) are considered. The confounding issue is that larger schools have higher risk of SCA due to statistical probabilities with larger numbers; however smaller schools are usually more isolated from other services. As a workplace one must also consider the staff profile as individuals who smoke, are overweight, suffer from high blood pressure or diabetes or have a family history of heart disease or heart attack, are more likely to suffer from SCA.
Residential Component	If your school has students that live on-site (boarding), this increases risk because the hours of supervision responsibility are longer and the overnight period has a decreased number of support resources for emergencies.
Student/s with known heart conditions that predispose them to SCA	Obviously if parents have identified to the school a student with known heart conditions this increases the risk of SCA and the dependence on an AED.
Maximum distance to AED	The 3 minute test: When deciding where to place an AED, and particularly if there is a requirement for more than one in the school, use a 3 minute response time as a guideline. The rule of thumb is you need 1 1/2 minutes to get to the AED, and 1 minute to

	return to the victim. Determine if there are places on site where the incidents of cardiac arrest may be higher, such as areas used for sports, or areas that are hard to reach quickly. You should also consider access to stairways and exit doors, near trained responders, and with quick access to playground and athletic fields. Consider an AED to take for school events away from campus.
Sport at PHDPE level/ inter-school level/State or National Level	Risk of SCA increases when sport is involved i.e. when stress is placed on the heart. However risk is not linear i.e. the higher the level of sport the more risk. Higher level athletes are usually conditioned for high exertion levels, whilst activity at PHDPE level can over-exert the unfit.
Contact sports Ball games with heavy/ fast moving ball (lacrosse, hockey, baseball, softball	Apart from endurance sports there are certain other sports where there is a higher risk of SCA, particularly where there is a risk of a blow or fall. A condition like Commotio Cordis (or concussion of the heart) can induce a SCA in even a healthy person.

Here is a handy risk assessment tool for staff http://www.scarisk.org/

Funding a Defibrillator

An AED and the necessary accessories, doesn't come without a cost. At present, the cost of an AED is borne by the school as is any consumables that need to be replaced. The purchase of a defibrillator is an important issue for parents at the school and so the P&C is a logical place to start to focus fund raising efforts. The purchase and installation of an AED in the local school has a high community interest. Promotion of such an initiative is likely to bring positive attention and support from the community and media.

There are also some organisations that have programs to support the purchase of defibrillators in the community. In other countries, like the UK, Government and private grants are available for the purchase of defibrillators for schools. There are also corporations that are willing to sponsor an AED for schools.

The Department of Education in the UK has also produced more detailed and helpful guidelines to also assist schools with purchasing and maintaining AEDs.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/519994/AED_guide_for_schools.pdf

Final Tips

The 3 keys to operating an AED are:

1. An AED is most effective when used in combination with fast deep compression (although compressions should be ceased whilst the AED is diagnosing and delivering a shock – the machine will remind you of this)
2. All AEDs should have a skin preparation kit with the machine. This should include:
    - A pair of trauma scissors to remove the clothing on the chest quickly
    - A safety razor to remove any excess hair from the pads placement area
    - A disposable towel to wipe down the skin to remove moisture
3. Ensure no one is touching the casualty when a shock is delivered. The AED will tell you to "STAND CLEAR" when it is charging up ready to shock.

An AED should be in a location where it can be accessed by the public during out-of-hours functions. Security for the AED does not need to be over-the-top and breakable security tags have proven to be effective measures in public places across Australia. Alternatively a "break box for key" arrangement could be employed, however this increases response time.

Conclusion

The reality of cardiac arrest is that is usually has a very poor outcome if we rely on Ambulance response and CPR. The best chance a casualty has in SCA is early defibrillation (using an AED) combined with fast deep compressions. Modern AEDs do not require any special training to operate and all basic CPR training in Australia includes the operation of a defibrillator (AED). Ambulance operators are also trained to guide you through the operation of the AED in an emergency.

Despite the general lack of enthusiasm by Government regarding schools in NSW installing defibrillators, they remain the most effective measure for a positive outcome in the tragic event of SCA. Hopefully, after reading this document you have a more thorough and balanced understanding of AEDs, and will be able to appreciate that an AED is not just an "unnecessary" complication to your school, but both a valuable and necessary part of a modern education system, and in the best interests of students, staff and the community.