



THE IMPLEMENTATION OF SCHOOL BASED  
CARDIOPULMONARY RESUSCITATION (CPR) AND  
AUTOMATED EXTERNAL DEFIBRILLATION (AED)  
PROGRAM AMONG SECONDARY SCHOOL  
STUDENTS IN KUANTAN, PAHANG

BY

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## ABSTRACT

Bystander resuscitation efforts, such as cardiopulmonary resuscitation (CPR) and use of automatic external defibrillator (AED), save lives in out of hospital cardiac arrest (OHCA). School training in CPR and AED use may increase the currently low community rates of bystander resuscitation. Hence, the study objective was to determine the effectiveness of CPR and AED training among secondary school students. Prior to this study, quantitative design using cross sectional survey was used to determine the level of experiences and attitudes towards CPR and AED among students before the training. Further, prospective intervention study involving pre-test, post-test and retention test design was used to evaluate the effectiveness of the school based CPR and AED program on student's knowledge and skills. The training consisted of lecture, video presentation, skills demonstration and practical session on CPR and AED. The questionnaire was provided before, immediately after and at one month after training. Finally, focus group discussion was used to explore the feelings of the student after completing the program. From the survey, out of 290 students, 89.3% know CPR whereas only 18.6% know AED and 15.5% had seen AED previously. Most of the students, 84.1% reported willingness to perform CPR on family members while only 46.6% willing to perform CPR on strangers. Majority reported reasons not do CPR and AED due to fear will harm patient (44.8%). For the training, 111 students were recruited from three types of school; daily school, cluster school and boarding school to provide greater generality. The median (IqR) total knowledge scores for the pre-test were 40.00 (20.00), post-test were 70.00 (20.00) and retention test were 70.00 (20.00). Students showed improvement in CPR and AED knowledge test following the training ( $p < 0.01$ ) and demonstrated knowledge retention after 4 weeks. On the other hand, following initial training the median (IqR) total skills scores test were 22.00 (4.00) and at four weeks, the median (IqR) were 22.00 (4.00), students demonstrated skill retention in similar adult cardiac arrest scenario testing. Demographic factors of school category, course stream and prior training were statistically significant with pre-test knowledge score with p value 0.023, 0.01 and  $< 0.001$  respectively whereas there was no factor associated with the skill score. During focus group discussion, most of the participants shared their positive feelings after completing the CPR and AED program. The level of knowledge and skills of secondary school students improved significantly after CPR and AED program. Increase the number of trained students may minimise the reluctance to conduct bystander CPR and AED and consequently will increase the survival rate of OHCA.

## خلاصة البحث

جهود الإنعاش التي يقوم بها المارة ، مثل الإنعاش القلبي الرئوي (CPR) و استخدام جهاز الصدمات الكهربائية الخارجي التلقائي (AED) ينقذ الارواح في حالات السكتة القلبية خارج المستشفى (OHCA). قد يؤدي التدريب المدرسي في مجال الإنعاش القلبي الرئوي (AED) و استخدام جهاز الصدمات الكهربائية الخارجي التلقائي (AED) إلى زيادة معدلات الإنعاش المحلية الحالية التي يقوم بها المارة. و كان الهدف من هذه الدراسة هو تحديد فعالية التدريب على (CPR) و (AED) في المدارس الثانوية. قبل البدء بهذه الدراسة , تم استخدام التصميم الكمي باستخدام المسح المقطعي لتحديد مستوى الخبرات والمواقف تجاه (CPR) و (AED) قبل التدريب. وعلاوة على ذلك، تم استخدام دراسة التدخل المحتملة التي تنطوي على اختبار ما قبل الاختبار، وبعد الاختبار واختبار الاحتفاظ لتقييم فعالية برنامج (CPR) و (AED) على معرفة ومهارات الطالب. وتألّف التدريب من محاضرة، وعرض فيديو، وشرح المهارات والجلسة العملية على (CPR) و (AED). تم توزيع الاستبيان قبل التدريب، مباشرة بعد التدريب ومن ثم بعد شهر من التدريب. وأخيراً، تم استخدام النقاش الجماعي المكثف لاستكشاف خبرات الطالب بعد إكمال البرنامج. من أصل 290 طالباً، 259 (89.3%) كانوا يعرفون (CPR) في حين أن 54 فقط (18.6%) يعرفون (AED) و 16 (5.5%) قد شاهدوا (AED) قبل. معظم الطلاب، 244 (84.1%) أفادوا عن استعدادهم لأداء (CPR) على أفراد الأسرة في حين أن 135 فقط (46.6%) يرغبون في أداء (CPR) على الغريباء. وأفادت الغالبية أسباب عدم فعل (CPR) و (AED) بسبب الخوف من اضرار المريض (44.8%). وفيما يتعلق بالتدريب، تم تجنيد 111 طالباً من ثلاثة أنواع من المدارس؛ المدرسة اليومية، والمدرسة العنقودية والمدرسة الداخلية لتوفير مزيد من العمومية. بلغ متوسط (IqR) درجات المعرفة الكلية للاختبار القلبي 40.00 (20.00)، وكان الاختبار البعدي 170.00 (20.00) وكان اختبار الاحتفاظ 70.00 (20.00). وأظهر الطلبة تحسناً في اختبار المعرفة ل (CPR) واختبار (AED) بعد التدريب ( $P < 0.01$ )، وأظهروا الاحتفاظ بالمعرفة بعد 4 أسابيع. من ناحية أخرى، وبعد التدريب الأولي كان متوسط (IqR) مجموع درجات اختبار المهارات 22.00 (4.00)، وفي الاسبوع الرابع كان متوسط (IqR) مجموع اختبار درجات المهارات 22.00 (4.00)، وقد أظهر الطلاب الاحتفاظ بالمهارات في سيناريو مماثل لحالة السكتة القلبية في البالغين . وكان المتغير الديموغرافي في فئة المدرسة، المقرر التعليمي، والتدريب السابق ذات دلالة إحصائية مع درجة المعرفة مع قيمة  $p = 0.023$ ، و  $0.01$  و  $0.001$  على التوالي في حين لم يكن هناك عامل يرتبط مع درجة المهارة. خلال مناقشة مجموعة التركيز، شارك جميع المشاركين تقريباً مشاعرهم الإيجابية بعد الانتهاء من برنامج (CPR) و (AED). تحسن المستوى المعرفي والمهاري لدى طلاب المدارس الثانوية بشكل ملحوظ بعد برنامج (CPR) و (AED). إن زيادة عدد الطلاب المدربين قد يقلل من التردد في إجراء (CPR) و (AED) من قبل المارة وبالتالي سيزيد من معدل البقاء على قيد الحياة من (OHCA)

## APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Biobehavioral Health Sciences.

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## DECLARATION

I hereby declare that this thesis is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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## **LIST OF ABBREVIATIONS**

OHCA	Out of Hospital Cardiac Arrest
CPR	Cardiopulmonary Resuscitation
AED	Automatic External Defibrillator
AHA	American Heart Associations
EMS	Emergency Medical Services
WHO	World Health Organization
FGD	Focus group discussion

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 INTRODUCTION**

This research report is about the study on implementation of school based cardiopulmonary resuscitation (CPR) and automated external defibrillation (AED) program among secondary school students. There are consists of chapter one to chapter five. The first chapter begins with some background of the study conducted, followed by problem statement of the study. The significance of the study will be outlined and the study objectives are listed. Definition of terms will be described based on the variables use in this context of this study. Finally, conclusion will be made to summarise this chapter.

### **1.2 BACKGROUND OF THE STUDY**

Sudden cardiac arrest are the most common cause of death worldwide. Health data compiled from more than 190 countries show heart disease remains the number one global cause of death with 17.3 million deaths each year, according to Heart Disease and Stroke Statistics 2015 Update (Mozaffarian et al., 2015). In Malaysia, coronary heart disease also remains as the number one killer in terms of diseases and health-related problems for the last ten years, from 2005 to 2014. In 2014, the number of deaths resulted from coronary heart disease recorded the highest percentage in Malaysia with 13.5 percent including sudden cardiac arrest (Department of Statistics Malaysia, 2014).

Sudden cardiac arrest is defined as the sudden cessation of functional cardiac mechanical activity as confirmed by the absence of the signs for circulation. These includes the absence of response to stimulation, absence of breathing, and absence of a detectable pulse (Wu, 2013). Without rapid and appropriate treatment, most of these cardiac arrests will result in death. Majority of the case occur in out of hospital which is known as out of hospital cardiac arrest (OHCA). Outcome after OHCA is depends on the critical action provide by bystander, particularly effective chest compression and early defibrillation, along with immediate emergency medical service response need to be activated for advanced life support (Wissenberg et al., 2013). Therefore, teaching and public participation are essential in handling society who is experiencing cardiac arrest.

Early initiation of CPR and early defibrillation with public access AED by bystanders is the key to increasing survival after an OHCA victim. Bystander CPR is defined as CPR performed by any person who is not responding as part of an organised emergency response system approach in response to cardiac arrest (Cummins et al., 1991). Bystander CPR serves as a vital link to improve the chance of survival among the OHCA patients. It serves as a vital link by temporarily perfusing the heart and brain with oxygen for preservation while awaiting the arrival of the emergency medical services (EMS).

The involvement of bystander CPR in Malaysia is largely unknown. A one year study done in Emergency Department (ED), Hospital Universiti Sains Malaysia in 2005 by Chew et al., (2008) to find out how frequently bystander CPR was performed among OHCA patients with CPR performed. This study found out that from a total of 23 OHCA patients that had CPR performed on arrival at the emergency department, only two cases (8.7 percent) had bystander CPR performed. However,



none of these two cases achieved return of spontaneous circulation. Although the findings from this study has many limitations, however it does indicates that the frequency of bystander CPR is dismally low in our community.

Furthermore, CPR performed by bystander was reported not to translate into a higher chance of survival to admission. The quality and effectiveness of the technique is equally important for example to make an emergency call quickly and being able to recognise the condition of cardiac arrest, good chest compression to the appropriate depth and the frequency of compression are the key elements in basic life support for CPR (Bohn et al., 2013). Therefore, it is important to educate our community the importance of quality and proper technique of CPR.

Sudden cardiac arrests are the catastrophic events of life, and one of the key factors to improve the outcome in OHCA is to promote the willingness of community to perform CPR. Bystander CPR has demonstrated improved survival as well as better quality of life for those who survive OHCA (Sasson et al., 2013). Following the introduction of current CPR techniques, the impact of bystander CPR has been reinforced in the concept of the chain of survival and public access defibrillation. Further, to maximize the chance of a successful resuscitation outcome, CPR must be started as soon as possible after a victim collapses. Improved survival rate depends on the training and motivation one's having to recognize the emergency, activate the emergency response system, initiate high-quality CPR, and use of an AED if available.

Moreover, the American Heart Association (AHA) issued an advisory statement in 2011 which recommended CPR training for school children to be mandatory (Cave et al., 2011). The main reason for this training at school is to increase the rate of bystander and survival after of OHCA around the community.

That recommendation was based on the opinion that over the long term, children trained in CPR contribute significantly to the number of adults trained in CPR in the community. The expected direct benefit of increasing the number of people trained to perform CPR is to increase the likelihood that a victim of OHCA promptly receives CPR. One of the factors that causing decrease of survival rates is a lack of bystander initiated CPR and the apparent under use of AED by the public (Atkins & Berger, 2012).

Further, most sudden cardiac arrests result from ventricular fibrillation which if it is not treated within minutes, will cause death. Ventricular fibrillation is a rapid and unsynchronized heart rhythm starting in the heart's lower pumping chambers (the ventricles). The heart must be "defibrillated" quickly, because a victim's chance of surviving drops by 7 to 10 percent for every minute a normal heartbeat is not restored (Larsen et al., 1993). After more than 12 minutes of ventricular fibrillation, the survival rate is less than five percents. An AED is a lightweight, portable device that delivers an electric shock through the chest to the heart and can be used by non-medical people. The shock can stop an irregular rhythm and allows normal rhythm to resume during sudden cardiac arrest. Hence, AEDs are possible for more people to respond to a medical emergency where defibrillation is required (Weisfeldt et al., 2010).

AEDs are now available in many public locations such as airports, shopping malls, exercise facilities and federal building thus increasing the likelihood that a bystander will have a direct access an AED or that a second bystander will get an AED from a nearby location and bring it to the side of a cardiac arrest victim. However, to help an unresponsive victim a bystander must know the purpose of an AED and understand how it functions. Otherwise, indecisiveness and discussion with

other bystanders could delay or even prevent the use of the AED altogether. Hence, it is reasonable that all CPR training should explain the purpose and basic function of an AED to all trainees regardless of age, including school students.

Therefore, the purpose of this study is to implement and evaluate the effectiveness of school based CPR and AED program among secondary school students in Kuantan, Pahang. In this study, we are planning to train and empower the young nation to be an accessible rescuer for the society not only limits in school but in outside environment too. This study may provides baseline information for further educational activity and implementation of CPR and AED training in school.

### **1.3 STATEMENT OF THE PROBLEM**

Approximately 300,000 persons in the United States of America (USA) experience an out of hospital cardiac arrest (OHCA) each year which reported leading to death (Cave et al., 2011). The similar problem also faces by the entire nation around the globe including Malaysia. OHCA can occur from non-cardiac causes such as trauma, drowning, overdose, asphyxia, electrocution, primary respiratory arrests, and other noncardiac etiologies, the majority of such events have a cardiac cause (National Heart Lung and Blood Institute, 2011). Most deaths from cardiac disease are sudden, occurring outside of a hospital setting. It is thus necessary to improve the out of hospital emergency care system to decrease mortality from cardiac disease.

Early initiation of CPR and defibrillation with public access AED by bystanders is the key to increase survival after an OHCA (Link et al., 2010). According to study done in Japan, the data shows that nationwide dissemination of public access AEDs and bystander CPR had been able to increase the survival rate and

neurological outcome after OHCA (Iwami, 2012). Unfortunately in Malaysia, the implementation of AED and CPR by public bystanders is not sufficient.

Many cardiac arrests are precipitated by lethal heart arrhythmias that only can be reversed by delivering a shock to the victim's chest using defibrillator. The sooner the shock is delivered, the higher the probability of the victim's survival. Effective CPR can prolong the window of opportunity for successful defibrillation, along with adequate shock given will reverse the lethal arrhythmia (Cave et al., 2011). When an AED and CPR are immediately available, the chance of survival from sudden cardiac arrest is substantially improve (Sasson et al., 2013). Hence, bystander CPR and AED plays an important role to improve the survival rate in relation to OHCA. However in Malaysia, there is a neither legislation that assures AED installation in public places nor compulsory CPR training in school. Therefore, to improve the rate of OHCA survival with a good neurological outcome, there need to be further spread of educational activities and practical programs on CPR and AED use in the community.

Furthermore, the majority of persons who experience an OHCA event, do not receive bystander CPR or other timely interventions that are known to improve the survival to hospital discharge for instance defibrillation. Because nearly half of cardiac arrest events are witnessed, efforts to increase survival rates should focus on timely and effective delivery of interventions by bystanders and emergency medical services (EMS) personnel. The actions taken during the first few minutes of an emergency are critical to victim survival. The AHA uses four links in the "chain of survival" to illustrate the time-sensitive actions required for victims of of OHCA. The links in this chain are early recognition of signs of cardiac arrest, early activation of EMS, early initiation of CPR, early defibrillation and early initiation of advanced cardiac life support (Abella et al., 2008). The first three chains in an outside hospital

setting depend very much on the initiation of bystanders to call and activate the emergency medical services, to start CPR while awaiting the arrival of the ambulance and to be able to competently use the AED to analyse and start defibrillation if necessary. Every chain is important and weakness in any link would lessen the chance of survival of OHCA (Cummins et al., 1991).

Furthermore, in many communities the time interval from activation of EMS to arrival of these medical personnel is seven to eight minutes (Ibrahim, 2007). However, in Malaysia, the mean ambulance response time in Malaysia, varies from places to places; in Kota Bharu, for example it is about 15.2 minutes and in Kuala Lumpur, it is about 21.1 minutes (Hisamuddin NH et al., 2007). The mean ambulance response time is the duration when call is received to the time of arrival at the scene. Therefore, initial care in the first critical minutes after sudden cardiac arrest including performance of CPR and potential use of an AED depends on the actions of bystander near the victim.

Although the majority of cardiac arrests occur at home, nevertheless the presence of trained and willing rescuers and the availability of an AED are critical whether the cardiac arrest occurs in a public space or at home. Therefore, we must rely on a trained and willing public to initiate CPR and to call for professional help and early defibrillation. Based on this facts, many countries have recently started public training program on teaching CPR and AED usage in school setting including Europe, USA, Canada and Japan (Hazinski, 2003; Iwami, 2012; Berger, 2014). For example several projects namely Automated Defibrillators in Adam's Memory (ADAM) in USA meanwhile the Advanced Coronary Treatment (ACT) in Canada were implemented to promote health and empower the young nation to save lives.

Nevertheless, in Malaysia there is neither legislation or campaign to promote CPR training in school. Some student may had informal CPR training when they joined First Aid Club in the school whereas AED training not included. Moreover, a recent study done by Hisamuddin et al., (2013) only focused on the level of knowledge and attitude on CPR among secondary school children. Therefore, in this study we focused further to look into student's knowledge and skills following school based CPR and AED program.

Furthermore, the study reported by Iwami (2010) also documented very interesting outcomes which highlighted the OHCA events occur at schools. Similarly highlighted in previous study by Drezner et al., (2009), the occurrence of OHCA in school where most society of different ages gathered for social and leisure activities such as sports events as well as other community activities. Therefore, one important way of increasing the rate of bystander resuscitation is to offer resuscitation already as a subject in schools. Training middle and high school students in CPR and use of an AED represents an opportunity to increase the number of laypersons who can apply CPR and use an AED. School seems to be particularly suitable to start training in order to anchor the skill at the earliest possible stage of lifelong learning.

It has been shown that, teaching and public participation was essential in handling out of hospital cardiac arrest. However, social responsibility of the authority seems to delay in promoting and developing a successful bystander and public access defibrillation (Chew et al., 2008). According to Vaillancourt (2008) stated that efforts to engage older adults in CPR training have been discouraging, whereas Lorem (2010) reported that high school students are an accessible population that can performed CPR and AED as well as adults. Therefore, training middle and high school students

in CPR and AED represents an opportunity to increase the number of laypersons who can apply CPR and AED.

#### **1.4 SIGNIFICANCE OF THE STUDY**

This study will create awareness for the student to be a more responsible nation and being competent bystander for increasing the survival rates of OHCA in Malaysia context. Therefore, we agree wholeheartedly that the dissemination of CPR and AED education in schools is essential in promoting and developing a successful bystander and public access defibrillation. Training middle and high school students in CPR and AED represents an opportunity to increase the number of laypersons who can apply CPR and AED.

In this study, we are planning to train and empower the young nation to be an accessible rescuer for the society. Thus, attention should be highlighted in recognizing the state of cardiac arrest and basic measures in resuscitation. In addition, provision of CPR and AED education to students will train future society who are willing to serve the community and performed bystander rescuer CPR and AED when needed. Such scenario has the potential to increase survival and improve outcomes from OHCA.

Once this study has been successful, further study will be focused on a large scale training at school based CPR and AED program at multistates. Continuous endeavours towards the goal of teaching high quality public CPR and AED has the potential to position all citizens for early chain of survival when cardiac arrest occurs. Such strategies have and should continue to include mass training events as well as advocacy for CPR and AED education in the schools as a mandate or at least as part of the educational curriculum in all schools. These strategies will ultimately position each and every citizen for the ability to understand and implement the chain of

survival. Through these actions, which are intended to encourage and broaden school based CPR and AED program, thousands of additional lives can be saved every year.

## **1.5 RESEARCH OBJECTIVES**

### **1.5.1 General Objective**

The aim of this study is to implement and evaluate the effect of the school based CPR and AED program on knowledge and skills among secondary school students in Kuantan, Pahang.

### **1.5.2 Specific Objectives**

- i. To determine the level of experiences and attitudes towards CPR and AED among secondary school students before the implementation of school based CPR and AED program.
- ii. To assess the effectiveness of school based CPR and AED program on knowledge and skills among secondary school students.
- iii. To explore the feelings and experiences of the student after completing the school based CPR and AED program.

## **1.6 RESEARCH QUESTIONS**

1. What is the level of experiences and attitudes towards CPR and AED among secondary school students before the implementation of school based CPR and AED program?
2. Is there any relationship between level of experiences and attitudes towards CPR and AED with socio-demographic variables?